

Revision of European EU Ecolabel Criteria for Detergents for Dishwashers

PRELIMINARY REPORT

for

THE REVISION OF EUROPEAN ECOLOGICAL CRITERIA FOR DETERGENTS FOR DISHWASHERS: DOMESTIC AND INDUSTRIAL AND INSTITUTIONAL

- 1) Executive summary
- 2) Scope and definition
- 3) Market analysis
- 4) Technical/Environmental analysis
- 5) Improvement potential

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Working Document

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ABBREVIATIONS AND ACRONYMS

A.I.S.E	International Association for Soaps, Detergents and Maintenance Products (trade body)
aNBO	aerobically non-biodegradable
anNBO	anaerobically non-biodegradable
APD	alkyl phenol derivative
APEO	alkyl phenol ethoxylate
ASP	Advanced Sustainability Profile
BCF	bioconcentration factor
BRIC	Brazil, Russia, India and China
CADD	consumer automatic dishwasher detergents
CAGR	compound annual growth rate
CDV	critical dilution volume
CFC	chloro-fluorocarbon
CLP	(EU Regulation on the) Classification, Labelling and Packaging of Substances and Mixtures
COMEXT	statistical database on trade of goods managed by Eurostat
DADMAC	diallyl dimethyl ammonium chloride
DD	dishwasher detergents
DID list	Detergents Ingredient Database list
DTPA	diethylene triamine pentaacetic acid
EC	European Commission
EC ₅₀	median effective concentration
ECHA	European Chemicals Agency
EDTA	ethylene diamine tetracetate
EEA	European Economic Area
EU	European Union
FSC	Forest Stewardship Council
GDP	gross domestic product
GHG	greenhouse gas
GHS	Globally Harmonized System of Classification and Labelling of Chemicals
GLDA	glutamic acid di-acetic acid
GPP	green public procurement
IC ₅₀	median inhibition concentration
I&I	industrial and institutional
IFRA	International Fragrance Association
IIDD	industrial and institutional dishwasher detergents
IKW	Industrieverband Körperpflege- und Waschmittel e. V.
ILCD	International Reference Life Cycle Data System
ISO	International Organisation for Standards
K _{ow}	octanol-water partition coefficient
LAS	linear alkylbenzene sulphonate
LCA	life cycle assessment
LCIA	life cycle impact assessment
LC ₅₀	median lethal dose
MGDA	methylglycin di-acetic acid
n.e.c.	not elsewhere classified
NLT	natural land transformation
n.p.r.s	Not packaged for retail sale
NTA	nitrilo tri-acetic acid

PBT	persistent, bio-accumulable and toxic
ppm	parts per million
PRODCOM	PRODUCTION COMMUNAUTAIRE (Community Production)
p.r.s	Packaged for retail sale
PVC	polyvinyl chloride
REACH	Registration, Evaluation, Authorisation and restriction of Chemicals
RSPO	Roundtable on Sustainable Palm Oil
TAED	tetra acetyl ethylene diamine
TCmax	total chemicals maximum dosage limit
vPvB	very persistent and very bio-accumulable
WUR	weight/utility ratio

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TERMS AND DEFINITIONS

Domestic Dishwasher (DD)	This term is used to denote dishwasher detergent products which are intended for use principally in automatic domestic dishwashers, but may also include use of automatic dishwashers for professional use of which the size and usage is similar to that of domestic machines. May be used interchangeably with the term 'household dishwasher'.
Industrial and institutional dishwasher detergent (IIDD)	This term is used to denote dishwasher detergent products which are intended for use solely by professional users in the industrial and institutional sector. May be used interchangeably with 'professional dishwasher'. Industrial and institutional detergent means a detergent for washing and cleaning outside the domestic sphere, carried out by specialised personnel using specific products.
Biocide	Chemicals used to suppress organisms that are harmful to human or animal health, or that cause damage to natural or manufactured materials. ¹
Biocidal products	Active substances and preparations containing one or more active substances put up in the form in which they are supplied to the user, intended to destroy, render harmless, prevent the action of or otherwise exert a controlling effect on any harmful organism by chemical or biological means. ²
Bio-accumulative	The tendency for a substance to be accumulated in an organism due to difference in the rate of intake and loss of the substance from the organism.
Detergent	Any substance or mixture containing soaps and/or other surfactants intended for washing and cleaning processes. Detergents may be in any form (liquid, powder, paste, bar, cake, moulded piece, shape, etc.) and marketed for or used in the household, or institutional or industrial purposes. ³
Enzyme	Proteins that speed up the rate of chemical reactions without interacting in the reactions themselves.
EU Ecolabel	A voluntary method of environmental performance certification which identifies overall proven environmental preference of a product or service within a specific product/service category based on life cycle considerations. There are three types of voluntary labels identified by ISO with the EU Ecolabel falling under the Type I category.
Type I Ecolabel	A voluntary, multi criteria-based, third party program that awards a license that authorises the use of environmental labels on products indicating overall environmental preferability of a product within a particular product category based on life cycle considerations.
Surfactant	Any organic substance and/or mixture used in detergents that has surface-active properties and that consists of one or more hydrophilic and one or more hydrophobic groups of such a nature and size that it is capable of reducing the surface tension of water, and of forming spreading or adsorption monolayers at the water-air interface, and of forming emulsions and/or micro emulsions and/or micelles, and of adsorption at water-solid interfaces. ³
Standard	A document established by consensus and approved by a recognised body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

¹ For more details see: http://ec.europa.eu/environment/chemicals/biocides/index_en.htm.

² Based on Regulation (EC) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (L 167/1 OJEU 27.8.2012) Available from: http://ec.europa.eu/environment/chemicals/biocides/index_en.htm.

³ Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents (OJ L 104, 8.4.2004) Available from: <http://ec.europa.eu/enterprise/sectors/chemicals/documents/specific-chemicals/detergents/>.

TABLE OF CONTENTS

TABLE OF CONTENTS	7
1. INTRODUCTION.....	11
1.1 Background.....	11
1.2 Purpose of this document	11
1.3 EU Ecolabel for dishwasher detergents.....	11
1.4 Investigation overview.....	12
2. LEGAL REVIEW, SCOPE AND DEFINITION.....	13
2.1 Introduction	13
2.2 Scope and definition	13
2.2.1 Product definition	13
2.2.2 Current EU Ecolabel product scope and definition.....	13
2.3 Feedback from stakeholder consultation	14
2.4 Review of legislation – key changes since the 2011 revision.....	16
2.4.1 EU Ecolabel Regulation.....	16
2.4.2 Revision to the EU Detergents Regulation	16
2.4.3 EC Biocides Regulation	17
2.4.4 Classification, Labelling and Packaging of Chemical Substances and Mixtures.....	17
2.5 Review of national ecolabelling schemes	18
2.6 The need for separate criteria for DD and IIDD	47
2.6.1 Stakeholder feedback	47
2.6.2 Differences between DD and IIDD products.....	47
2.6.3 Conclusions.....	49
2.7 Proposed scope and definition	49
2.8 Recommendations for revision of existing criteria.....	50
2.8.1 Comparison between the three criteria (DD, IIDD and GPP).....	50
2.8.2 Assessment and verification of measurement thresholds for constituents	51
2.8.3 Criteria for detergents for DD product category.....	51
2.8.4 Criteria for Industrial and Institutional Automatic Dishwasher Detergents	59
2.8.5 Additional hot spots.....	65
2.8.6 Summary of suggested criteria changes to be further examined	65
3. MARKET ANALYSIS	68
3.1 Introduction	68
3.1.1 Categorisation of dishwasher detergents.....	68
3.1.2 Market overview, dishwasher detergents	71
3.2 Market structure.....	72
3.2.1 Product overview and market segmentation	72
3.2.2 Manufacturers and market shares	75
3.2.3 Structure of supply chain	77
3.3 Sales of dishwashing detergents	78
3.3.1 EU-28 Sales.....	78
3.4 Market trends and projections.....	79
3.4.1 Dishwasher ownership.....	79
3.4.2 Hand dishwashing detergents	81
3.4.3 Types of dishwasher detergent.....	84
3.5 Labelling.....	85
3.6 Product and process innovation	87
3.6.1 Dishwasher tablets	87
3.6.2 Sustainability trends.....	88
3.7 Consumer trends	88
3.7.1 Trade-off with hand dishwashing detergents.....	88
3.7.2 A ‘perfect result every time’.....	89
3.8 Market analysis conclusions	89
3.8.1 Market overview.....	89
3.8.2 Products available on the market.....	89
3.8.3 Drivers of sales	90

4.	TECHNICAL ANALYSIS	91
4.1	Technological aspects	91
4.1.1	<i>Supply chain for dishwasher detergent production</i>	<i>91</i>
4.1.2	<i>Description of the production processes.....</i>	<i>92</i>
4.1.3	<i>Dishwasher detergents ingredients</i>	<i>92</i>
4.2	LCA review	93
4.2.1	<i>Selection criteria</i>	<i>93</i>
4.2.2	<i>Quality assessment of available studies</i>	<i>94</i>
4.2.3	<i>Key findings</i>	<i>96</i>
4.3	Non-LCA Impacts	97
4.3.2	<i>Risk assessment of chemical release</i>	<i>99</i>
4.3.3	<i>Sustainable sourcing.....</i>	<i>99</i>
4.4	In-house LCA studies.....	100
4.4.1	<i>Methodology</i>	<i>100</i>
4.4.2	<i>Life cycle inventory (LCI)</i>	<i>102</i>
4.4.3	<i>Life cycle impact assessment (LCIA).....</i>	<i>106</i>
4.5	Sensitivity analysis	109
4.5.1	<i>Washing program.....</i>	<i>109</i>
4.5.2	<i>Product dosage.....</i>	<i>109</i>
4.5.3	<i>Surfactant origin.....</i>	<i>110</i>
4.5.4	<i>Energy source for heating the water</i>	<i>111</i>
4.5.5	<i>Toxicity impact of ingredients.....</i>	<i>111</i>
4.5.6	<i>Sensitivity of the surfactant to the database.....</i>	<i>112</i>
4.6	Summary of findings	114
5.	PRODUCT INNOVATIONS AND IMPROVEMENT POTENTIAL	116
5.1	Introduction and approach.....	116
5.2	Dishwasher detergent product innovations	116
5.2.1	<i>Low/no harmful chemicals</i>	<i>116</i>
5.2.2	<i>Environmentally friendly packaging</i>	<i>116</i>
5.3	Conclusions	117
ANNEXES.....	119
ANNEX I:	Stakeholder survey	119
ANNEX II:	Dishwasher detergent ingredients	137
ANNEX III:	Market analysis data.....	138
ANNEX IV:	Life cycle impact assessment.....	141
ANNEX V:	Contribution analysis of different life cycle stages.....	142
ANNEX VI:	Sensitivity analysis	143
ANNEX VII:	Place settings.....	145

LIST OF TABLES

Table 1: Summary of respondents to questionnaire.....	14
Table 2: Summary of questionnaire analysis.....	14
Table 3: Alternative voluntary labelling schemes	18
Table 4: Product group definitions and scope from alternative voluntary labelling schemes.....	22
Table 5: Overview of the requirements of different ecolabels and voluntary agreements for household detergents for automatic dishwashers	25
Table 6: Overview of the requirements of different ecolabels and voluntary agreements for industrial and institutional dishwasher detergents	37
Table 7: Comparison of excluded substances	45
Table 8: Summary of wash processes by automatic dishwasher type.....	49
Table 9: Comparison of the criteria for DD, IIDD and GPP under revision.....	50
Table 10: Summary of suggested criteria changes for DD	65
Table 11: Summary of suggested criteria changes for IIDD	66
Table 12: PRODCOM cleaning product categories, code and description	68
Table 13: Comparison of criteria for PRODCOM categories (cleaning product-type) and EU Ecolabel for dishwasher detergents.....	69
Table 14: Production of manufactured cleaning products in EU-28, value and tonnes, 2013	70
Table 15: COMEXT detergent code and description	70
Table 16: Intra-EU and Extra-EU trade of detergents, import and exports, 2013	71
Table 17: Market value of dishwashing detergents (EU-27 + CH + NO), 2012.....	73
Table 18: Largest organisations in European* DD** market, % breakdown by retail value, 2013	75
Table 19: Western Europe, distribution channels by value (%), 2009	75
Table 20: Common brand name dishwasher detergent products in Europe, 2013.....	76
Table 21: Common brand name dishwasher detergent products in Europe, % market share (based on retail value)	76
Table 22: Expected growth in the I&I market for kitchen and catering detergents	77
Table 23: Total home and fabric care speciality ingredients market ⁷⁹ - share of revenues by chemical type, Europe, 2009	77
Table 24: Home and fabric care speciality ingredients market ⁷⁹ : impact of top eight industry challenges ranked in order of impact, Europe	78
Table 25: Number of products with the EU Ecolabel for DD, by country.....	86
Table 26: Number of products with the EU Ecolabel for IIDD, by country.....	86
Table 27: Number of products with the Nordic Swan, by country.....	86
Table 28: overview of studies on dishwasher detergents.....	94
Table 29: Summary of conclusions and opportunities for improvement from studies on dishwasher detergents	96
Table 30: <i>Toxicity values and degradation data for example detergent ingredients in the DID list</i>	99
Table 31: Generic dishwasher detergent formulation	102
Table 32: Ecoinvent data inventory for a dishwasher detergent frame formula.....	103
Table 33: Primary and secondary packaging for dishwasher detergent	104
Table 34: Key assumptions.....	105
Table 35: Glossary	106
Table 36: Aggregate midpoint results for a dishwasher detergent (wash temperature at 60°C).....	107
Table 37: Toxicity impacts of key ingredients per gram.....	111
Table 38: Overall summary of the key environmental considerations linked to the EU Ecolabel criteria..	115
Table 39: Outcomes of sensitivity analysis and actions in EU Ecolabel criteria	118
Table 40: Intra EU-28, Import, 2013.....	138
Table 41: Intra EU-28, Export, 2013	138
Table 42: Extra EU-28, Import, 2013	139
Table 43: Extra EU-28, Export, 2013.....	140
Table 44: Life cycle impact contribution of a dishwasher detergent	142

Table 45: Life cycle impact contribution of a dishwasher detergent (in percentages)	142
Table 46: Impact contribution of the dosage sensitivity	143
Table 47: Impact contribution of wash temperature sensitivity	143
Table 48: Impact contribution of surfactant sensitivity	144
Table 49: Impact contribution of energy source sensitivity	144

LIST OF FIGURES

Figure 1: Sales of dishwasher detergent products by category, value (€m), 2012	73
Figure 2: Split of dishwasher detergent products by category (%), 2012	74
Figure 3: Sales of dishwasher detergent and dishwasher additives, value (€m), 2012	75
Figure 4: Retail value (€m) of dishwashing market for EU-28, 2013	79
Figure 5: Dishwasher possession rates (%), EU-28, 2013	80
Figure 6: Dishwasher ownership rates (%) EU-28 average, 2008-13	81
Figure 7: Market value and % share of all household dishwashing detergents, Europe, 2012	82
Figure 8: Actual and projected total retail value (€m) of dishwashing detergents* in Europe**, 2008-18 .	82
Figure 9: Actual and projected retail value (€m) for countries with top five market share in dishwasher detergent* value across Europe, 2008-18	83
Figure 10: Market trends, actual and projected sales (€m) of dishwasher detergents, 2007-16	84
Figure 11: Sales of dishwasher detergents by category, EU average, €m	84
Figure 12: Sales of dishwasher detergent tablets by country, €m	85
Figure 13: Supply chain for home and fabric care products	91
Figure 14: Steps of the life cycle assessment, according to UNE-EN ISO 14040: 2006	100
Figure 15: Schematic representation of the life cycle of a dishwasher detergent.	101
Figure 16: Inventory inputs and outputs	102
Figure 20: Impact contribution of different life cycle stages a dishwasher detergent	107
Figure 21: Normalised endpoint results for dishwasher detergent	108
Figure 22: Characterised results for wash temperature sensitivity (tablet).	109
Figure 23: Characterised results of dosage sensitivity	110
Figure 24: Sensitivity analysis of surfactant origin (tablet)	110
Figure 25: Sensitivity analysis of energy source mix	111
Figure 26: Comparison between the environmental impact at endpoint level of 1 kg of ethoxylated alcohols from coconut oil in Ecoinvent and in Agri-Footprint	113
Figure 27: Comparison between the environmental impact at endpoint level of 1 kg of ethoxylated alcohols from palm kernel oil in Ecoinvent and in Agri-Footprint. ¹⁴⁴	114
Figure 28: Relationship between LCI parameters (left), midpoint (middle) and endpoint indicator (right) in ReCiPe 2009	141

1. INTRODUCTION

1.1 Background

The EU Ecolabel initiative is a policy instrument designed to encourage the production and use of more environmentally friendly products and services through the certification and specification of products or services which have a reduced environmental footprint. It forms part of the European Commission's action plan on Sustainable Consumption and Production and Sustainable Industrial Policy adopted on 16th July 2008.⁴

The EU Ecolabel is a voluntary scheme coordinated by the European Commission⁵ that is used to distinguish environmentally beneficial products and services. The EU Ecolabel is awarded through a process in which an applicant has to demonstrate that the specified EU Ecolabel criteria for a particular product group are met. Successful applicants are then allowed to use the EU Ecolabel logo and to advertise their product as having been awarded the EU Ecolabel.

1.2 Purpose of this document

This document forms part of the stages of revising the criteria for the EU Ecolabel for detergents for automatic dishwashers and encapsulates the activities and outputs of Tasks 1-4, i.e. 1) goal and scope definition, 2) market analysis, 3) technical analysis and 4) analysis of innovations and improvement opportunities. This report represents a first evaluation of likely areas for investigation as a result of stakeholder surveys, market analysis and known concerns with existing criteria including, amongst others, changes in hazardous substance classification. In doing so, it identifies where there is scope for strengthening the EU Ecolabel and which criteria should be amended, removed or further developed.

The information contained in this document provides an overview of changes to the dishwasher detergents market since the last revision of the criteria in 2011, and a technical analysis to understand where the greatest environmental impacts arise in their life cycle.

This report is also being used as a consultation document to gain feedback, evidence and opinion from stakeholders and experts on proposed changes and significant environmental issues. This document covers the EU Ecolabel criteria for both domestic and industrial and institutional dishwasher detergents.

1.3 EU Ecolabel for dishwasher detergents

The EU Ecolabel criteria for detergents for dishwashers were adopted in 2011 (Commission Decision 2011/263/EU) for and the ones for industrial and institutional automatic dishwasher detergents in 2012 (Commission Decision 2012/720/EU).⁶ The aim of these criteria documents was to promote laundry detergents that corresponded to the best 10-20 % of the products available on the Community market in terms of environmental performance considering the whole life-cycle of production, use and disposal. These criteria are due to expire in 2016. A breakdown of the number of EU Ecolabel products for the dishwasher detergents (DD) and industrial and institutional dishwasher detergents (IIDDD) categories can be found in the market analysis section of this report.

⁴ Communication from The Commission to The European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions on the sustainable consumption and production and sustainable industrial policy action plan, Brussels 16.7.2008. Available from: http://ec.europa.eu/environment/eussd/pdf/com_2008_397.pdf

⁵ Regulation (EC) No 66/2010 of The European Parliament and of The Council of 25 November 2009 on the EU Ecolabel. Available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:027:0001:0019:en:PDF>

⁶ Documents available at <http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html>

1.4 Investigation overview

The revision process takes the existing criteria document as the starting point and seeks to update these, taking into account technological and economic changes in the European market, relevant legislative change and improved scientific knowledge.

To review the existing EU Ecolabels, the following aspects have been investigated:

- 1) Product definition and categorisation of DD and IIDD.
- 2) The reasons that support keeping the two sets of criteria separate.
- 3) An economic and market analysis.
- 4) Technical analysis including environmental performance investigation of the dishwasher detergents product groups.
- 5) Product innovations to and improvement opportunities for dishwasher detergents.

DRAFT - WORK IN PROGRESS

2. LEGAL REVIEW, SCOPE AND DEFINITION

2.1 Introduction

The aim of the first task is to conduct a review of the practicality of the existing product group definition and scope, as well as the current EU Ecolabels. The areas where the existing criteria and scope are no longer in line with current legislation or market conditions will be identified. The review will consider: feedback from stakeholders, literature and legal reviews and alternative ecolabels. The first task has been divided into the following sub-tasks:

- 1) An introduction to the existing product scope and definition.
- 2) A summary of the feedback received from the stakeholder questionnaire.
- 3) A review of alternative and national ecolabels for dishwasher detergents.
- 4) An investigation into the need for separate criteria for DD and IIDD.
- 5) A review of existing EU legislation that is likely to affect the criteria revision.
- 6) The proposed scope and definitions for DD and IIDD categories.
- 7) A summary of the proposed changes to the criteria which require further investigation.

As a key element of this task a stakeholder survey has been conducted, a blank copy of which can be found in Annex I. The survey has been used to gain viewpoints of the successes and failings of the criteria and to guide the development of the criteria revision. The survey addresses principal questions such as: the validity of the product group, definition and scope; the potential for merging DD and IIDD criteria; additional technological or environmental matters that have arisen since the previous revision; and issues with specific criteria. Outputs from the stakeholder survey have been used throughout this section of the report.

2.2 Scope and definition

2.2.1 Product definition

Before investigating the classification and definition of dishwasher detergent products, it is important that key concepts of the product, such as its composition, are fully described. Within the context of the EU Ecolabel and this report, the definition used for dishwasher detergents is taken from the definition of detergents used in Regulation (EC) No 648/2004 (the Detergents Regulation):⁷

'Detergent' means any substance or mixture containing soaps and/or other surfactants intended for washing and cleaning processes. Detergents may be in any form (liquid, powder, paste, bar, cake, moulded piece, shape, etc.) and marketed for or used in household, or institutional or industrial purposes.

Before discussing in detail the classification of dishwasher detergents, it is important that certain key concepts of their composition are described. Dishwasher detergent formulations are made up of several components which include surfactants, preservatives, enzymes, dyestuffs, complexing agents, bleaches, anti-corrosion agents and anti-foaming agents. As a result, the composition of detergents varies significantly and this will affect the impact of the product on the environment and on human health. A brief overview of the functions of the main ingredients can be found in Annex II.

2.2.2 Current EU Ecolabel product scope and definition

Commission Decisions 2011/263/EC and 2012/720/EC define 'detergents for dishwashers' and 'industrial and institutional automatic dishwasher detergents' as the following:

⁷ Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents (L 104/1 OJEU 8.4.2004)
Available from: http://ec.europa.eu/enterprise/sectors/chemicals/documents/specific-chemicals/detergents/index_en.htm

Detergents for dishwashers: The product group 'Detergent for Dishwashers' shall comprise detergents for dishwashers and products used as rinse aids, whether in powder, liquid or any other form, which are intended to be marketed and used exclusively in automatic domestic dishwashers and in automatic dishwashers for professional use, the size and usage of which is similar to that of domestic dishwashers.

Industrial and institutional automatic dishwasher detergents: The product group 'Industrial and Institutional Automatic Dishwasher Detergents' shall comprise single and multi-component dishwasher detergents, rinse and pre-soaks, designed for use in professional dishwashers.

The following products are excluded from the scope of this product group: consumer automatic dishwasher detergents, detergents intended to be used in washers of medical devices or in special machines for the food industry.

Sprays not dosed via automatic pumps are excluded from this product group.

2.3 Feedback from stakeholder consultation

To obtain feedback on the current EU Ecolabel criteria for DD and IIDD, a questionnaire was sent to stakeholders (see a blank copy in Annex I). The target groups for the questionnaire were European Ecolabel competent bodies, industry, technology institutes and trade associations. Eighteen stakeholders formally responded to the consultation by returning the completed questionnaire. The respondents feature a mixture of stakeholders and are summarised in Table 1.

Table 1: Summary of respondents to questionnaire

Stakeholder	Number of respondents
Competent bodies	3
Environment Agency	1
Industry	10 (5 IIDD, 1 DD, 4 both)
Consulting agency	1
Research institute	1

Table 2 summarizes responses for both DD and IIDD. Further detail of the respondents' suggestions can be found later in this section.

Table 2: Summary of questionnaire analysis

	No. of responses	Summary of responses
Scope, definition and potential for merging of criteria	16/18	100 % of the respondents agreed with the existing products in scope for the DD category. No suggestions for further products to be included into the scope for DD were made. For the IIDD category, over 90 % of respondents agreed with the current scope of the criteria. Only 1 respondent out of 16 suggested that further products should be covered by the scope of the criteria, namely products for washing medical devices. 75 % of respondents considered that the DD and IIDD criteria, and therefore the EU Ecolabels, should remain separate. Some useful comments were made on the definitions of the product group and there were calls for defining one-component and multi-component detergents, so as to avoid confusion over which products are in scope.
Total chemicals (DD only)	15/18	Over 90 % of the respondents thought that the existing total chemicals requirements were strict enough for promoting the best 10-20 % environmentally performing DD products on the market. However, just over 25 % of the respondents thought that additional requirements for dosage are needed. These additional requirements could be added for the level of soiling and water hardness.

	No. of responses	Summary of responses
Excluded or limited substances	15/18	<p>33 % of respondents considered that additional ingredients should be excluded or limited (for both DD and IIDD). Recommendations for additional exclusions include for phosphonates, chlorine bleach, persistent, bio-accumulable and toxic (PBT) substances, endocrine disrupters, and perborates. A stakeholder suggested that where possible harmonisation between the DD and IIDD criteria should be sought.</p> <p>Apart from the feedback received through the stakeholders consultation, DG ENV received a request for derogating the enzyme subtilisin that has recently changed classification</p>
Toxicity to aquatic organisms	15/18	<p>Less than 15 % of the respondents thought that the existing critical dilution volume (CDV) values in the DD criteria are not effective in distinguishing the best performing products on the market in terms of environmental performance.</p> <p>A general comment was made about the fact that the CDV values should be recalculated in accordance with the revised Detergents Ingredient Database (DID) list. Few comments were received regarding IIDD products.</p>
Biodegradability	13/18	<p>85 % of respondents thought that the current limits set for aerobically and anaerobically non-biodegradable (aNBO and anNBO) substances for DD are strict enough when considering the DD currently on the market. For IIDD, two of the stakeholders commented that the current limits for biodegradability are too strict and anaerobic biodegradability is not relevant for this product category.</p> <p>All of the stakeholders who responded to the question thought that the current limits set for aNBO and anNBO of rinse aids was strict enough. Two stakeholders commented that for both DD and IIDD the criterion should be modified to allow all organics that are biodegradable under aerobic conditions.</p>
Packaging requirements	13/18	<p>85 % of the stakeholders did not support the suggestion that additional criteria should be set to further promote the use of recycled materials in packaging.</p> <p>Opinion was split when asked if the current criteria for packaging are sufficient and whether or not further criteria are required. Just over 60 % of the respondents suggested that the current requirements are sufficient. However, the feedback did provide several suggestions for the packaging criteria, such as promoting recyclability through the use of easy-to-access concepts. For IIDD one of the stakeholders questioned the relevance of weight/utility ratio (WUR) for professional products.</p>
Washing performance	8/18	<p>Most respondents had no comments to make about the current testing procedure.</p> <p>For household dishwasher detergents two of the respondents commented that the IKW test method is currently under revision and that this criterion should be updated once the revision is complete.</p>
User/consumer information	10/18	<p>In general few comments were received regarding criteria on consumer information for DD. For IIDD stakeholders commented on encouraging low temperature washing, but it is a complicated issue as washing at a low temperature in some instances will require products with a disinfectant component.</p>

2.4 Review of legislation – key changes since the 2011 revision

2.4.1 EU Ecolabel Regulation

Regulation (EC) No 1980/2000⁸ on a revised Community eco-label award scheme was replaced by Regulation (EC) No 66/2010⁹ on the EU Ecolabel (the Ecolabel Regulation) to increase its effectiveness and streamline its operation. A number of key changes, relevant to this product group, were incorporated:

- 1) Criteria would be determined on a scientific basis (Ecolabel Regulation - Art.6.3).
- 2) There would be a focus on the most significant environmental impacts over the product life cycle (Ecolabel Regulation - Art.6.3.a).
- 3) The substitution of hazardous substances with safer substances (Ecolabel Regulation – Art.6.3.b).
- 4) Any substances classified according to CLP¹⁰ as hazardous to the environment, toxic, carcinogenic, mutagenic or toxic for reproduction and referred to in Art.57 of Regulation (EC) No 1907/2006 (the REACH Regulation) would be restricted (Ecolabel Regulation - Art.6.6).
- 5) Derogations may be given in respect of the above, if substitution or use of alternative materials is not technically feasible. However no derogations are possible in respect of substances of very high concern (SVHC) identified in accordance with the procedure set out in REACH - Art.59 (Ecolabel Regulation - Art.6.7).

2.4.2 Revision to the EU Detergents Regulation

The 2012 Revision to the Detergents Regulation¹¹ regulates the use of phosphates and other phosphorus compounds in consumer laundry detergents and consumer automatic dishwasher detergents (CADDs) in the EU (see Regulation (EU) No 259/2012).¹² The revision limits the use of phosphates and phosphorus compounds in CADDs, to reduce their contribution to eutrophication and to reduce the cost of their removal during waste water treatment. The limit applies to all phosphorus compounds, so that they are not simply substituted for each other.

The 2012 Revision defines CADDs as “detergents placed on the market for use in automatic dishwashers by non-professionals”. The Revision notes that technically- and economically-feasible alternatives to the use of phosphates and phosphorus compounds in IIDD are not yet available. However, alternatives to phosphorus and phosphorus compounds are likely to be widely available in the near future.

It expresses concern that phosphate-based substitutes (phosphonates) pose a potential risk to the environment. Accordingly, it encourages producers to use alternative substances with a more environmentally-friendly profile than phosphate-based substitutes in the manufacture of CADDs. The Revision is clear that these alternative substances should either be risk-free, or should only pose a limited risk, to humans and the environment (under normal conditions of use). Where appropriate, the framework for assessing chemical risk as described by the REACH system will be used to evaluate the suitability of these alternative substances.

Finally, the 2012 Revision also lays down requirements for dosage information to be clearly indicated on CADD package labelling. The CADD producer is required to indicate on CADD package labelling a standard dosage (in grams, millilitres or number of tablets) for a fully-loaded dishwasher operating on a normal washing cycle.

⁸ Regulation (EC) No 1980/2000 of the European Parliament and of the Council of 17 July 2000 on a revised Community eco-label award scheme

⁹ Regulation (EC) No 66/2010 of the European Parliament and of the Council of November 25 2009 on the EU Ecolabel. Acts adopted before 1 December under the EC Treaty, the EU Treaty and the Euratom Treaty.

¹⁰ The (EU Regulation on the) Classification, Labelling and Packaging of Substances and Mixtures. Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

¹¹ Regulation (EC) No 648/2004 of the European Parliament and of the Council of 31 March 2004 on detergents (L 104/1 OJEU 8.4.2004) Available from: http://ec.europa.eu/enterprise/sectors/chemicals/documents/specific-chemicals/detergents/index_en.htm

¹² Regulation (EU) No 259/2012 of the European Parliament and of the Council of 14 March 2012 amending Regulation (EC) No 648/2004 as regards the use of phosphates and other phosphorus compounds in consumer laundry detergents and consumer automatic dishwasher detergents

Where applicable, the producer is also required to indicate different dosages for soft, medium, and hard water hardness.

Sweden and Norway have been allowed to maintain in place national phosphorus limits that are stricter than the 2012 Revision (EU/259/2012):

- Since July 2011, Sweden has restricted the authorised phosphate content of CADDs to 0.5 %, and intends to maintain these rules until further notice, whilst also waiting for the evaluation of the Commission (according to Art.16 of the Regulation). This exception is valid until 1 January 2017.
- Norway prohibits the manufacture, import and sale for use in Norway of CADDs with a phosphorus content of 3.8 % or higher (by overall weight). This exception is valid until 1 January 2017.

2.4.3 **EC Biocides Regulation**

The EU Biocidal Products Directive (98/8/EC)¹³ applies to insecticides and products that have anti-microbial properties, including disinfectants. In dishwasher detergent, biocides may be used in small amounts as preservatives to maintain product quality. The original Biocidal Products Directive (98/8/EC) regulated the placing of biocidal products on the EU market. The Directive applied only to products containing active agents that imparted biocidal properties to the product into which they were incorporated.

Under the 1998 Biocidal Products Directive, active substances had to be assessed at the Community level. Once an active substance had been assessed, it could be included in Annex I. Each Member State was then required to authorise products containing the biocide before they could be placed on the market in that individual Member State. Once authorised by one EU Member State, the product could then be placed on the market in any other EU Member State.

Regulation (EU) No 528/2012¹⁴ *concerning the making available on the market and use of biocidal products* repeals and replaces the 1998 Biocidal Products Directive. Under the 2012 Biocides Regulation, each EU Member State retains the obligation to authorise products containing biocides before they can be placed on the market in that individual Member State. In addition, the rules on the mutual recognition of existing authorisations have been simplified to speed up decision-making, facilitate market access to other Member States, and avoid duplication.

Under the 2012 Biocides Regulation, the mandate for the regulation of biocidal products has been transferred to the European Chemicals Agency (ECHA), with the aim being further convergence with the biocidal requirements of REACH. The Biocides Regulation also establishes a *Register for Biocidal Products*, which allows the Member States, the Commission and ECHA to make available to each other the particulars and scientific documentation submitted in connection with applications for authorisation of biocidal products.

2.4.4 **Classification, Labelling and Packaging of Chemical Substances and Mixtures**

The use of many (often incompatible) national systems for providing information on hazardous properties and control measures of chemicals requires multiple labels and Safety Data Sheets for the same product. This causes confusion for customers of these chemicals and increases the burden on companies complying with many different regulations. To address this, Regulation (EC) No 1272/2008¹⁵ on the Classification, Labelling and Packaging of Substances and Mixtures (the CLP Regulation) was developed to harmonise the process, requiring only one set of labels for all products sold throughout the EU.

¹³ Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

¹⁴ Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.

¹⁵ Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

The CLP Regulation entered into force on 20 January 2009 and implemented the UN Globally Harmonised System at EU level. The new system of classification, labelling and packaging was implemented by 1 December 2010 for substances, and will be implemented by 1 January 2015 for mixtures. However substances and mixtures will still have to be classified and labelled according to the predecessor Directive on Dangerous Substances (67/548/EEC)¹⁶ and Dangerous Preparations Directive (1999/45/EC)¹⁷, until 1 June 2015.

2.5 Review of national ecolabelling schemes

The aim of this chapter is to identify where alternative ecolabels have product categories for dishwasher detergents and which are their fundamental criteria. In general ecolabels can be categorised as either single-attribute or multi-attribute standards. Single attribute refers to certifications which only relate to one environmental characteristic, whereas multi-attribute certifications relate to more than one environmental characteristic. As the EU Ecolabel is a multi-attribute certification, only multi-criteria ecolabels will be compared in this section.

An overview of alternative voluntary labelling schemes is presented in Table 3.¹⁸ Table 4 discusses the scope and Table 5 shows the review of the criteria for a selection of alternative ecolabels highlighting the different approaches taken and the level of detail employed by different schemes.

Table 3: Alternative voluntary labelling schemes

Labelling programs	Region	Product category	Date of adoption/last revision
Nordic Swan	Denmark, Finland, Iceland, Norway, Sweden.	Dishwasher detergents ¹⁹	Version 6.0 – 19 March 2014 to 31 March 2018
		Dishwasher detergents for professional use ²⁰	Version 2.4 – 21 June 2010 to 31 March 2016
Blue Angel	Germany	No criteria for dishwasher detergents	N/A
Austrian Ecolabel	Austria	No criteria for dishwasher detergents	N/A
Bra Miljöval (Good Environmental Choice)	Sweden	Chemical products ²¹	Last issued 2006
Czech Ecolabelling	Czech Republic	Detergents for Dishwashers ²²	Last issued 2012
		Detergents for Automatic Dishwashers used in Industry and Institutions ²³	Last issued 2013

¹⁶ Directive 67/548/EEC of the European Parliament and of the Council of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

¹⁷ Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations.

¹⁸ Information on ecolabels on detergents, including laundry detergents can be found on the following website:

http://www.globalecolabelling.net/categories_7_criteria/list_by_product_category/1301.htm?xhighlightwords=detergents

¹⁹ Nordic EU Ecolabelling of Dishwasher detergents, 017 Dishwasher detergent, Version 6.0, 19 March 2014. Available from <http://www.nordic-ecolabel.org/criteria/product-groups/>

²⁰ Nordic EU Ecolabelling of Dishwasher detergents for professional use, 080 Dishwasher detergents for professional use, Version 2.4, 28 October 2013. Available from <http://www.nordic-ecolabel.org/criteria/product-groups/>

²¹ Good Environmental Choice criteria: Chemical products, Version 2006:4, Swedish Society for Nature Conservation, available from: <http://www.naturskyddsforeningen.se/sites/default/files/dokument-media/bra-miljoval-engelska/bmv-kem-chemical-crit.pdf>

²² Technical Guidelines Detergents for dishwashers, V68, 2012, Ministry of Environment available from: [http://www.cenia.cz/web/www/web-pub2.nsf/\\$pid/MZPMSFHMV9DV/\\$FILE/682012.pdf](http://www.cenia.cz/web/www/web-pub2.nsf/$pid/MZPMSFHMV9DV/$FILE/682012.pdf)

²³ Technical Guidelines for detergents for automatic dishwashers used in industry and institutions, Version V71, 2013, Ministry of Environment. Available: <http://www1.cenia.cz/www/sites/default/files/712013.pdf>

Labelling programs	Region	Product category	Date of adoption/last revision
P&G Future Friendly	UK	No categories, only Procter and Gamble products can be awarded the label	Launched in the UK in 2007
Ecocert ²⁴	Global (founded in France)	Natural detergents and Natural detergents made with organic ²⁵	Last revised May2012
Green Seal	USA	GS-52 Specialty cleaning for household products ²⁶	Last issued July 2013
		GS-53 Specialty cleaning products for industrial and institutional use ²⁷	Last issued July 2013
Environmental Choice	New Zealand	EC-03-14 Machine Dishwashing Detergents ²⁸	Last issued January 2014
		EC-35-14 Commercial and Institutional Dishwashing Detergents ²⁹	Last issued January 2014
EcoLogo	Canada	CCD 146: Hard Surface Cleaners ³⁰	Last issued August 2011 First published 2005
Cradle to Cradle	USA	No product specific categories	Last revised January 2013
Korea Eco-Label	Korea	EL304 Commercial Dishwasher Detergents ³¹	Last issued 2012
Singapore Green Label	Singapore	Dishwashing Detergents ³²	Scheme launched in 1992, criteria last issued May 2013
Good Environmental Choice Australia	Australia	Machine Dishwashing Detergents ³³	Last issued December 2013

Nordic Swan³⁴: The Nordic Swan became the official ecolabel for the Nordic countries in 1989. It is a voluntary scheme that uses a life cycle based approach to evaluate a product's impact on the environment. At present there are 63 product categories covered by the Nordic Swan, these include products and services. Each Nordic country had a national office which is responsible for licensing, auditing, marketing and criteria development. As per the EU Ecolabel, the Nordic Swan uses the same DID list for data on ingredient ecotoxicity and degradability.

²⁴ Ecocert is a certification body and not a program labelling. However, they have also expertise in developing standards, especially related to detergents that have no petrochemical ingredients. The standards is the result of a partnership between ECOCERT Greenlife, a certification body in the environmental field, and certain detergent professionals who have long expressed the need to find a solution to the detergent problems. <http://www.ecocert.com/sites/default/files/u3/Natural-Detergents-made-with-Organic-Ecocert-Greenlife-11.05.2012.pdf>

²⁵ Ecocert Standard: Natural detergents and natural detergents made with organic, May 2012, Ecocert Greenlife SAS, available from: <http://www.ecocert.com/sites/default/files/u3/Natural-Detergents-made-with-Organic-Ecocert-Greenlife-11.05.2012.pdf>

²⁶ Green Seal Standard for speciality cleaning products, GS-52 Edition 2.2 April 2014. Available from: <http://www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=2&sid=38>

²⁷ Green Seal Standard for speciality cleaning products for industrial and institutional use, GS-53 Edition 2.2 April 2014. Available from: <http://www.greenseal.org/GreenBusiness/Standards.aspx?vid=ViewStandardDetail&cid=2&sid=42>

²⁸ The New Zealand Ecolabelling Trust: Licence criteria for machine dishwashing detergents, EC-03-14, January 2014. Available from: http://www.environmentalchoice.org.nz/docs/publishedspecifications/ec0314_machine_dishwashing_detergents.pdf

²⁹ The New Zealand Ecolabelling Trust: Licence criteria for commercial and institutional dishwashing detergents, EC-35-14, January 2014. Available from: http://www.environmentalchoice.org.nz/docs/publishedspecifications/ec3514_commercial_institutional_dishwashing.pdf

³⁰ EcoLogo: Hard surface cleaners, CCD146, August 2011. Available from: <http://industries.ul.com/environment/>

³¹ Korea Eco-Label: Commercial dishwasher detergents, EL304-2006/6/2008-213. Available from: <http://el.keiti.re.kr/enservice/enpage.do?mMenu=2&sMenu=1>

³² Singapore Green Labelling Scheme Certification Guide: Dishwashing Detergents, May 2013. Available from: <http://www.sec.org.sg/sgls/standards-criteria.php>

³³ The Australian EU Ecolabel Program: Machine dishwashing detergents, Version 4.0 December 2013. Available from: http://www.geca.org.au/media/medialibrary/2013/12/MDDv4.0-2013_Final.pdf

³⁴ More information available at: <http://www.nordic-ecolabel.org/>

Bra Miljöval (Good Environmental Choice)³⁵: Good Environmental Choice (or Bra Miljöval in Swedish), is the ecolabelling system established by the Swedish Society for Nature Conservation. A life-cycle analysis based approach is employed for the testing and award procedure. At present the system covers 11 product areas including chemical products. For detergents the criteria sets limits on aquatic toxicity and biodegradability the scheme sets limits by ingredient type, for instance solvents or complexing agents. For biodegradability OECD 301³⁶ or an equivalent test must be used, surfactants must be anaerobically in accordance with ISO 11734.³⁷

Czech Ecolabelling³⁸: The Czech Ecolabel was launched in 1994 and is administered by CENIA, Czech Environmental Information Agency. The Czech Ecolabel covers a wide range of products and services, for many of these it employs the EU Ecolabel criteria. The criteria for product groups which exist in both labelling schemes are gradually being unified. At present the Czech Ecolabel has developed its own criteria for DD and IIDD; however, these will gradually become discontinued and the EU Ecolabel criteria for these product groups will be used instead.

P&G Future Friendly³⁹: Future Friendly is a private label, in that it can only be awarded to Proctor & Gamble products. It was established in 2007 by a partnership between P&G and sustainability experts, including Energy Saving Trust, Waste Watch and Waterwise.

Ecocert⁴⁰: Ecocert is an inspection and certification body founded in France in 1991. Its focus is on sustainable development and organic agricultural products. Ecocert develops internationally recognised standards for products, systems and services. The product categories include natural cleaning products, paints and coatings from natural origin and inputs eligible for use in organic farming. The basic principle of the label is to protect our planet and its resources, to protect and inform the consumer and to reduce unnecessary waste and discharges. In France Ecocert is accredited by the French Accreditation Committee (Cofrac).

Green Seal⁴¹: Green Seal is an independent non-profit certification organisation that operates in the USA and was established in 1989. Green Seal uses a life cycle approach to evaluate the environmental impacts of products, services and companies. It develops its criteria for product categories with input from industry, government, academia and the public.

Environmental Choice (New Zealand): The Environmental Choice ecolabel is operated by the New Zealand Ecolabelling Trust and is endorsed by the New Zealand Government. The ecolabel was launched in 1992 and has standards based on life cycle considerations, for a wide range of products, services and companies. For detergents this labelling scheme does not set limits for CDV or equivalent; instead the approach taken is to exclude substances classified as aquatic ecotoxins.

EcoLogo⁴²: EcoLogo is North America's largest environmental standard and certification mark. It uses a life cycle based approach to certify products, services and packaging. The standards use metrics in a wide variety of criteria including: materials, energy, manufacturing and operations, health and environment, product performance and use, and product stewardship and innovation.

³⁵ More information available at: <http://www.naturskyddsforeningen.se/in-english>

³⁶ Test No.301, OECD Guidelines for the Testing of Chemicals, Section 3, July 1992. Available from: http://www.oecd-ilibrary.org/environment/test-no-301-ready-biodegradability_9789264070349-en

³⁷ ISO 11734:1995, Water quality – Evaluation of the “ultimate” anaerobic biodegradability of organic compounds in digested sludge – Method by measurement of the biogas production. Available from:

http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=19656

³⁸ More information available at: <http://www1.cenia.cz/www/ekoznaceni/ekologicky-setrne-vyroby>

³⁹ More information available at: http://www.pg.com/en_UK/sustainability/environmental-sustainability/pg-future-friendly.shtml

⁴⁰ More information available at: <http://www.ecocert.com/>

Standards for detergents are available at: <http://www.ecocert.com/sites/default/files/u3/Natural-Detergents-made-with-Organic-Ecocert-Greenlife-11.05.2012.pdf>

⁴¹ More information available at: <http://www.greenseal.org/Home.aspx>

⁴² More information available at: <http://www.ul.com/global/eng/pages/offering/businesses/environment/services/ELmark/>

Korea Ecolabel: The Korea Ecolabel was launched by the government of the Republic of Korea in 1992. The label uses a life cycle based approach and is verified by an independent organisation. The Korea EcoLabel covers a wide range of products and services.

Singapore Green Label: The Singapore Green Label Scheme was launched by the Ministry of the Environment in 1992. Since 1995 the scheme has been run by the Singapore Environment Council, which is an independently managed non-profit and non-government organisation. The Green Label considers overall product environmental impacts such as raw materials, manufacturing process, health impacts and disposal. The label covers a wide range of products, but does not cover services and processes. In addition there are five levels of certification: basic, bronze, silver, gold and platinum. Products are scored across all five criteria categories and the overall certification level is equal to the lowest score in any category.

Good Environmental Choice Australia: The Australian Good Environmental Choice program was launched in November 2011 and is currently managed by a non-profit organisation. The program is compliant with ISO 14024 and provides Standards for a wide range of products and services. The scheme aims to enable consumers to choose certified products and standards and have confidence that they have a lower impact on the environment, human health and address important social considerations.

The Charter for Sustainable Cleaning: This charter is a voluntary initiative of AISE.⁴³ It aims to encourage both consumers and industry to adopt more sustainable approaches to cleaning. The charter is not a national labelling scheme but the information on the scope, definition and sustainability of the criteria is relevant for this revision. The Charter is based on a life cycle analysis and covers initiatives and activities ranging from human and environmental safety of chemicals and products, to eco-efficiency, occupational health and safety, resource use and consumer information. To participate in the program, companies must report annually on key performance indicators. The charter has an advanced sustainability profile (ASP) for 'household automatic dishwashing detergents'.⁴⁴ The ASPs are sustainability criteria which have been created for each AISE product category, taking into account a life cycle approach. However, there are no limits values set for environmental impacts such as aquatic toxicity and biodegradability. The ASP for a given product category describes the product group characteristics which the industry considers represent a good sustainability profile. For dishwasher detergents the ASPs have criteria covering product formulation, packaging, end user information and performance. As this is a voluntary agreement and not an ecolabelling scheme it has not been covered in Table 3.

In addition to taking on board feedback from the stakeholders, the current scope and definition of the EU Ecolabel criteria for DD and IIDD have been compared to those of other national ecolabelling schemes. An overview of the ecolabelling schemes and the product definitions used (for the schemes which provide product definitions) is given in Table 4. Note that not all standard documents for ecolabels provide category or product definitions.

The products included in the scope and definition of the different ecolabels vary. For DD, the products covered by the different ecolabels are similar, the exceptions being that (1) the Nordic Swan ecolabel does not cover rinse agents unless they form part of a combined dishwasher detergent product and (2) Sweden's Good Environmental Choice criteria for chemical products do not cover rinse aids. The Singapore Green Label for Dishwashing Detergents covers both detergents for automatic dishwashers and liquid hand dishwashing detergents for household use. For IIDD, the Nordic Swan ecolabel also includes products which are intended for use in instrument maintenance in health care. The criteria documents for the Green Seal and Good Environmental Choice Australia ecolabels are less prescriptive and, in theory, cover the widest range of dishwasher detergent products.

⁴³ More information available at: <http://www.sustainable-cleaning.com/en.home.orb>

⁴⁴ More information available at: http://www.sustainable-cleaning.com/content_attachments/documents/ASPs_ADW_23Feb2012_FINAL.pdf

The Nordic Swan and Good Environmental Choice Australia ecolabels use wash cycle length to distinguish between DD and IIDD products. In contrast, the EU Ecolabel uses the machines in which the products are intended to be used to distinguish between the two. The Singapore Green Label and Korea Ecolabel take a similar approach to the EU Ecolabel for defining commercial/professional dishwashers.

Table 4: Product group definitions and scope from alternative voluntary labelling schemes

Labelling programs	Product category	Definitions & scope
EU Ecolabel	Detergents for Dishwashers	The product group 'Detergent for Dishwashers' shall comprise detergents for dishwashers and products used as rinse aids, whether in powder, liquid or any other form, which are intended to be marketed and used exclusively in automatic domestic dishwashers and in automatic dishwashers for professional use, the size and usage of which is similar to that of domestic dishwashers.
	Industrial and Institutional Automatic Dishwasher Detergents (IIADD)	The product group IIADD shall comprise single- and multi-component dishwasher detergents, rinse and pre-soaks, designed for use in professional dishwashers. The following products are excluded from the scope of this product group: CADD, detergents intended to be used in washers of medical devices or in special machines for the food industry. Sprays not dosed via automatic pumps are excluded from this product group.
The Nordic Swan	Dishwasher detergents and rinsing agents (domestic use)	Dishwasher detergents and rinsing agents for household machines. The rinsing agent may be integrated into the product or may be a separate product. Dishwasher detergents for professional use cannot be labelled under these criteria. Cleaning agents for dishwashers cannot be labelled under these criteria.
	Dishwasher detergents for professional use	Single and multi-component dishwasher detergents, rinse aids and pre-soak for professional use within institutions and catering centres. The criteria also cover products that are used in washer-disinfectors destined for instrument maintenance in health care. Products that are designed for a wash cycle of less than 20 minutes are considered professional products, i.e. also including products for hybrid/semi-professional machines. The maximal length of the wash cycle for health care is 30 minutes. The maximal time does not include pre-soaks. Dishwasher detergents for special machines used in food production, dairies, etc., are not included.
Czech Ecolabelling	Detergents for Dishwashers ⁴⁵	Same definition as for EU Ecolabel is used.
	Detergents for Automatic Dishwashers used in Industry and Institutions ⁴⁶	Same definition as for EU Ecolabel is used.

⁴⁵ Technical Guidelines Detergents for dishwashers, V68, 2012, Ministry of Environment available from: [http://www.cenia.cz/web/www/web-pub2.nsf/\\$pid/MZPMSFHMV9DV/\\$FILE/682012.pdf](http://www.cenia.cz/web/www/web-pub2.nsf/$pid/MZPMSFHMV9DV/$FILE/682012.pdf)

⁴⁶ <http://www1.cenia.cz/www/sites/default/files/712013.pdf>

Labelling programs	Product category	Definitions & scope
Bra Miljöval (Good Environmental Choice)	Chemical products Dishwasher detergents:	Products that are used in dishwashers for domestic use and for automatic dosing. Rinse aids that are used in dishwashers are not included in this definition, but are regarded as a separate product group.
Environmental Choice New Zealand	EC-03-14 Machine Dishwashing Detergents	All detergents intended for use exclusively in automatic domestic dishwashers and all detergents intended for use in automatic dishwashers operated by professional users but similar to automatic domestic dishwashers in terms of machine size and usage.
	EC-35-14 Commercial and Institutional Dishwashing Detergents	Automatically dosed dishwasher detergents, drying agents and pre-soaking liquids for professional use within institutional and catering facilities. The criteria do not cover dishwasher detergents and pre-soaking liquid for special machines used in food production, dairies, etc. The criteria do not cover dishwasher detergents and pre-soaking liquids intended for use in automatic domestic dishwashers or in automatic dishwashers operated by professional users but similar to automatic domestic dishwashers in terms of machine size and usage.
Green Seal (USA)	No separate criteria but DD are covered under (GS-52) Speciality Cleaning Products for Household Use	Automatic dish cleaning products, rinse agent products and combined dish cleaning/rinse agent products for automatic dishwashers
	No separate criteria but IIDD are covered under (GS-53) Speciality Cleaning Products for I&I Use	Automatic dish cleaning products, rinse agent products and combined dish cleaning/rinse agent products for automatic dishwashers
Good Environmental Choice Australia	Machine Dishwashing Detergents	Detergents (liquid and powder) and rinse aids intended for use in automatic dishwashers. There are two separate categories of product covered by this standard: products for use in domestic dishwashers (long-cycle products) wash cycles longer than 15 minutes; and products for use in commercial dishwashers (short-cycle products) wash cycled less than 15 minutes.
Singapore Green Label	Dishwashing Detergents	All detergents intended for use in automatic domestic dishwashers and all detergents intended for use in automatic dishwashers operated by professional users but similar to automatic domestic dishwashers in terms of machine size and usage. This category also includes all liquid hand dishwashing detergents for household use, the main function of which is washing up by hand. ⁴⁷
Korea Ecolabel	EL304 Commercial Dishwasher Detergents	“Commercial dishwashers” refers to a type of dishwasher mainly used in large-sized food service locations and where dishes and eating utensils can be continuously loaded during every stage of use, including washing, rinsing, and drying

An overview of the requirements of the criteria documents for different ecolabels for dishwasher detergents is given in Table 5 and Table 6, for DD and IIDD products respectively. The excluded substances for different ecolabels are compared in Table 7. All of the criteria documents for the ecolabels listed in Table 4 were examined, however, only those which have a tighter scope than the EU Ecolabel have been included. Please

⁴⁷ [http://www.sec.org.sg/spls/criterion_pdf/Dishwashing %20Detergents.pdf](http://www.sec.org.sg/spls/criterion_pdf/Dishwashing%20Detergents.pdf)

note that for ease of comparison, some details of environmental criteria for dishwasher detergents have been excluded.

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Table 5: Overview of the requirements of different ecolabels and voluntary agreements for consumer detergents for automatic dishwashers

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
Limited substances				
<p>Biocides: The product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone. This does not refer to surfactants which may also have biocidal properties. It is prohibited to claim on the packaging or by any other communication that the product has an antimicrobial action.</p> <p>Fragrances: Any ingredients added to the product as a fragrance shall be manufactured and handled following the code of practice of the International Fragrance Association (IFRA).</p>	<p>Preservatives: Must not be bioaccumulating. The requirement applies to all preservatives in product ingredients and raw materials.</p> <p>Fragrances: If used, must be done in accordance with IFRA guidelines.</p> <p>The following substances must not be included in the product at levels >100 ppm per substance:</p> <ul style="list-style-type: none"> • 26 fragrance substances encompassed by the declaration requirement in the Detergents Regulation and its subsequent amendments • Fragrances classified as H317 (R43) or H334 (R42) • <i>Cananga odorata</i> and Ylang-ylang oil • <i>Eugenia caryophyllus</i> leaf/flower oil • <i>Jasminum grandiflorum / officinale</i> • <i>Myroxylon pereirae</i> • <i>Santalum album</i> • Turpentine oil • Verbene absolute. <p>Enzymes: May be present in liquid form or as dust-free granulate</p> <p>Phosphorus: The total content of phosphorus in the product must not exceed: Dishwasher detergents: 0.20 g/wash. Rinsing agents: 0.030 g/wash</p>	<p>Biocides and preservatives: The product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone.</p> <p>This criterion does not apply to ingredients (e.g. quaternary ammonium salts) added for other functions but which may also have biocidal properties.</p> <p>Fragrances: Fragrances must be produced and used in accordance with the code of practice compiled by IFRA.</p> <p>Enzymes: The enzyme production micro-organism shall be absent from the final enzyme preparation.</p> <p>In other products, enzymes must be present in liquid form or as a dust-free granulate.</p> <p>Phosphonates: The product must not contain more than 0.2 g phosphonates which are not readily biodegradable (aerobically) per wash.</p> <p>Colorants: Colouring agents may be added to liquid</p>	<p>Fragrances: Are not permitted.</p> <p>Enzymes: Are approved in products that bear the Good Environmental Choice label.</p> <p>Phosphorus: Ingredients that contain phosphorus must not be added to the product intentionally.</p> <p>Colouring agents: Are not permitted.</p> <p>Complexing agents: Organic complexing agents must be readily biodegradable. The product may contain a maximum of 2.0 % by weight of complexing agent.</p> <p>Solvents: Must be readily biodegradable. Solvents, preservatives, thickening agents/ dissolving agents, bleaching agents must have a bioconcentration factor (BCF) of < 100 or $\log K_{ow} < 3$.</p> <p>Nitrogen: The nitrogen content of the product must not exceed 1.0 % by weight.</p> <p>Fillers: Must meet the requirements for other additives.</p>	<p>Fragrances: All fragrances synthesised and included in the final product must comply with the IFRA code of practice.</p> <p>Enzymes: No micro-organism should be present in the concluding step of any enzyme production process. Enzymes used in the product must be in liquid state or anti-dust particulate state.</p> <p>Phosphorus: The total phosphorus content shall not exceed 0.5 %. The pH value of the detergent shall be < 11.</p> <p>Colourants: Only dyes accepted for use in food colouring and non-bioaccumulative dyes may be used in the product.</p> <p>Heavy metals: Specified substances are prohibited: mercury, lead, cadmium, chromium, arsenic zinc.</p> <p>Builders: The following are prohibited: phosphonates, ethylene diamine tetracetate (EDTA), nitrilotriacetic acid (NTA), diethylene triamine pentaacetic acid (DTPA) or any</p>

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)																																																																																
	<p>Colorants: The colorant must be approved for use in foodstuffs or must not be bioaccumulating ($\log K_{ow} < 4.0$ or $BCF < 500$).</p>	<p>products only, provided they have been approved a food additive or are not bioaccumulative.</p> <p>Palm oil and palm kernel oil: The licence applicant must have an effective purchasing policy for all palm oil, palm kernel oil (or derivatives) or raw materials that are manufactured from palm kernel oil to maximise the use of palm oil and palm kernel oil from sustainable sources.</p>		<p>salts formed from it.</p> <p>Other: The following substances shall not be incorporated into the manufacturing process or final product: chemical dyes, optical brighteners, formalin, halogenated hydrocarbons.</p>																																																																																
Hazardous substances and mixtures																																																																																				
<p>The product or any part of it thereof shall not contain substances or mixtures meeting the classification with the hazard class or categories listed below:</p> <table border="1"> <thead> <tr> <th>GHS Hazard statemt</th> <th>EU Risk Phrase</th> </tr> </thead> <tbody> <tr><td>H300</td><td>R28</td></tr> <tr><td>H301</td><td>R25</td></tr> <tr><td>H304</td><td>R65</td></tr> <tr><td>H310</td><td>R27</td></tr> <tr><td>H311</td><td>R24</td></tr> <tr><td>H330</td><td>R23/26</td></tr> <tr><td>H331</td><td>R23</td></tr> <tr><td>H340</td><td>R46</td></tr> <tr><td>H341</td><td>R68</td></tr> <tr><td>H350</td><td>R45</td></tr> <tr><td>H350i</td><td>R49</td></tr> <tr><td>H351</td><td>R40</td></tr> <tr><td>H360F</td><td>R60</td></tr> </tbody> </table>	GHS Hazard statemt	EU Risk Phrase	H300	R28	H301	R25	H304	R65	H310	R27	H311	R24	H330	R23/26	H331	R23	H340	R46	H341	R68	H350	R45	H350i	R49	H351	R40	H360F	R60	<p>Products must not be classified according to the classifications listed below:</p> <table border="1"> <thead> <tr> <th>Classi- fication</th> <th>(CLP Reg)</th> <th>EU Risk Phrase</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Hazardous to the aquatic environment</td> <td>H400</td> <td>N with R50</td> </tr> <tr> <td>H410</td> <td>R50/53.</td> </tr> <tr> <td>H411</td> <td>R52,</td> </tr> <tr> <td>H412</td> <td>R53 or</td> </tr> <tr> <td rowspan="5">Very Toxic</td> <td>H413</td> <td>R52/53 without N.</td> </tr> <tr> <td>H300</td> <td>Tx with</td> </tr> <tr> <td>H310</td> <td>R26, R27,</td> </tr> <tr> <td>H330</td> <td>R28</td> </tr> <tr> <td>H370</td> <td>with/or R39</td> </tr> <tr> <td rowspan="5">Toxic</td> <td>H301</td> <td>T with</td> </tr> <tr> <td>H311</td> <td>R23, R24,</td> </tr> <tr> <td>H330</td> <td>R25, R39</td> </tr> <tr> <td>H331</td> <td>and/or</td> </tr> <tr> <td>H372</td> <td>R48</td> </tr> </tbody> </table>	Classi- fication	(CLP Reg)	EU Risk Phrase	Hazardous to the aquatic environment	H400	N with R50	H410	R50/53.	H411	R52,	H412	R53 or	Very Toxic	H413	R52/53 without N.	H300	Tx with	H310	R26, R27,	H330	R28	H370	with/or R39	Toxic	H301	T with	H311	R23, R24,	H330	R25, R39	H331	and/or	H372	R48	<p>Machine dishwashing detergents shall not be formulated or manufactured with substances that are classified as:</p> <ul style="list-style-type: none"> Category 1 or Category 2 under the EC priority list developed under the Community strategy for endocrine disruptors Under Hazardous Substances and New Organisms Act as: 6.7 (carcinogens), 6.6 (mutagens), 6.8 (reproductive/developmental toxins), 9.1B (aquatic ecotoxins). 	<p>Ingredients or their known breakdown products must not be classified as:</p> <table border="1"> <thead> <tr> <th>Classification</th> <th>EU Risk Phrase</th> </tr> </thead> <tbody> <tr><td>Carcinogenic</td><td>R45, R49, R40</td></tr> <tr><td>Mutagenic</td><td>R46, R68</td></tr> <tr><td>Toxic for reproduction</td><td>R60, R61, R62, R63, R64</td></tr> </tbody> </table> <p>Products must not be classified as:</p> <table border="1"> <thead> <tr> <th>Classification</th> <th>EU Risk Phrase</th> </tr> </thead> <tbody> <tr><td>Toxic</td><td>R48, R33</td></tr> <tr><td>Sensitising</td><td>R42, R43</td></tr> <tr><td>Very toxic</td><td>R26, R27, R28, R23, R24, R25, R39</td></tr> <tr><td>Irritant</td><td>R35</td></tr> </tbody> </table>	Classification	EU Risk Phrase	Carcinogenic	R45, R49, R40	Mutagenic	R46, R68	Toxic for reproduction	R60, R61, R62, R63, R64	Classification	EU Risk Phrase	Toxic	R48, R33	Sensitising	R42, R43	Very toxic	R26, R27, R28, R23, R24, R25, R39	Irritant	R35	<p>The following substances shall not be incorporated into the manufacturing process or final product: carcinogens, mutagens, endocrine disruptors such as reproductive toxins and phthalates.</p>
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H360D	R61		Carcinogenic	H350	Carc with R40, R45 and/or R49			
H360FD	R60/61/60-61			H351				
H360Fd	R60/63		Mutagenic	H340	Mut with R46 and/or R68			
H360Df	R61/62			H341				
H361f	R62		Toxic for reproduction	H360	Repr with R60, R61, R62, R63 and/or R64			
H361d	R63			H361				
H361fd	R62-63			H362				
H362	R64		Harmful to health	H304	Xn with R20, R21, R48, R65 and/or R68			
H370	R39/23/24/25/26/27/28			H312				
H371	R68/20/21/22			H332				
H372	R48/25/24/23			H371				
H373	R48/20/21/22			H373				
H400	R50		Skin or respiratory sensitisation	H317	Xi with R43 Xn with R42			
H410	R50-53			H334				
H411	R51-53		Corrosive	H314	C with R34 or R35			
H412	R52-53							
H413	R53		Substances in the product must not be classified according to the classifications in the table below:					
EUH059	R59		Derogations:					
EUH029	R29		Substance /mixture	GHS Hazard statemt	EU Risk Phrase			
EUH031	R31		Fragrances	H334	R42			
EUH032	R32		Enzymes	H317	R43			
EUH070	R39-41			H334	R42			
H334	R42		H317	R43				
H317	R43		Derogations:					
Derogations: the following substances or mixtures are specifically exempted from this requirement:			Substance /mixture	GHS Hazard statemt	EU Risk Phrase			
			Surfactants (< 25 % wt)	H400	R50			
			Biocides used preservation	H401	R50-53			
				H411	R51-52			

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purposes	H412	R52-53																		
Fragrances	H412	R52-53																		
Enzymes	H334	R42																		
	H317	R43																		
NTA as in impurity in MGDA and GLDA	H351	R40																		
Total chemicals, dosage limits																				
<p>The total chemicals (TC) are the recommended dosage in g/wash minus the water content. The current criteria specify that the TC shall not exceed the following amounts:</p> <table border="1"> <thead> <tr> <th>Dishwasher detergent</th> <th>TCmax (g/wash)</th> </tr> </thead> <tbody> <tr> <td>Single function products</td> <td>20</td> </tr> <tr> <td>Multi-functional products</td> <td>22</td> </tr> </tbody> </table>			Dishwasher detergent	TCmax (g/wash)	Single function products	20	Multi-functional products	22	<p>The maximum dosage limits are:</p> <table border="1"> <thead> <tr> <th>Dishwasher detergent</th> <th>Dose (g/wash)</th> </tr> </thead> <tbody> <tr> <td>Single function products</td> <td>18</td> </tr> <tr> <td>Multifunctional products</td> <td>20</td> </tr> </tbody> </table> <p>Rinsing agent is exempted from this requirement.</p>		Dishwasher detergent	Dose (g/wash)	Single function products	18	Multifunctional products	20	<p>Dosage instructions shall appear on the product packages. The recommended dosages shall be specified for 'normal' and 'heavily' soiled dishes, and for the ranges of water hardness appropriate to where the product is marketed.</p>		<p>Products must give good results at a dosage not exceeding 18 g for soft water (0-6°dH) in a 12-setting dishwasher.</p> <p>The recommended dosage for different water hardness levels must be clearly stated on the packaging. Information on which areas in the country have hard water and which have soft must be stated in words or shown on a map. Advice on increasing the dosage must be stated to be a deviation from normal dosage.</p>	
Dishwasher detergent	TCmax (g/wash)																			
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Biodegradability of organics																				
<p>All surfactants must be readily biodegradable (aerobically). All surfactants classified as environmentally hazardous (with H410, H411, H412, H413) must also be anaerobically degradable.</p>			<p>All surfactants must be readily biodegradable and anaerobically degradable.</p>		<p>Surfactants must be readily biodegradable.</p> <p>Surfactants must be 60 % anaerobically biodegradable.</p> <p>Surfactants must have a very low residual content of organohalogen compounds – below 100 mg/kg Tox.</p> <p>Surfactants must not be very toxic to aquatic organisms. Surfactants</p>		<p>A biodegradability test for anionic surface active agents/surfactants is required:</p> <ul style="list-style-type: none"> • If anionic surfactant content is more than 5 % by weight in the product, the biodegradability test needs to be performed on the surfactant and it has to be more than 90 % biodegradable. • If anionic surfactant content 													

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			<p>must not be classified as R50, very toxic to aquatic organisms.</p> <p>If palm oil is used as a raw material in surfactant production, the surfactant manufacturer or the palm oil supplier must be a member of the Roundtable on Sustainable Palm Oil (RSPO) or be able to show that the palm oil used to produce the surfactants comes from a plantation that is certified in accordance with RSPO's sustainable cultivation rules.</p>	<p>is below 5 % by weight in the product, it is not necessary to do the biodegradability test.</p> <ul style="list-style-type: none"> • If cationic or non-ionic surfactants are used, it is not necessary to do the biodegradability test. <p>Biodegradability of anionic surfactants should be measured according to ISO 7827, 9439, 10707, 10708, 9408, 14593 or OECD methods 310A - F.</p>																
Toxicity to aquatic environments																				
<p>The critical dilution volume of the product must not exceed the following limits (CDV_{chronic}):</p> <table border="1"> <thead> <tr> <th>Product type</th> <th>CDV_{chronic} (l/wash)</th> </tr> </thead> <tbody> <tr> <td>DD (multi-function)</td> <td>30,000</td> </tr> <tr> <td>DD (single function)</td> <td>25,000</td> </tr> <tr> <td>Rinsing agents</td> <td>10,000</td> </tr> </tbody> </table> <p>Preservatives, colouring agents and fragrances present in the product shall also be included in the CDV calculation even if the concentration is lower than 0.10 %.</p>	Product type	CDV _{chronic} (l/wash)	DD (multi-function)	30,000	DD (single function)	25,000	Rinsing agents	10,000	<p>The products critical dilution volume must not exceed 70,000 L/wash.</p> <p>Multi-function tablets that meet performance requirements without the addition of salt and rinsing agent may have maximum CDV of 80,000 L/wash. If the application is for both dishwasher detergent and rinsing agent, these must be calculated together.</p> <table border="1"> <thead> <tr> <th>Product type</th> <th>CDV_{chronic} (l/wash)</th> </tr> </thead> <tbody> <tr> <td>DD (multifunction)</td> <td>38,000</td> </tr> <tr> <td>DD (single function)</td> <td>28,000</td> </tr> <tr> <td>Rinsing agents</td> <td>10,000</td> </tr> </tbody> </table>	Product type	CDV _{chronic} (l/wash)	DD (multifunction)	38,000	DD (single function)	28,000	Rinsing agents	10,000		<p>The toxicity of chemical substances to aquatic organisms must be specified, giving results for fish, daphnia and algae (except for preservatives for which data is only required for fish and daphnia).</p> <p>Complexing agents must not be very toxic to aquatic organisms (LC₅₀, EC₅₀ and IC₅₀ > 1 mg/L).</p> <p>Solvents must not be toxic to aquatic organisms (LC₅₀, EC₅₀ and IC₅₀ > 10 mg/L).</p> <p>Included solvents must not be harmful to aquatic organisms (LC₅₀, EC₅₀ and IC₅₀ > 100 mg/L).</p> <p>Preservatives must not be very toxic to aquatic organisms (LC₅₀ and</p>	
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			EC ₅₀ > 1 mg/L). Thickening agents/dissolving agents must not be toxic to aquatic organisms (LC ₅₀ , EC ₅₀ and IC ₅₀ > 10 mg/L). Bleaching agents must not be very toxic to aquatic organisms (LC ₅₀ , EC ₅₀ and IC ₅₀ > 1 mg/L). Acids must not be toxic to aquatic organisms (LC ₅₀ , EC ₅₀ and IC ₅₀ > 10 mg/L).																
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The content of organic substances in the product that are aerobically non-biodegradable (aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the following limits: <table border="1"> <thead> <tr> <th>type</th> <th>aNBO (g/wash)</th> <th>anNBO (g/wash)</th> </tr> </thead> <tbody> <tr> <td>DD</td> <td>1.00</td> <td>5.50</td> </tr> <tr> <td>Rinse aid</td> <td>0.15</td> <td>0.50</td> </tr> </tbody> </table>	type	aNBO (g/wash)	anNBO (g/wash)	DD	1.00	5.50	Rinse aid	0.15	0.50	The content of organic substances that are not readily anaerobically biodegradable must not exceed the following limits: <table border="1"> <thead> <tr> <th>Product type</th> <th>anNBO (g/wash)</th> </tr> </thead> <tbody> <tr> <td>DD</td> <td>1.20</td> </tr> <tr> <td>Rinsing agents</td> <td>0.30</td> </tr> </tbody> </table> This criterion applies to organic substances only.	Product type	anNBO (g/wash)	DD	1.20	Rinsing agents	0.30	Raw materials with 9.1A (aquatic toxicity) must be readily biodegradable and not potentially bioaccumulative.	Organic ingredients must be readily biodegradable Organic ingredients must be 60 % anaerobically biodegradable Exceptions are made for substances for which there is no risk of accumulation in anaerobic environments. Preservatives, thickening agents/ dissolving agents, bleaching agents and acids must be readily biodegradable.	
type	aNBO (g/wash)	anNBO (g/wash)																	
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Packaging																			
Primary packaging shall not exceed 2.0 g/wash. Cardboard packaging shall consist of ≥ 80 % recycled material. Labelling of plastic packaging must be marked in accordance with DIN 6210	The products weight-to-benefit ratio (WBR) must not exceed the following values: <table border="1"> <thead> <tr> <th>Product</th> <th>WUR (g/wash)</th> </tr> </thead> <tbody> <tr> <td>DD multi/ single funct</td> <td>2.75</td> </tr> <tr> <td>Rinsing agents</td> <td>1.5</td> </tr> </tbody> </table>	Product	WUR (g/wash)	DD multi/ single funct	2.75	Rinsing agents	1.5	Primary packaging shall not exceed 2.0 g/wash. All plastic packaging must be made of plastics that are able to be recycled in the country where the product is sold.	Packaging must be made of components that are easy to take apart, and each component must consist of a single type of material. Refill packaging that weighs no more than 30 % of the weight of the original packaging is exempted from this rule.										
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Rinsing agents	1.5																		

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
<p>Section 2 or the equivalent. Caps and pumps are exempted from this requirement.</p> <p>Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 2 b (hazardous substances and mixtures) may be used in the plastic packaging.</p>	<ul style="list-style-type: none"> • Polyvinyl chloride (PVC) and other halogenated plastics must not be used for packaging. • To ease the sorting of packaging materials for recycling all packages need to have information on what they are made of and how they should be sorted in the relevant user stage. The packaging can be marked according to European standards (for example DIN 6120, section 2) recommendations from national recycling schemes or equivalent. • Take-back system: national regulations, legislation and/or agreements within the sector regarding the recycling systems for products and packaging shall be met in the Nordic countries in which the company markets its dishwasher detergents. 	<p>Primary packaging must not be impregnated, labelled, coated or otherwise treated in a manner which would prevent recycling (e.g. PVC sleeves, metallic labels).</p> <p>Primary cardboard packaging shall consist of 80 % recycled content, 25 % of which must be port-consumer material.</p> <p>Information shall be provided to the Trust on the following:</p> <ul style="list-style-type: none"> • The percentages by weight of recycled and virgin PVC • Information regarding the manufacture of PVC for used in packaging • The use of refillable containers • Use of PVC and/or phthalates in packaging • Any product stewardship arrangements for the packaging. 	<p>Plastic packaging must be made from polyethylene, polypropylene, poly-ethylene terephthalate or an equivalent plastic. PVC is not permitted. Plastic packaging must be marked in accordance with DIN 6120 or American SPI. It is not necessary to mark small parts, such as stoppers, in this way.</p> <p>At least 80 % of cardboard packaging must be manufactured from wood fibre obtained from recycled raw material. If new raw material is used for the rest of the card-board, at least 30 % of this must be certified by the Forest Stewardship Council (FSC). If the product content prevents the use of recycled raw materials for packaging, it is acceptable to use cardboard that is 100 % FSC-certified. Only wholly chlorine-free bleaching methods may be used.</p> <p>As far as possible, the pack-aging must comply with REPA's⁴⁸ recommendations to facilitate recycling. Products that are intended for sale to consumers must carry instructions on how the packaging should be sorted for</p>	

⁴⁸ REPA is part of Sweden's Packaging and Newspaper Collection Service and is a trade and industry solution to producer responsibility for packaging made of paper, plastic and metal.

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
			<p>recycling in accordance with the document <i>REPA's instructions</i>. If the packaging consists of different materials, information must also be given on how the different components should be recycled.</p> <p>No metal may be used in the packaging. Exceptions may be allowed for large packaging that can be recycled. Metal may be used in the handles of buckets that hold 15 L or more if the handle can easily be removed when the packaging is recycled. Nozzles on packaging such as pump bottles and trigger sprays are exempted from this requirement.</p>	
Consumer information				
<p>The following information or text shall appear on the packaging:</p> <p><i>This EU Ecolabel detergent works well at low temperatures (*). Select low temperature washing cycles on the dishwasher, wash full loads and do not exceed the recommended dosage. This will minimise both energy and water consumption and reduce water pollution.</i></p> <p>(*) The applicant shall insert here the</p>	<p>The following should be clearly stated on the label:</p> <ul style="list-style-type: none"> • The recommended dosage for soft water (0-6 °dH) and a recommendation is to be given to use salt to soften the water in the dishwasher. • Information stating that the product is efficient at/from 50 °C (or lower if tested at a lower temperature). <p>Exceptions: If multifunction products meet the performance requirement</p>	<p>The detergents shall be accompanied by instructions for proper use so as to maximise product performance and minimise waste. These instructions shall include information on reuse, recycling and/or correct disposal of packaging.</p> <p>The applicant shall take suitable steps to help the consumer respect the recommended</p>		<p>Instructions guiding the appropriate use of the product to enhance performance and generate lesser waste (e.g. reuse/ recycle and disposal methods) should be available to consumers.</p> <p>Product ingredients must be clearly visible on the product packaging in accordance with the labelling criteria stated in Article 11 of the Detergents</p>

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
<p>recommended temperature or range at temperatures that shall not exceed 55 °C.</p> <p>The type of enzymes shall be indicated on the packaging.</p> <p>There is an optional requirement for a text box containing the following text:</p> <ul style="list-style-type: none"> • Reduced impact on aquatic ecosystems. • Limited hazardous substances. • Performance tested. 	<p>without added salt in the machine, the recommendation about salt does not need to be given. The requirement does not apply to rinsing agents.</p> <p>If the product contains phosphates, the product must display the following or equivalent text: <i>“products that contain phosphates should only be used by households that are connected to district wastewater treatment system”</i></p>	<p>dosage, for example by making available a dosage device (for liquid or powdered products), and/or by indicating the recommended dosage at least in ml (for powdered or liquid products).</p> <p>A recommendation shall appear on the packaging for the consumer to contact their water supplier or local authority in order to find out the degree of hardness of their tap water.</p> <p>All dishwashing detergents must display on the container a list of product ingredients that complies with the labelling requirements of Article 11 of the Detergents Directive and its 2006 amendment.</p> <p>The following or equivalent words should be clearly displayed on the packaging: <i>“All detergents have an effect on the environment. Always use the correct dose for maximum efficiency and minimum environmental impact. Use the lowest recommended</i></p>		<p>Directive and the amended version in 907/2006/EC.⁴⁹</p>

⁴⁹ Amendment 907/2006/EC to directive 648.2004 available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:168:0005:0010:en:PDF>

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
		<p><i>temperature</i>"</p> <p>Any proposed changes/ alterations to this wording must be submitted to and approved by The Trust.</p> <p>All packaging shall include a website reference where a copy of the product data sheet can be obtained.</p>		
		<p>No claim or suggestion, on the packaging or by any other means, shall be made that the product has an antimicrobial action.</p> <p>If the licence holder includes claims relating to the product being 'natural' or 'plant based' the licence holder shall provide evidence to support the claim, including but not limited to:</p> <ul style="list-style-type: none"> • the definition used by the licence holder to support the 'natural' or 'plant based' claim; • the source of all ingredients including whether they are synthetic versions of the chemicals; and • evidence of chain of custody where synthetic versions exist and the ingredients are non-synthetic versions. 		

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
Performance				
<p>Tests shall be carried out to ensure that the product has a satisfactory wash performance at the recommended dosage according to the standard test developed by IKW or the modified standard EN 50242 as follows.</p> <p>The tests shall be carried out at 55 °C or at a lower temperature if the product claims to be efficient at this temperature. When applying for rinse aids in combination with dishwasher detergents, the rinse aid shall be used in the test instead of the reference rinse aid. For multifunctional products the applicant must submit documentation proving the effect of the claimed functions.</p> <p>Modifications apply if the EN 50242:2008 test is to be used.</p>	<p>At the recommended dose, the dishwasher detergent must perform as well as, or better than, the reference detergent (IEC-D or IEC-B), with an average for each soil categories (of minimum 3 cycles) at 50 °C in all 4 soil categories (bleachable, burnt-on, amylase-specific, protease-specific). Alternatively the product is considered as good as the reference if the average value for all 8 soil types (at a minimum of 3 dish cycles) is better than the reference detergent. A 95 % confidence interval is to be used when evaluating the results.</p> <p>Cleaning performance is to be tested in accordance with the standard test for dishwasher detergents developed by IKW, with the following amendments:</p> <ul style="list-style-type: none"> • wash temperature 50 °C for the test product and 55 °C for the reference • water hardness 6 °dH • reference detergent IEC-D or IEC-B is to be used at a dose of 20 g • reference rinsing agent (formula III) at dose setting of between 2 and 3 	<p>The product shall be fit for its intended use and conform, as appropriate, to relevant product performance standards. Product performance with respect to both cleaning ability (ability to remove soil) and cleaning performance (the total amount of soil removed per wash) must be assessed.</p>		
Waste management				
		<p>The licence applicant/holder and product manufacturer must have a waste management programme and/or effective waste management policies and procedures. Licence holders must report annually to The Trust on waste management.</p>		

EU Ecolabel (detergents for dishwashers)	Nordic Swan (dishwasher detergents)	Environmental Choice NZ (machine dishwashing detergents)	Bra Miljöval (Good Environmental Choice) (chemical products)	Singapore Green Labelling Scheme (Dishwashing detergents)
Energy management				
		The licence applicant/holder and product manufacturer must have effective energy management policies and procedures and/or an energy management programme. In addition licence holders must report annually to The Trust on energy management.		Effective energy management policies and procedures and/or an energy management program must be in existence or proposed.
Bioconcentration factor				
			Ingredients must have a BCF < 100 If no BCF data is available, logK _{ow} < 3 Exceptions may be made if any of the following requirements are met: a) the ingredient must not be harmful to aquatic organisms (LC ₅₀ , EC ₅₀ and IC ₅₀ > 100 mg/L). b) it can be shown that the ingredient is quickly broken down into substances whose BCF or logK _{ow} satisfies the requirements. Acids must have a bio-concentration factor (BCF) of less than 100. If no BCF data is available, logK _{ow} < 3	

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Table 6: Overview of the requirements of different ecolabels and voluntary agreements for industrial and institutional dishwasher detergents

EU Ecolabel Industrial and institutional detergents for dishwashers	Nordic Swan dishwasher detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents																								
Limited substances																										
<p>Biocides: the product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone. This does not refer to surfactants which may also have biocidal properties. The product may contain biocides provided that they are not bioaccumulating. A biocide is not considered bioaccumulating if $BCF < 100$ or $\log K_{ow} < 3.0$. If both BCF and $\log K_{ow}$ values are available, the highest measured BCF value shall be used.</p> <p>Enzymes: Enzymes must be in liquid form or dust-free granulate. Enzymes must be free from micro-organism remnants from manufacture.</p> <p>Phosphorus: The total quantity of phosphates and other Phosphorus compounds must not exceed the limit values specified in the table below, in grams of phosphorus per litre:</p> <table border="1"> <thead> <tr> <th>(g P/l water)</th> <th colspan="3">Water hardness (°dH)</th> </tr> <tr> <th>Product type</th> <th>Soft (0-6)</th> <th>Med (7-13)</th> <th>Hard (>14)</th> </tr> </thead> <tbody> <tr> <td>Pre-soaks</td> <td>0.08</td> <td>0.08</td> <td>0.08</td> </tr> <tr> <td>Detergents</td> <td>0.15</td> <td>0.30</td> <td>0.50</td> </tr> <tr> <td>Rinse aids</td> <td>0.02</td> <td>0.02</td> <td>0.02</td> </tr> <tr> <td>Multicomp system</td> <td>0.17</td> <td>0.32</td> <td>0.52</td> </tr> </tbody> </table> <p>Colouring agents: Colouring agents are allowed in the product must not be bioaccumulating. In the case of colouring agents approved for foodstuffs it is not necessary to submit documentation of bioaccumulation potential. A colouring agent is considered not bioaccumulating if $BCF < 100$ or $\log K_{ow} < 3.0$. If both BCF and $\log K_{ow}$ values are available, the highest measured BCF value shall be used.</p>	(g P/l water)	Water hardness (°dH)			Product type	Soft (0-6)	Med (7-13)	Hard (>14)	Pre-soaks	0.08	0.08	0.08	Detergents	0.15	0.30	0.50	Rinse aids	0.02	0.02	0.02	Multicomp system	0.17	0.32	0.52	<p>Preservatives: The product may contain preservatives provided that the preservatives are not bioaccumulating. A preservative is not considered bioaccumulating if $BCF < 500$ or $\log K_{ow} < 4.0$. If both BCF and $\log K_{ow}$ values are available, the highest measured BCF value shall be used.</p> <p>Enzymes: Must be liquid form or dust-free granulate. Enzymes must be free from micro-organisms remnants from manufacture. Products in spray bottles or designed for use in spray bottles or equivalent must not contain enzymes.</p> <p>Phosphorus: The total content of phosphorus in the product is limited to: Dishwasher detergents and presoaks: 0.08 g/l water Rinse aids: 0.04g/l water. The total content of phosphonates/phosphonic acids must not exceed the limits specified below: Dishwasher detergents and presoaks: 0.01 g/l water Rinse aids: 0.006g/l water</p> <p>Complexing agents, phosphonates/phosphonic acids: Phosphonates/phosphonic acids may, in total, be present in quantities of no more than 0.15 g/kg of articles to be washed.</p> <p>Colouring agents: must not be considered bioaccumulating. A colouring agent is not considered bioaccumulating if $BCF < 500$ or $\log K_{ow} < 4.0$. If both BCF and $\log K_{ow}$ values are available, the highest measured BCF value shall be used. Colouring agents approved for use in foodstuffs can be approved.</p>	<p>Biocides and preservatives: The product may only include biocides in order to preserve the product, and in the appropriate dosage for this purpose alone. This criterion does not apply to ingredients (e.g.: quaternary ammonium salts) added for other functions but which may also have biocidal properties.</p> <p>Enzymes: The enzyme production micro-organism shall be absent from the final enzyme preparation. Enzymes must be present in liquid form or as a dust-free granulate.</p> <p>Phosphorus: Total phosphorus used in commercial and institutional dishwashing detergents must not exceed the following quantities: Dishwasher detergents and pre-soaking liquid (in soft water): 0.4 gP/L solution Drying agent (in soft water): 0.4 gP/L solution</p> <p>The product must not contain more than 0.2 g of phosphonates that are not readily biodegradable (aerobically) per wash.</p> <p>Colorants: Colouring agents may be added to liquid products only, provided they have been approved a food additive or are not bioaccumulative.</p> <p>Palm oil and palm kernel oil: the licence applicant must have an effective purchasing policy for all palm oil, palm kernel oil (or derivatives) or raw materials that are</p>
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The following dosage recommendations must appear on the packaging, and/or on product information sheet or equivalent: dose according to the degree of soil, and the water hardness. Follow the dosing instructions.	The product must be easily dispensed using an automatic dosage system. If the product is dispensed manually, clear dosage instructions shall be provided.	The label or an accompanying technical product data sheet, must include details of the recommended dosage for different levels of soiling and for different water hardness																																																																				
Hazardous substances																																																																						
The product or any part of it thereof shall not contain substances or mixtures meeting the classification with the hazard class or categories listed below:	Products must not be classified according to the classifications listed below:	Commercial and institutional dishwashing detergents shall not be formulated or manufactured with substances (active content only) that are: <ul style="list-style-type: none"> classified as Category 1 or Category 2 under the European Commission priority list developed under the Community strategy for endocrine disruptors; classified under the Hazardous Substances and New Organisms Act as: 6.6 (mutagens), 6.7 (carcinogens), 6.8 (reproductive/developmental toxins), 9.1B (aquatic ecotoxins) Any raw ingredient that is classified as 9.1A (aquatic ecotoxin) must be readily biodegradable and not potentially bioaccumulative. <p>The limits by weight of substances classified 6.5 (respiratory and contact sensitisers) shall not exceed 0.1 %</p>																																																																				
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EU Ecolabel Industrial and institutional detergents for dishwashers		Nordic Swan dishwasher detergents for professional use		Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents															
H362	R64			<p>Substances in the product must not be classified according to the classifications in the table below:</p> <table border="1"> <thead> <tr> <th>Classification</th> <th>CLP</th> <th>EU Risk Phrase</th> </tr> </thead> <tbody> <tr> <td>Carcinogenic</td> <td>H350 H351</td> <td>T with R45 and/or R49, Carc1 or Carc2 or Xn with R40, Carc3</td> </tr> <tr> <td>Mutagenic</td> <td>H340 H341</td> <td>T with R46, Mt 1 or Mut2 or Xn with R68, Mut3</td> </tr> <tr> <td>Toxic for reproduction</td> <td>H360 H361 H362</td> <td>T with R60, R61, R64 and/or R33, Repr1 or Repr2 or Xn with R62, R63, R64 and/or R33, Repr 3</td> </tr> <tr> <td>Sensitising</td> <td>H334 H317</td> <td>R42 R43</td> </tr> </tbody> </table> <p>Environmentally hazardous substances: Are permitted in limited quantities in single component dishwasher detergents and multi-component dishwasher detergent systems.</p> <p>The inclusion of substances that are classified with any of the risk phrases R50/53, R51/53 or R52/53, alternatively are classified as Hazardous to the aquatic environment Category Chronic 1 H410, Category Chronic 2 H411 or Category Chronic 3 H412 is limited, as specified below:</p> <p>100 *AR50/53 + 10* AR51/53 + AR52/53 ≤ 0.40mg/ litre water or: 100 *AH410 + 10* AH411 + AH412 ≤ 0.40mg/ litre water</p> <p>At the highest recommended dose:</p>	Classification	CLP	EU Risk Phrase	Carcinogenic	H350 H351	T with R45 and/or R49, Carc1 or Carc2 or Xn with R40, Carc3	Mutagenic	H340 H341	T with R46, Mt 1 or Mut2 or Xn with R68, Mut3	Toxic for reproduction	H360 H361 H362	T with R60, R61, R64 and/or R33, Repr1 or Repr2 or Xn with R62, R63, R64 and/or R33, Repr 3	Sensitising	H334 H317	R42 R43
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EUH032	R32																		
EUH070	R39-41																		
H334	R42																		
H317	R43																		
Derogations: the following substances or mixtures are specifically exempted from this requirement:																			
Substance/ mixture	GHS Hazard statement	EU Risk Phrase																	
Surfactants (in concentrations < 15 % in the product)	H400	R50																	
Surfactants (in concentrations < 25 % in the product)	H412	R52-53																	
Biocides used for preservation purposes	H311	R23																	
	H334	R42																	
	H317	R43																	
	H400	R50																	
Enzymes	H334	R42																	
	H317	R43																	
	H400	R50																	
NTA as in impurity in MGDA and GLDA	H351	R40																	

EU Ecolabel Industrial and institutional detergents for dishwashers	Nordic Swan dishwasher detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents																																																	
	<p>AR50/53 / H410 is the quantity of substances assigned R50/53 or H410 classification in milligrams per litre water. AR51/53 / H411 is the quantity of substances assigned R51/53 or H411 classification in milligrams per litre water. AR52/53 / H412 is the quantity of substances assigned R52/53 or H412 classification in milligrams per litre water.</p> <p>Surfactants classified with H412 are exempted from the requirement, provided that they are readily degradable and anaerobically degradable.</p>																																																		
Toxicity to aquatic environments																																																			
<p>The critical dilution volume of a single of multi-component system must not exceed the following limits (CDV_{chronic}):</p> <table border="1"> <thead> <tr> <th>CDV_{chronic} (L/kg)</th> <th colspan="3">Water hardness (°dH)</th> </tr> <tr> <th>Product type</th> <th>Soft (0-6)</th> <th>Med (7-13)</th> <th>Hard (>14)</th> </tr> </thead> <tbody> <tr> <td>Pre-soaks</td> <td>2,000</td> <td>2,000</td> <td>2,000</td> </tr> <tr> <td>DD</td> <td>3,000</td> <td>5,000</td> <td>10,000</td> </tr> <tr> <td>Multi-comp system</td> <td>3,000</td> <td>4,000</td> <td>7,000</td> </tr> <tr> <td>Rinse aids</td> <td>3,000</td> <td>3,000</td> <td>3,000</td> </tr> </tbody> </table>	CDV _{chronic} (L/kg)	Water hardness (°dH)			Product type	Soft (0-6)	Med (7-13)	Hard (>14)	Pre-soaks	2,000	2,000	2,000	DD	3,000	5,000	10,000	Multi-comp system	3,000	4,000	7,000	Rinse aids	3,000	3,000	3,000	<p>The CDV of a single or multi-component system must not exceed the limit values (at the highest recommended dose) for CDV_{chronic} and CDV_{acute} given below:</p> <table border="1"> <thead> <tr> <th rowspan="2">l/l water</th> <th colspan="2">Critical Dilution Volume</th> </tr> <tr> <th>CDV_{acute}</th> <th>CDV_{chronic}</th> </tr> </thead> <tbody> <tr> <td>DD and presoaks</td> <td>5000</td> <td>8000</td> </tr> <tr> <td>Rinse aids</td> <td>1900</td> <td>3000</td> </tr> </tbody> </table>	l/l water	Critical Dilution Volume		CDV _{acute}	CDV _{chronic}	DD and presoaks	5000	8000	Rinse aids	1900	3000															
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EU Ecolabel Industrial and institutional detergents for dishwashers	Nordic Swan dishwasher detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents																															
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<p>The weight/utility ratio (WUR) must not exceed the following values:</p> <table border="1"> <thead> <tr> <th>WUR (g/l washing solution)</th> <th colspan="3">Water hardness (°dH)</th> </tr> <tr> <th>Product type</th> <th>Soft</th> <th>Med</th> <th>Hard</th> </tr> </thead> <tbody> <tr> <td>Powders</td> <td>0.8</td> <td>1.4</td> <td>2.0</td> </tr> <tr> <td>Liquids</td> <td>1.0</td> <td>1.8</td> <td>2.5</td> </tr> </tbody> </table> <p>Plastic/paper/cardboard packaging containing more than 80 % recycled material or more than 80 % plastic from renewable origin is exempt from this requirement.</p> <p>Only phthalates that at the time of application have been risk assessed and have not been classified according to the criterion on hazardous substances and mixtures may be used in any plastic packaging. To allow for identification of different parts for recycling, the primary packaging must be market in accordance with DIN 6120, Part 2 or the equivalent. Caps and pumps are exempted from this requirement.</p>	WUR (g/l washing solution)	Water hardness (°dH)			Product type	Soft	Med	Hard	Powders	0.8	1.4	2.0	Liquids	1.0	1.8	2.5	<p>Plastic material must be labelled in accordance with DIN 6120, Part 2 or equivalent. Small parts (<5 g) are exempted from this requirement.</p> <p>PVC or other halogenated plastics must not be incorporated in either the packaging or the labelling</p>	<p>All plastic packaging must be made of plastics that are able to be recycled in the country where the product is sold.</p> <p>Primary packaging must not be impregnated, labelled, coated or otherwise treated in a manner which would prevent recycling.</p> <p>Primary cardboard packaging shall consist of 80 % recycled content, 25 % of which must be post-consumer material.</p> <p>The primary packaging, shall have a weight utility ratio (WUR) of less than or equal to:</p> <table border="1"> <thead> <tr> <th rowspan="2">Product type/water hardness</th> <th colspan="3">WUR (g/l washing solution)</th> </tr> <tr> <th>Soft</th> <th>Med</th> <th>Hard</th> </tr> </thead> <tbody> <tr> <td>Powders</td> <td>0.8</td> <td>1.4</td> <td>2.0</td> </tr> <tr> <td>Liquids</td> <td>1.0</td> <td>1.8</td> <td>2.5</td> </tr> </tbody> </table> <p>Information shall be provided to the Trust on the use of refillable containers, PVC and/or phthalates used in the packaging. Further information on this can be found in the criteria document.</p>	Product type/water hardness	WUR (g/l washing solution)			Soft	Med	Hard	Powders	0.8	1.4	2.0	Liquids	1.0	1.8	2.5
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<p>The performance and efficiency of the product must be satisfactory. The product must satisfy the requirements for the user test or internal testing in accordance with Appendix II.⁶ Either internal testing or user testing can be used.</p>	<p>The performance of the single or multi-component system must be satisfactory at the recommended dosage with soft water.</p> <p>The performance and efficiency of the product must be satisfactory. The product must satisfy the requirements for the user test in accordance with Appendix 5.</p> <p>The results from tests from at least 8 test locations shall be submitted along with a report summarising these results and specifying the number and position of respondents.</p> <p>Dosing must agree with the producer's recommendations. The test period must last for at least four weeks. At least</p>	<p>The product must be fit for its intended use and conform, as appropriate, to relevant product performance standards. Performance of the product with respect to both cleaning ability (ability to remove soil) and cleaning performance (the total amount of soil removed per dish wash) must be assessed.</p>																															

EU Ecolabel Industrial and institutional detergents for dishwashers	Nordic Swan dishwasher detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents
	<p>80 % of the test locations must assess the product as offering satisfactory or excellent performance on all accounts. Respondents must also be satisfied or very satisfied with the customer visit agreement.</p> <p>If products that are destined for use in instrumental maintenance within health care (as defined in the product group definition) are tested according to the standard ISO 15883 no user tests are required. In case a test report from a certified laboratory (see appendix 4, point 1) showing that the tests have been carried out according to the standard with satisfying results shall be included as documentation.</p>	
Automatic dosing systems and customer visits		
<p>Multi-component systems shall be offered together with an automatic and controlled dosing system. In order to ensure correct dosage in the automatic dosing systems, customer visits must be incorporated as a normal routine for manufacturers/supplies. These customer visits are performed at all premises at least once a year during the license period; they must include calibration of the dosage equipment. Also, a third party can perform customer visits. In exceptional cases, customer visits may be dispersed with if the distance and method of delivery makes the visit impracticable.</p>	<p>Customer visits shall be made during the licence period in accordance with the supplier's procedures and agreement with each customer. The manufacturer/supplier must have a standard procedure for customer visits. In exceptional cases, a customer visit may be waived for occasional customers if the distance and method of delivery makes the visit impractical and difficult. The customer visit may be performed by a third party, such as a test institute or consultancy firm. The visit report shall be the supplier's standard visit report and contain the following items:</p> <ul style="list-style-type: none"> • Check that users have access to care instructions for the dishwasher. • Measurement of water hardness or certificate from the water supplier (does not have to be measured every time, but water hardness needs to be documented at all customers). • Dosage recommendation at the particular water hardness. • Current dosage. • Offer to provide an environmental advice poster free of charge, to include at least the following environmental advice: attempt to wash full machines whenever, do not leave the dishwasher on for extended periods when not in use, wash at the lowest temperature possible resulting in hygienic dishes. 	

EU Ecolabel Industrial and institutional detergents for dishwashers	Nordic Swan dishwasher detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents
User information		
<p>The following recommendations must appear on the packaging, and/or on product information sheet or equivalent:</p> <ul style="list-style-type: none"> • Dose according to soil and water hardness; follow the dosing instructions. • Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution, waste production and energy consumption. <p>Information appearing on the EU Ecolabel: The logo should be visible and legible. The use of the EU Ecolabel logo is protected in primary EU law. The EU Ecolabel registration/licence number must appear on the product, it must be legible and clearly visible.</p> <p>The optional label with text box shall contain the following text:</p> <ul style="list-style-type: none"> — reduced impact on aquatic ecosystems, — limited hazardous substances, — performance tested. <p>The guidelines for the use of the optional label with text box can be found in the 'Guidelines for use of the Ecolabel logo' on the website: http://ec.europa.eu/environment/ecolabel/documents/logo_guidelines.pdf</p>		<p>The detergent must be accompanied by instructions for proper use so as to maximise product performance and minimise waste. These instructions shall include information on reuse, recycling and/or correct disposal of packaging. The label, or an accompanying technical product data sheet, must include details of the recommended dosage for different levels of soiling and for different water hardness.</p> <p>The following or equivalent words should be clearly displayed on the packaging: <i>"All detergents have an effect on the environment. Always use the correct dose for maximum efficiency and minimum environmental impact."</i></p> <p>Any proposed changes/alterations to this wording must be submitted to and approved by The Trust.</p> <p>The label or accompanying documents must specify that the product is intended for use in automatically dosed dishwashers for professional use within institutional and catering facilities and not for use in domestic-type dishwashers.</p>
Claims		
<p>It is prohibited to claim or suggest on the packaging or by any other communication that the product has an antimicrobial or disinfecting effect.</p>		<p>No claim or suggestion, on the packaging or by any other means, shall be made that the product has an antimicrobial action.</p> <p>If the licence holder includes claims relating to the product being 'natural' or 'plant based' the licence holder shall provide evidence to support the claim, including but not limited to:</p> <ul style="list-style-type: none"> • the definition used by the licence holder to support the 'natural' or 'plant based' claim;

EU Ecolabel Industrial and institutional detergents for dishwashers	Nordic Swan dishwasher detergents for professional use	Environmental Choice New Zealand Commercial and Institutional Dishwashing Detergents
		<ul style="list-style-type: none"> • the source of all ingredients including whether they are synthetic versions of the chemicals; and • evidence of chain of custody where synthetic versions exist and the ingredients are non-synthetic versions <p>This criterion does not apply to palm oil or palm kernel oil.</p>
Waste management		
		<p>The licence applicant/holder and product manufacturer must have effective waste management policies and procedures and/or a waste management programme. In addition licence holders must report annually to The Trust on waste management. Further information on annual report can be found in the criteria document.</p>
Energy management		
		<p>The licence applicant/holder and product manufacturer must have effective energy management policies and procedures and/or an energy management programme. In addition licence holders must report annually to The Trust on energy management. Further information on annual report can be found in the criteria document.</p>

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Table 7: Comparison of excluded substances

Substance	EU Ecolabel DD	EU Ecolabel IIDD	Nordic Swan DD	Nordic Swan IIDD	Environmental Choice NZ DD	Environmental Choice NZ IIDD	Singapore Green Labelling Scheme DD
Phosphates	X	Separate criterion on P-compounds	Separate criterion on P-compounds	Separate criterion on P-compounds	X	Separate criterion on P-compounds	Separate criterion on P-compounds
DTPA	X		X		X		X
Perborates	X			X (and borates)			
Reactive chlorine compounds	X	X	X	X	X	X	
EDTA	X	X	X	X	X	X	X
Nitro-musks and polycyclic musks	X		X				X
APEO and ADP derivatives	x	X	X	X	X	X	
Enzymes	Limitations apply	Limitations apply	Limitations apply	Limitations apply			
LAS			X	X			
DADMAC ⁵⁰				X			
NTA	Derogations apply	Derogations apply		X	X	X	X
Fragrances	Special exemptions apply	X	Special exemptions apply	X		X	Special exemptions apply
PBT (Annex XIII of REACH)			X	X			
vPvB (Annex XIII of REACH)	x	x	X	X			
Substances on the EU list of 118 substances documented to cause endocrine disruption			X	X		X	
Nanoparticles (size <100 nm) based on metal, carbon or fluorine compounds				X			
Heavy metals					X	X	X

⁵⁰ DADMAC = diallyl dimethyl ammonium chloride, used in the manufacture of water soluble cationic polymers used as coagulants.
 TAED = tetra acetyl ethylene diamine, used as peroxide bleach activator for household detergents and for paper pulp

Opacifiers					X	X	
Quaternary ammonium salts that are not readily biodegradable					X		

Note that this does not take into account other substances which may be excluded by applicable regulations in the region for which they operate.

DRAFT - WORK IN PROGRESS

2.6 The need for separate criteria for DD and IIDD

2.6.1 Stakeholder feedback

In the initial stage of the study the potential for merging DD and IIDD criteria was analysed. Stakeholders were asked whether they thought the criteria for DD and IIDD should remain separate or be merged into one set of criteria. Over 75 % of the respondents agreed that they should remain as two separate sets of criteria. Some examples of the reasons for keeping the two separate are given below, as stated by questionnaire respondents:

- They are different types of products in terms of formulation, dosage, etc., for different types of machines.
- The machines have different operating cycles: 5-20 minutes for professional compared with 2-3 hours for mainly domestic dishwashers.
- Industrial and institutional products are most often intended for completely different wash processes.

Fewer than 25 % of the respondents thought that the criteria should be merged; these responses were from industry including manufacturers of IIDD. The reasons given were that DD and IIDD might use the same ingredients and the usage and target market of both is the same. It should be noted that these reasons contradict the reasoning given for keeping the criteria separate. Also by merging the criteria it would encourage the design of one product for both markets.

The review of other national ecolabelling schemes (see Section 2.5) has revealed that they have separate criteria for domestic and industrial/professional dishwasher detergents. For instance, the New Zealand Ecolabelling Trust quotes the following in its criteria document for commercial and institutional dishwashing detergents *“Commercial and institutional dishwashing detergents may contain more potent chemicals than similar dishwasher detergents intended for household use, and along with the volume of commercial and institutional dishwashing detergents used, this represents a potentially significant burden on the environment in terms of wastewater loading and subsequent treatment, resource consumption and disposal of packaging materials.”* This helps to explain why different environmental criteria are required for detergent products intended for I&I use. The Good Environmental Choice Australia Standard for Machine Dishwashing Detergents covers both DD and IIDD.⁵¹ In the criteria document, products intended for either domestic or commercial dishwashers are differentiated by the length of the wash cycles.

2.6.2 Differences between DD and IIDD products

In order to form a balanced argument for and against merging DD and IIDD criteria, it is important to fully understand the differences in the products which are covered by these categories and how they are used. Compared to household products, IIDD products are used in a wide range of locations including hotels, bars and catering, restaurants, food production, schools, hospitals and nursing homes.

In comparison to dishwasher detergents intended for household use, IIDD are likely to have tougher performance expectations and requirements. Due to these performance requirements, IIDDs contain more potent chemicals and/or higher concentrations of ingredients than the equivalent DDs. As a consequence they are likely to have a greater burden on the environment, in particular when taking into account the volumes at which detergents for I&I use are used when compared to DDs.⁵²

Due to the confidentiality of manufacturers' product formulations, limited information has been gathered regarding the key differences in product formulation between DD and IIDD. However, it has been possible to make some general comments on the differences in product formulation which can provide some useful insights. In general IIDD product formulas are more concentrated than their household equivalents. Otherwise, many of the same substances are used in IIDD and DD, but in varying concentrations. The major components in

⁵¹ Machine Dishwashing Detergents, Good Environmental Choice Australia: Environmental Performance Standard, December 2013.

⁵² The New Zealand Ecolabelling Trust: Licence criteria for commercial and institutional dishwashing detergents, EC-35-14, January 2014. Available from: http://www.environmentalchoice.org.nz/docs/publishedspecifications/ec3514_commercial__institutional_dishwashing.pdf

machine dishwashing detergents are alkaline silicates and builders. Typically IIDDs are more alkaline than household equivalents. Detergents intended for professional users will be designed for use with automatic dosing systems.^{51,53} In addition, the stakeholders' comments regarding the motivation for keeping the two criteria separate are mostly based on the differences in dishwashing processes and the automatic dishwashers used, and not on differences in product formulation. To further characterise the differences between DDs and IIDDs, the typical users, wash performance requirements and washing processes and equipment are outlined below.

2.6.2.1 Typical users and required wash performance

Professional dishwashing detergents are typically used in institutions and catering centres. Excluded from the EU Ecolabel criteria are detergents for dishwashing in special machines such as those used in food production factories, dairies and similar installations.

Professional users of detergents for dishwashers are likely to have more demanding and specific performance requirements than domestic users do. There is unlikely to be a vast difference in the types of soiling experienced in household and professional situations. However, professional users often employ specialist detergents depending on the wash ware; for instance, bars which mostly wash glassware will employ a specialist glassware detergent. This is in contrast to the domestic situation where general use detergents are used for all types of wash ware, such as cutlery, glassware, pans and porcelain. In general, domestic users require good cleaning and efficiency and professional users will have additional requirements for hygiene.

2.6.2.2 Differences in washing processes and equipment

The design of professional dishwashers is vastly different from that of domestic machines, reflecting the higher volumes of dishes and different conditions they need to work under. One of the main differentiating parameters is that productivity and throughput per hour is far more important for professional machines. To cope with higher demand, professional machines are operated more often or sometimes continuously. In contrast, domestic dishwashers are operated on average five times per week. In general, professional machines use higher clean and rinse temperatures, reuse washing suds, employ shorter cycle durations and are designed to handle more loads per year. These differences in wash processes will affect the environmental impact of industrial compared to household wash processes.

The main properties required of professional dishwashers can be summarised by the following points:

- water supply
- stationary rack or conveyor type
- front loading or pass through loading
- type of wash ware
- size and format.

Standard household dishwashers have significantly longer wash cycle times compared to professional machines, in the region of 2-3 hours compared to 5-20 minutes. This is because domestic machines heat the water for each cycle, and dishes are often not cleaned immediately after meals leading to dried soiling which requires longer soaking times.⁵⁴ Unlike domestic machines, professional machines do not always have a specific drying operation at the end of the wash cycle; drying may be carried out by a separate machine in a batch process.

There is a larger variety of professional machines, in terms of size and capacity, because of specific requirements such as type of wash and space. The differences in wash load, wash programme duration and wash temperatures for different types of dishwasher are summarised in Table 8.

⁵³ About Nordic EU Ecolabelled Dishwasher detergents for professional use, Version 2.1, Background to ecolabelling, October 2013

⁵⁴ *Preparatory Studies for Eco-design Requirements of Energy-using Products, Lot 24: Professional Washing Machines, Dryers and Dishwashers: Final Report*, Part: Dishwashers Task 1: Definition, Oeko Institut, Bio Intelligence Service and Büro Ö-Quadrat, February 2011.

Table 8: Summary of wash processes by automatic dishwasher type

Type of appliance	Main customer segment	Typical rated capacity (dishes/hr)	Cleaning load (dishes/year)	Duration of typical cycle duration (min)
Typical household dishwasher	Private households	12 couverts	n/a	90-120
Under-counter, water-change	Semi-professional	200	24,000	16
Under-counter, one tank	Professional	550	237,600	2
Hood type	Professional	860	345,600	2
Utensil/pot type	Professional	20 cycles/hour	9,000	2
One-tank conveyor type	Professional	1,750	1,515,900	2
Multi-tank conveyor type	Professional	3,600	4,009,500	2

The types of appliances can be defined as follows:

- **Under-counter dishwasher:** A machine which is designed to be installed under food preparation workspaces, and in which a rack of dishes remains stationary whilst being subjected to sequential wash and rinse sprays. Usually water-change under-counter dishwashers are employed for semi-professional use and one-tank models are exclusively for professional use.
- **Hood-type dishwasher:** These are one-tank pass-through dishwashers; they use one reservoir tank for detergent solution and fresh water for the final rinsing. Any pre-cleaning, such as rinsing, is conducted manually.
- **Utensil/pot dishwasher:** These are dishwashers which are specifically designed for cleaning items other than dishes, glasses and cutlery, such as pots, pans, containers, trays and large utensils. They can be both front-loading and pass-through in design.
- **One-tank conveyor type:** The different steps of the dishwashing process are allocated to several individual treatment zones and the dishes are transported through these zones in baskets or directly on a conveyor belt.
- **Multi-tank conveyor type:** The different steps of the dishwashing process are allocated to several individual treatment zones; at least one prewash zone with a reservoir tank, a cleaning zone with a reservoir tank and a final rinse zone using fresh water. As with one-tank conveyor machines, the dishes can be transported through the zones in baskets or directly on a conveyor machine.

2.6.3 Conclusions

When compared to household users, professional users have different requirements and often higher expectations of dishwasher detergents. The evidence presented above suggests that the wash processes employed are very different for household and I&I dishwashing and consequently so are the detergent requirements. We therefore recommend that DD and IIDD should remain as two separate EU Ecolabel criteria. Additionally, over 75 % of the stakeholders were in agreement with the proposal to keep the criteria separate. Other national ecolabelling schemes also have separate criteria documents for DD and IIDD, for example Nordic Swan and New Zealand's Environmental Choice.

2.7 Summary of the findings

Very few formal definitions or scope documents for DD and IIDD have been developed. From the evidence gathered in this report, stakeholder survey and the review of other ecolabels and voluntary agreements for dishwasher detergents, a set of initial proposals on a revised scope definition has been formulated.

- For DD, it is proposed that the product group scope and definition shall remain the same.
- For IIDD, it is proposed that the product group scope shall remain the same and the definition shall be further clarified by defining multi-component systems.

Detergents for dishwashers: *The product group 'Detergent for Dishwashers' shall comprise detergents for dishwashers and products used as rinse aids, whether in powder, liquid or any other form, which are*

intended to be marketed and used exclusively in automatic domestic dishwashers and in automatic dishwashers for professional use, the size and usage of which is similar to that of domestic dishwashers.

Industrial and institutional automatic dishwasher detergents: The product group ‘Industrial and Institutional Automatic Dishwasher Detergents’ shall comprise single and multi-component dishwasher detergents, rinse and pre-soaks, designed for use in professional dishwashers. **Multi-component systems may incorporate a number of products including pre-soaks and rinsing agents.**

The following products are excluded from the scope of this product group: consumer automatic dishwasher detergents, detergents intended to be used in washers of medical devices or in special machines for the food industry.

Sprays not dosed via automatic pumps are excluded from this product group.

2.8 Recommendations for revision of existing criteria

In the following section, the initial recommendations for the revision of the current criteria, based on feedback received from the stakeholder survey and reviews of other ecolabelling schemes for dishwasher detergents, are presented. An initial discussion on the feasibility and motivations behind each recommendation is also provided.

This examination process will be used to help direct the revision of the criteria and highlight areas where further investigation and stakeholder input are required. These points have been suggested by stakeholders and further assessment may be required. They will be undertaken during the next stage of the revision and presented in the technical report. In the technical report the proposals for criteria revision will be assessed and verified by the results of the technical analysis and/or another applicable method.

2.8.1 Comparison between the three criteria (DD, IIDD and GPP)

The characteristics covered by the three different criteria documents for DD, IIDD and GPP (core and comprehensive) are summarised in Table 9. The EU Ecolabel product category for DD has the widest set of criteria. At present there are several discrepancies in the coverage of the different criteria; for instance, only the EU Ecolabel for DD sets a limit for the total amounts of chemicals at the recommended dosage in grams per wash.

Table 9: Comparison of the criteria for DD, IIDD and GPP under revision

Criterion description	Detergents for dishwashers (DD)	Industrial and institutional automatic dishwasher detergents (IIDD)	GPP (core criteria)	GPP (comprehensive criteria)
Total chemicals	X			
Excluded or limited substances	X	X	X	X
Toxicity to aquatic organisms (CDV)	X	X		X
Biodegradability of organics	X	X		
Washing performance	X	X		
Packaging requirements	X	X	X	X
Consumer/user information	X	X		
User info on the EU Ecolabel	X	X		
Automatic dosing systems		X		

For consistency between the product categories, further harmonisation should be considered within each individual criterion. For instance, for IIDD the CDV and biodegradability limits are specified for different levels of water hardness, whereas there is no mention of water hardness for these limits in the DD criteria document. The list of excluded substances should be harmonised between the criteria where possible: this suggestion has been supported by stakeholders who responded to the first questionnaire.

2.8.2 Assessment and verification of measurement thresholds for constituents

In the current EU Ecolabel criteria (both consumer and industrial and institutional) , the measurement threshold imposed on ingredient concentration for ecological requirements is set at $\geq 0.01\%$ weight of the preparation for all ingoing substances. Compliance is required for preservatives, colouring agents and fragrances regardless of the concentration.

As part of the questionnaire stakeholders were asked for their views on this threshold and to comment on whether or not they thought it should remain at 0.01 % or change. Opinion was split on this matter, with 50 % of the respondents suggesting a change to 0.1 % and the other 50 % calling for the threshold to remain at 0.01 %. A variety of motivations for and against the 0.01 % measurement threshold were given, such as:

Favourable to 0.1 % requirement:

- Should be 0.1 % used unless the toxicity requires a lower limit.
- These limits are also used by REACH and CLP
- Information of impurities is not always available, unless toxicity requires this information.
- Change to 0.1 % except for substances that have special toxicity scale/limits.

Favourable to 0.01 % requirement:

- Allows for harmonisation of EU Ecolabel with other European regulations
- Allows for consistency with other EU Ecolabel detergent product categories.

In order to uphold the environmental credentials of the EU Ecolabel, the threshold is proposed to remain at 0.01 %. No issues have been raised by the stakeholders with regard to the technical feasibility of this requirement. However, there is an argument towards a variable threshold, whereby stricter limits are applied when necessary. Employing a variable threshold would further complicate the criteria and application process, which may deter and hinder applicants. Moreover, other national ecolabelling schemes use the 0.01 % threshold and it would be detrimental for the EU Ecolabel to appear less strict on ecological criteria. At this stage it is proposed that the measurement threshold imposed on ingredient concentrations for ecological requirements is not changed.

2.8.3 Criteria for detergents for Dishwashers (consumer product)

2.8.3.1 Criterion 1: Total chemicals

Current criteria:

The total chemicals (TC) are the recommended dosage in g/wash minus the water content. The current criteria specify that the total chemicals shall not exceed the following amounts:

- For single-functional dishwasher detergents TC_{max} = 20.0 g/wash
- For multi-functional dishwasher detergents TC_{max} = 22.0 g/wash

When calculating the CDV, aNBO and anNBO a dosage of rinse aid of 3 ml shall be used.

Proposed changes:	Further information from stakeholder feedback
1) Reduce total chemicals limits for single-functional and multi-functional detergents	<p>Only one stakeholder suggested that the limits can be lowered to 18.0 g/wash for single functional dishwasher detergents and 20 g/wash for multifunctional detergents. The reasons for these proposed stricter limits are compaction and concentration of products.</p> <p>For example, the Nordic Swan ecolabel has stricter requirements for the maximum dosage; namely 18.0 g/wash for powder and tablets without rinsing agents and 20.0 g/wash for combination detergents with rinsing agents. During the previous revision this criteria was revised and the total chemicals was reduced.</p> <p><i>As there has been little stakeholder feedback on this issue further investigation and stakeholder input is required. This will be presented in the technical report.</i></p>
2) Additional dosage	4 out of 14 respondents considered that additional dosage requirements are

<p>requirements</p>	<p>needed, for example dosage depending on water hardness or level of soiling. The following reasons for additional dosage requirements were given:</p> <ul style="list-style-type: none"> - Dosage of the product can vary depending on level of soiling and/or water hardness, therefore the criteria should reflect this (industry stakeholder). - Decrease the dose depending on the level of soiling and not depending on the water hardness because of the use of regenerating salt (industry stakeholder). <p>Further criterion on dosage according to water hardness and soiling would make the criteria more complicated and potentially more difficult for manufacturers to access (industry stakeholder). Dosage instructions must be mentioned on the label according to hardness of water and level of soil (industry stakeholder).</p> <p>In addition, water hardness may be negligible for dishwasher detergents due to the use of regenerating salt to counteract water hardness. Sweden's Good Environmental Choice scheme requires that dosage should not exceed 18 g for soft water. Perhaps an alternative approach would be to clarify the criterion by stating the water hardness for which the total chemicals requirement is set. The market analysis has shown that dishwasher detergents in tablet form account for the majority of the market and in some countries represent over 80 % of dishwasher detergent sales. Thus making dosage instructions negligible, as it is difficult for the consumer to change the dose.</p> <p><i>Instead of further requirements on maximum dosage, which maybe be unnecessary and complicated, a criterion for encouraging the use of salt in automatic dishwashing machines should be included and further clarification of the water hardness level in the current criterion for total chemicals. Further investigation and proposals for clarification and rewording will be presented in the technical report.</i></p>
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2.8.3.2 Criterion 2: Excluded or limited substances or mixtures

<p>Current criteria:</p> <p>Under the existing criteria, the following ingredients must not be included in the product:</p> <ul style="list-style-type: none"> • phosphates • DTPA (diethylene triamine pentaacetic acid) • perborates • reactive chlorine compounds • EDTA (ethylene diamine tetracetate) • nitro-musks and polycyclic musks. <p>According to Article 6(6) of the Ecolabel Regulation, the product or any component of it shall not contain substances meeting criteria for classification with the hazard statements or risk phrases specified in the criteria document.</p> <p>Derogations and exemptions apply for the following substances:</p> <ul style="list-style-type: none"> • surfactants (in concentrations < 25 % in the product) (H400)(H412) • fragrances (H412) • biocides used for preservation (H410, H411 and H412) • enzymes (H334 and H317) • NTA as an impurity in MGDA and GLDA (H351).
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Proposed changes	Further information from stakeholder feedback
<p>1) Harmonise with list for IIDD (as far as possible)</p>	<p>A harmonisation would allow for synergies between the two product groups, however, there are some substances which will be acceptable in IIDD and not DD and vice versa. For example fragrances are rarely used in IIDD but in DD products with fragrances are favoured by consumers in most EU countries. Furthermore, the commission statement following the development of the IIDD</p>

	criteria called for closer alignment between DD and IIDD. ⁵⁵
2) Add derogation for surfactants with H412 classification ⁵⁶	Four of the stakeholders requested that a derogation should be added for surfactants classified under H412. Almost all ethoxylated alcohols are now classified under H412; however, these are commonly used surfactants in detergent products. <i>An amendment to the Commission Decision (2011/263) included a derogation for surfactants classified under H412. Therefore no action is required, other than to ensure that this amendment is included in the technical report.</i> ⁵⁷
3) Should also restrict substances considered persistent, bio-accumulable and toxic (PBT), very persistent and very bio-accumulable (vPvB) and/or those having endocrine disrupting properties ⁵⁸	One of the stakeholders suggested that the use of these substances in the ingredients of the product should be restricted. Further discussion with stakeholders is required on the best approach for excluding such substances in the criteria. In comparison to the EU Ecolabel the Nordic Swan has a larger list of excluded substances; however, substances considered to be PBT and vPvB are excluded from EU Ecolabel products through Article 6.6 in the Ecolabel Regulation. ⁵⁹ In addition alkylphenol ethoxylates (APEOs), alkylphenol derivatives (APDs) and linear alkylbenzene sulphonates (LASs) are also excluded by the Nordic Swan. A comparison of the substances excluded by the criteria of different ecolabels is provided in Table 7. <i>Further research is required on each substance for which an exclusion is proposed, with the exception of those already banned by Article 6.6. This will be presented in the technical report.</i>
4) Exclude phosphonates from EU Ecolabel dishwasher detergent formulations	2 stakeholders suggested that phosphonates should be excluded. Phosphonates are chelating agents and limescale inhibitors which are used as alternatives to phosphates in dishwasher detergents. However, phosphonates are not readily biodegradable and concerns have been raised over their use in detergents. Phosphonates do not release phosphorus to aquatic systems as readily as phosphates do. Phosphonates are only photo-degradeable and so release phosphorus to aquatic systems under certain conditions only. Reducing or eliminating phosphonates from formulations would affect the performance and quality of products. ⁶⁰ <i>Given all the evidence gathered so far, an exclusion of phosphonates would seem inappropriate. A more considered approach would be that of the Nordic Swan Ecolabel which sets a maximum limit for phosphorus substances in the product formulation. The EU Ecolabel criteria for IIDD set maximum phosphorus limits by product type. The Environmental Choice New Zealand scheme requires that dishwasher detergent products must not contain more than 0.2 g of phosphonates which are not readily biodegradable (aerobically) per wash. A criterion on the maximum limit of phosphorus will be proposed.</i>
5) Exclude specific nanomaterials of concern	An exclusion of specific nanomaterials was not suggested by stakeholders during the survey, but the review of national ecolabels found that the Nordic Swan ecolabel has banned nanoparticles compromising metal, carbon or fluorine compounds from professional dishwasher detergents.

⁵⁵ Summary of the meeting of the Regulatory Committee established under Article 16 of Regulation (EC) No 66/2010 of 25 November 2009 of the European Parliament and of the Council on the EU Ecolabel, Brussels, 29 June 2012.

⁵⁶ The derogation for surfactants classified as H412 was already introduced by an amendment to the EU Ecolabel criteria set). The point was kept as it was the request of the stakeholders.

⁵⁷ Commission Decision 2014/313/EU, available from: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0313&from=EN>

⁵⁸ These substances are already restricted through the Hazardous Chemical substances. The point was kept because it was the feedback directly received by the stakeholders.

⁵⁹ Regulation (EC) No 66/2010 of The European Parliament and of The Council Of 25 November 2009 on the EU Ecolabel. Available from: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:027:0001:0019:en:PDF>

⁶⁰ UEAPME's opinion on the revision of Eco-label criteria for laundry and dishwashing detergents, August 2008. Available from http://www.ueapme.com/docs/pos_papers/2008/0808_pp_ecolabel_laundry_and_dishwashing.pdf

	<p>The market analysis has not found any evidence of nanomaterials being used in dishwasher detergents at the present.</p> <p><i>Further investigation is required on the use of nanomaterials in dishwasher detergents and on the need to eventually ban specific nanomaterials of concern.</i></p>
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2.8.3.3 Criterion 3: Toxicity to aquatic organisms: Critical Dilution Volume

Current criteria:

The critical dilution volume of the product must not exceed the following limits (CDV_{chronic}):

Product type	CDV _{chronic}
Single-functional dishwasher detergent	25,000 l/ wash
Multi-functional dishwasher detergent	30,000 l/ wash
Rinse aid	10,000 l/ wash

Preservatives, colouring agents and fragrances present in the product shall also be included in the CDV calculation even if the concentration is lower than 0.010 % (100 ppm).

Proposed changes	Further information from stakeholder feedback
<p>1) CDV limits need to be recalculated according to the 2014 Detergent Ingredient Database list (DID list)⁶¹</p>	<p>The method of calculating the CDV limits should use the latest version of the DID list, which has recently been enlarged and updated. The DID list is regularly updated and includes as many detergent ingredients as possible. When ingredients are not on the DID list, it is more difficult for manufacturers to validate the data which they have received from their suppliers.</p> <p><i>Following an examination of the new DID list (updated every 4-5 years), the CDV limits will be revised accordingly; this will form part of the technical report. This will be done in parallel to the analysis of CDV values of EU Ecolabel products (to be obtained from competent bodies).</i></p>
<p>2) Consider taking an environmental risk approach</p>	<p>2 stakeholders commented that CDV takes a purely hazard based approach and uses the sum of these hazards. It would be more logical to use an environmental risk based approach, such as that employed by REACH.⁶² The environmental risk of each ingredient should be taken into account, for example. It has been suggested that rather than look at R phrases, REACH requires a risk assessment of the consumer's / environment's exposure which takes into account the way the chemicals (and products) are actually used.⁶³</p> <p><i>As little information was provided on this approach, further investigation and stakeholder input is required.</i></p>
<p>3) Consider different CDV levels for different product types/forms</p>	<p>4 out of the 13 respondents considered that different CDV limits should be set for different forms of dishwasher detergent, as the active ingredients and the way in which the ingredients are released differ for powders, liquids and tablets. The motivation behind this proposal is that the CDV limits for the current criteria do not depend on the form of the product; for instance, the limit for liquids and powders is the same. This may not be the most realistic approach as, for example, water soluble films contribute significantly to CDV levels and therefore should have stricter limits. The active ingredients contained in dishwasher detergents differ depending on whether they are powder, liquid or tablet form. In addition powders and tablets contain ingredients different than those used in</p>

⁶¹ <http://joutsenmerkki.fi/wp-content/uploads/2013/07/DID-list-Final-report-english.pdf>

⁶² For further information on REACH see http://ec.europa.eu/enterprise/sectors/chemicals/reach/index_en.htm

⁶³ Position of the European Chemical Industry Council (Cefic) on the Communication from the commission to the European Parliament, The Council, The European Economic and Social Committee and The Committee of the Regions. Public procurement for a better environment, Brussels, August 2013. From http://www.cefic.org/Documents/PolicyCentre/CEFIC-POSITION_on_GPP_final.pdf

	<p>liquid detergents and the way they are released during use is completely different. However, the market analysis conducted as part of this study showed that dishwasher detergents in tablet form have the largest market share in Europe. Additionally the EU Ecolabel should not encourage products forms (for example those with water soluble films) which perform worse environmentally, by allowing them to have less strict requirements than other product forms.</p> <p><i>To assess this requirement it may be necessary to acquire anonymised product formulations from existing licence holders via CBs. In order to propose new values for the revised EU Ecolabel criteria competent bodies and other stakeholders will be contacted and asked for information on CDV values of EU Ecolabel dishwasher detergents. The results of this investigation will be presented in the technical report.</i></p>
<p>4) Consider using USEtox for assessing toxicity to aquatic environment</p>	<p>USEtox is a method which can be used to calculate characterisation factors for human and ecotoxicity impact categories for life cycle assessment. The French environmental labelling standard under development by ADEME-AFNOR has chosen to employ USEtox instead of CDV.⁶⁴</p> <p>Studies have been conducted to compare the environmental scores from USEtox and CDV.^{65 66} They have found that the scores obtained from both for the same detergent may give different ingredient rankings. However, the general conclusion from the studies is that both methods are relevant for calculating product environmental impact scores related to their hazard.</p> <p>It should be noted that USEtox was not addressed by the comments of the stakeholders in reply to the survey. Instead, it has been suggested during the revision process by a CB</p> <p><i>The criterion on toxicity to the aquatic environment is very important for dishwasher detergents as they are released into water during use and after use: any changes to this criterion require careful consideration and thorough investigation.</i></p>

2.8.3.4 Criterion 4: Biodegradability of organics

Current criteria:

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable, aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

Product type	aNBO	anNBO
Dishwasher detergents	1.0 g/ wash	5.50 g/ wash
Rinse aid	0.15 g/ wash	0.50 g/ wash

Note that tetra acetyl ethylene diamine (TAED) should be considered as anaerobically biodegradable.

Proposed changes	Further information from stakeholder feedback
<p>1) Limits for anaerobically organic substances</p>	<p>Only 2 stakeholders responded that the current limits set for the maximum amounts of aNBO and anNBO organic substances were not strict enough. 3 of the stakeholders commented that the current limits are in fact too strict and that they are difficult to justify because anaerobic biodegradation is not a main</p>

⁶⁴ *General Principles for an Environmental Communication on Mass Market Products*, Methodology for the Environmental Impacts Assessment of Household Heavy Duty Laundry Detergents, ADEME, 2012

⁶⁵ *Comparing chemical environmental scores using USEtox and CDV from the European EU Ecolabel*, E.G. Saouter, C. Perazzolo, L.D. Steiner, Int.J.Life Cycle Assess., p795-802, 2011

⁶⁶ *Ecotoxicity impact assessment of laundry products: a comparison of USEtox and critical dilution volume approaches*, Van Hoof, G., Schowanek, D., Franceschini, H., Munoz, I., Int. J. Life Cycle Assess., p803-818, 2011.

	<p>factor for environmental performance.</p> <p>A stakeholder commented that the current limits set are too strict for anNBO for dishwasher detergents; they should be lowered to around 1.2 g/wash. Unfortunately, no further scientific evidence was provided to support this proposal. Further discussion is required on whether or not a new limit should be set. However, the motivation behind the current requirement was that reducing the level of non-biodegradable organics to a minimum, ensures that minimal accumulation of non-biodegradable substances will occur in waste water sludge. <i>Further investigation and stakeholder input is required if this criterion is to be revised. If possible this will include an analysis of anNBO levels of EU Ecolabel dishwasher detergents, information on which is to be obtained from the competent bodies.</i></p>
<p>2) Water hardness and biodegradability</p>	<p>Only 4 out of the 13 respondents considered that the biodegradability limits should be set for different levels of water hardness. However, the comments given by stakeholders appear to contradict each other. One industry stakeholder commented that water hardness is not relevant for automatic dishwasher detergents, whilst another commented that water hardness affects the performance of products. The use of regenerative salt in dishwasher softens the water and negates the need for dosing the product depending on the level of water hardness.</p> <p><i>Given the information available currently, further limits should not be set in terms of water hardness as it unnecessarily complicates the criteria. Moreover, the current market is dominated by dishwasher tablets that make difficult variation in the dosage. Instead it should be stated at what level of water hardness the anNBO and anNBO limits are set. A proposal for a clarification will be drafted.</i></p>

2.8.3.5 Criterion 5: Washing performance

Current criteria:

Tests shall be carried out to ensure that the product has a satisfactory wash performance at the recommended dosage according to the standard test developed by IKW or the modified standard EN 50242 as follows.⁶⁷

The tests shall be carried out at 55 °C or at a lower temperature if the product claims to be efficient at this temperature. When applying for rinse aids in combination with dishwasher detergents, the rinse aid shall be used in the test instead of the reference rinse aid. For multifunctional products the applicant must submit documentation proving the effect of the claimed functions.

If the EN 50242:2008 test is used, the following modifications shall apply:

- The tests shall be carried out at 55 °C ± 2 °C (or at a lower temperature if the detergent claims to be efficient at a temperature below 55 °C) with cold pre-wash without detergent.
- The machine used in the test shall be connected to cold water and must hold 12 place settings with a washing index of between 3.35 and 3.75.
- The machine's drying programme shall be used, but only the cleanliness of the dishes shall be assessed.
- A weak acidic rinsing agent in accordance with the standard (formula III) shall be used.
- The rinsing agent setting shall be between 2 and 3.
- The dosage of dishwasher detergent shall be as recommended by the manufacturer.
- Three attempts shall be carried out at water hardness in accordance with the standard.
- An attempt consists of five washes where the result is read after the fifth wash without the dishes

⁶⁷ Further information on the IKW standard test can be found at: www.ikw.org/

being cleaned between the washes.

- The result shall be better than or identical to the reference detergent after the fifth wash.
- Recipe for the reference detergent (Detergent B IEC 436) and rinsing agent (formula III) see Appendix B in the standard EN 50242:2008 (the surfactants are to be stored in a cool place in watertight containers not exceeding 1 kg and are to be used within 3 months).

If rinse aid and salt functions are part of a multifunctional product the effect must be documented by test.

The following feedback was given by stakeholders regarding the washing performance test:

- Following the revision of the IKW test method an update to the criterion is needed.
- The performance test needs to be more realistic; reduce the quantity of soils.
- The IKW protocol should be the preferred choice of performance test.
- The IKW test is the performance test of choice; nevertheless an alternative reference may need to be developed for the evaluation of liquid products as the existing test criteria were developed for powder/tablets.
- A standard formula detergent should be used for reference instead of the leader in the market, as there is no formal information on the leader in the detergent market for all local markets.
- A second reference detergent should be assessed for evaluation of liquids, the current one (IEC 436 B) is relevant for powder and tablets only.

If revision of this criterion is required then further stakeholder input will be needed.

2.8.3.6 Criterion 6: Packaging requirements

Current criteria:

The current criteria for detergents for dishwashers state the following requirements for packaging:

Packaging	Requirements
Primary packaging	Shall not exceed 2.0 g/wash
Cardboard packaging	Shall consist of $\geq 80\%$ recycled material
Labelling of plastic packaging	Must be marked in accordance with DIN 6210 Part 2 or the equivalent. Caps and pumps are exempted from this requirement
Plastic packaging	Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 2 b (hazardous substances and mixtures) may be used in the plastic packaging.

Proposed changes	Further information from stakeholder feedback
1) Criteria which further promote the use of recycled materials are required	2 out of the 12 agreed that additional criteria should be set to further promote the use of recycled materials in packaging. <i>The motivation for using recycled materials is that the environmental impact of packaging is further reduced. However, this is only true when the recycled materials are available on the market and it does not create market distortions. Compared to other environmental impacts associated with dishwasher detergents, those caused by packaging are negligible. The use of recycled cardboard packaging is already encouraged in the existing criteria. There is little motivation to add further requirements on the use of recycled materials.</i>
2) Encourage ease of disassembly of packaging and design for recycling	3 stakeholders agreed that there should be restrictions on combinations of materials used for packaging, for instance to encourage ease of disassembly for recycling. Stakeholders commented that 'non-compatible materials are the major barrier to improve the recyclability of packaging'; 'encourage ease of disassembly for recycling'; and 'materials that are not recycled and cannot be separated from the primary packaging must not be used'. Recycling of packaging is hindered by products which are hard to disassemble. Non-compatible materials are a major barrier to improving the recyclability of packaging. Adding

	a requirement for ease of disassembly improves the ability to recycle. <i>In order to facilitate effective recycling a criterion for disassembly of primary packaging should be included. A requirement for this will be proposed in the technical report.</i>
3) Promote use of sustainably sourced wood fibres	The current criteria do not promote the use of sustainably sourced wood fibres, only the use of recycled cardboard and paper. One of the stakeholders commented that “sustainably sourced wood fibres should be regarded as an alternative to recycled paper/board”. Both the AISE Charter for Sustainable Cleaning and Sweden’s Good Environmental Choice have criteria on the use of sustainably sourced wood fibres. <i>It is proposed that a criterion should be set for board and paper packaging to ensure that the virgin material comes from sustainably managed forestry. A requirement for sustainably sourced wood fibres will be proposed in the technical report.</i>

2.8.3.7 Criterion 7: Consumer information

Current criteria:

The following information or text shall appear on or in the product:

a) Information on the packaging:

This EU Ecolabel detergent works well at low temperatures (). Select low temperature washing cycles on the dishwasher, wash full loads and do not exceed the recommended dosage. This will minimise both energy and water consumption and reduce water pollution.*

(*) The applicant shall insert here the recommended temperature or range at temperatures that shall not exceed 55 °C.

b) Dosage instructions

Dosage instructions shall appear on the product packages. The recommended dosages shall be specified for the ranges of water hardness appropriate to where the product is marketed. The instructions shall specify how to make best use of the product according to soil.

The applicant shall take suitable steps to help the consumer respect the recommended dosage, for example by making available a dosage device (for powdered or liquid products) and/or by indicating the recommended dosage at least in ml (for powdered or liquid products).

c) Information and labelling of ingredients

The type of enzymes shall be indicated on the packaging.

Proposed changes	Further information from stakeholder feedback
1) A recommendation on the use of dishwasher salt	The use of dishwasher salt in medium and hard water areas should be encouraged, instead of overdosing the detergent product. A recommendation explaining this could be included as part of the consumer information on the packaging. <i>A recommendation for the use of dishwasher salt shall be drafted and presented with the criteria proposal and the technical report.</i>
2) Refer to A.I.S.E cleanright tips	A.I.S.E. has proposed that the packaging should include a reference to their <i>cleanright</i> tips. The <i>cleanright</i> campaign has tips on how to save water and energy while using a dishwasher. These tips include: scrape instead of pre-rinsing, fill the machine to capacity or try the 50 °C or lower temperature programmes. These tips could be referred to on the packaging to encourage water and energy saving. <i>EU Ecolabel cannot directly promote private campaigns; nevertheless the tips and recommendations which encourage water and energy saving shall be included. Analysis of the cleanright will be made and this information will be</i>

discussed in the framework of criterion on consumer information.

2.8.3.8 Criterion 8: Information appearing on the EU Ecolabel

Current criteria:

There is an optional requirement for a text box containing the following text:

- Reduced impact on aquatic ecosystems.
- Limited hazardous substances.
- Performance tested.

No proposed changes from stakeholders.

2.8.4 Criteria for Industrial and Institutional Automatic Dishwasher Detergents

2.8.4.1 Criterion 1: Toxicity to aquatic organisms: Critical Dilution Volume (CDV)

Current criteria:

The critical dilution volume of the product must not exceed the following limits (CDV_{chronic}):

CDV at the highest recommended dosage,	Soft	Medium	Hard
Product type	0-6 °dH	7-13 °dH	> 14 °dH
Pre-soaks	2,000	2,000	2,000
Dishwasher detergents	3,000	5,000	10,000
Multi-component system	3,000	4,000	7,000
Rinse aid	3,000	3,000	3,000

Biocides and colouring agents present in the product shall also be included in the CDV calculation even if the concentration is lower than 0.010 % (100 ppm).

Because of degradation of the substances in the wash process, separate rules apply to the following substances:

- hydrogen peroxide (H₂O₂) – not to be included in calculation of CDV
- peracetic acid – to be included in the calculation as acetic acid.

Proposed changes	Further information from stakeholder feedback
1) CDV limits need to be recalculated according to the 2014 DID list	<i>See changes suggested for DD.</i>
2) Water hardness should be explained in a more international way, for example in mmol/l	The current criteria use °dH for describing water hardness; a more international used unit such a mmol/l should be used. Where possible this should be harmonised, with the criteria for detergents for dishwashers and the laundry detergents criteria. <i>This clarification will be drafted and presented with the criteria proposal and</i>

	<i>technical report.</i>
3) The limits for multi-component and dishwasher detergents could be stricter	One of the stakeholders commented that the limits for multi-component system and dishwasher detergents in soft water could be lowered to ~ 2,000. The Nordic Swan CDV limits for dishwasher detergents and multi-component systems in soft water are stricter, which indicates the possibility of decreasing these limits. ⁶⁸ <i>In the first instance the CDV values will be revised in accordance with the new DID list. Following this revision the CDV limits for multi-component systems and dishwasher detergents will be reassessed.</i>
4) Consider using USEtox instead of CDV for assessing toxicity to aquatic environment	<i>See changes suggested for DD.</i>

2.8.4.2 Criterion 2: Biodegradability

Current criteria:

All surfactants must be biodegradable under aerobic and anaerobic conditions.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

For aerobically non-biodegradable (aNBO) organic substances:

Product type (g/l washing solution)	Soft	Medium	Hard
	0-6 °dH	7-13 °dH	> 14 °dH
Pre-soaks	0.4	0.4	0.4
Dishwasher detergents/Multi-component system	0.4	0.4	0.4
Rinse aid	0.04	0.04	0.04

For anaerobically non-biodegradable (anNBO) organic substances:

Product type (g/l washing solution)	Soft	Medium	Hard
	0-6 °dH	7-13 °dH	> 14 °dH
Pre-soaks	0.4	0.4	0.4
Dishwasher detergents/Multi-component system	0.6	1.0	1.5
Rinse aid	0.04	0.04	0.04

Note that TAED should be considered anaerobically biodegradable.

Proposed changes	Further information from stakeholder feedback
1) Criteria could be more strict for anaerobic biodegradability	The responses showed that there were opposing opinions on the strictness of the anaerobic biodegradability criterion. On the one hand, a stakeholder commented that the limit for anNBO of dishwasher detergents and multi-component systems could be stricter, for example 0.4 g in soft water. Having strict requirements on the amount of non-biodegradable organics in EU Ecolabel detergents would minimise the accumulation of non-biodegradable organics in wastewater sludge and contribute to the overall

⁶⁸

Product type	CDVacute (l/litre water)	CDVchronic (l/litre water)
Dishwasher detergents and pre-soaks	5,000	1,900
Rinse aids	8,000	3,000

	<p>environmental performance of these products. Another stakeholder also proposed that the criteria should be stricter on anNBO.</p> <p>On the other hand, other stakeholders commented that the current criterion on anNBO is too strict and not relevant for this product type.</p> <p><i>Further evidence is required to support this claim, the stakeholder will be asked to provide further evidence and this will be presented in the technical report.</i></p>
2) Allow all organics that are biodegradable under aerobic conditions	<p>2 stakeholders proposed to modify the criterion on biodegradability to allow for all organics that are biodegradable aerobically in the product formulation.</p> <p><i>We propose that this suggestion should not be made a requirement, as there may be some organic ingredients which are aerobically biodegradable but are restricted by other criteria. Therefore adding such a requirement will lead to confusion for the applicant and competent bodies.</i></p>
3) Water hardness should be explained in a more international way, for example in mmol/l	<p>The current criteria use °dH for describing water hardness: a more international used unit such a mmol/l should be used. Where possible this should be harmonised with the criteria for DD and the laundry detergents criteria. <i>This has also been suggested for the CDV criterion.</i></p>

2.8.4.3 Criterion 3: Excluded or limited substances and mixtures

Current criteria:

The following ingredients must not be included in the product:

- reactive chlorine compounds
- EDTA (ethylene diamine tetracetate)
- APEOs (alkyl phenol ethoxylates) and APDs (alkyl phenols and derivatives thereof)
- fragrances.

According to the Article 6(6) of the Ecolabel Regulation, the product or any component of it shall not contain substances meeting criteria for classification with the hazard statements or risk phrases specified in the criteria document.

Derogations and exemptions apply for the following substances:

- Surfactants (in concentrations < 15 % in the product) (H400)
- Biocides used for preservation (H331, H334, H317, H400)
- Enzymes (H334, H317 and H400)
- NTA as an impurity in MGDA and GLDA (H351)
- Colouring agents (must not be bio-accumulating)
- Enzymes (must be in liquid form)
- Phosphorus (limits for total quantities of phosphorus compounds).

Proposed changes	Further information from stakeholder feedback
1) The same exemptions should exist for DD and IIDD	See previous section on DD for further information
2) Add derogation for surfactants with H412 classification⁶⁹	See previous section on DD for further information
3) Should also restrict substances considered PBT, vPvB and/or those	Stakeholders have recommended that the use of these substances in the ingredients of the product should be restricted. Further discussion is required on the best approach for excluding such substances in the criteria. In

⁶⁹ See previous section on DD

having endocrine disrupting properties⁷⁰	comparison to the EU Ecolabel the Nordic Swan has a larger list of excluded substances. <i>See previous section on DD for further information.</i>
4) Perborates should be excluded	One of the stakeholders commented that perborates should be excluded for IIDD. Sodium perborates (tetra and monohydrates) are used in dishwasher detergents as bleaching agents. Perborates are excluded for both DD and IIDD in the current Nordic Swan criteria. However, under the CLP Regulation perborates have been classified as toxic for reproduction (under H360) and as such their use in dishwasher detergents is already excluded. ⁷¹ <i>As these substances are already excluded under CLP and the hazard statement H360, no further action is required.</i>
5) Phosphates and phosphonates should be excluded	Phosphates are currently excluded in the criteria for DD but not in the IIDD criteria. An industry stakeholder commented that if a producer is able to make DDs without phosphates, it should be possible to make IIDDs without phosphates. <i>See previous section on DD for further information on the use of phosphonates. The IIDD criteria currently set limits for the total amounts of phosphorus compounds in the product. Further investigation is required to ascertain which is the best approach for phosphorus substances in IIDD.</i>

2.8.4.4 Criterion 4: Packaging requirements

Current criteria:

The weight/utility ratio must not exceed the following values:

Product type	Soft	Medium	Hard
	0-6 °dH	7-13 °dH	> 14 °dH
Powders (g/l washing solution)	0.8	1.4	2.0
Liquids (g/l washing solution)	1.0	1.8	2.5

Exemptions:

Plastic/paper/cardboard packaging containing more than 80 % recycled material or more than 80 % plastic from renewable origin is exempted from this requirement. Packaging is regarded as recycled if the raw material used to make the packaging has been collected from packaging manufacturers at the distribution stage or at the consumer stage. Where raw material is industrial waste from the material manufacturer's own production process, then the material will not be regarded as recycled.

The existing criteria state the following requirements for plastic packaging:

- Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 3b (excluded or limited substances and mixtures) may be used in the plastic packaging.
- Plastic parts in primary packaging must be marked in accordance with DIN 6210, Part 2 or the equivalent. Caps and pumps are exempted.

Proposed changes	Further information from stakeholder feedback
1) Criteria which further promote the use of recycled materials are required	<i>See previous section on DD for further information</i>
2) Encourage case of	<i>See previous section on DD for further information.</i>

⁷⁰ See previous table on DD

⁷¹ About Nordic EU Ecolabelled detergents and rinsing agents: Background to ecolabelling, version 6, March 2014.

disassembly of packaging and design for recycling	
3) Promote use of sustainably sourced wood fibres	<i>See previous section on DD for further information.</i>

2.8.4.5 Criterion 5: Washing performance (fitness for use)

Current criteria:

Tests shall be carried out to ensure that the performance and efficiency of the product satisfy the requirements for the user test or internal testing in accordance with the following:

a) Internal testing

The manufacturer's test laboratory can be approved to conduct testing to document effectiveness if the following additional requirements are met:

- It must be possible for ecolabelling organisations to monitor the performance of testing,
- The ecolabelling organisation must have access to all data on the product,
- Performance of the effectiveness test must be described in the quality control systems.

The applicant must submit documentation proving that the product has been tested under realistic conditions:

- a) Dishes soiled with spots that are representative for the kind of soiled expected in the areas where the products will be marketed
- b) Recommended dosage and at the corresponding water hardness at the lowest recommended wash temperature. The applicant must submit documentation proving: the product's ability to remove soiling from the dishes; the product's ability to dry the dishes.

The test product must be tested against a reference product. The reference product may be a well-established product on the market and the tested product must be at least as effective as the reference.

b) User test

- 1) Responses must be obtained from at least five test centres representing a random selection of customers.
- 2) The procedure and dosage must conform to the manufacturer's recommendations.
- 3) The test period must continue for at least four weeks with at least 400 test cycles.
- 4) Every test centre must assess the effectiveness of the product or multi-component system by answering questions relating to the following aspects (or similar formulations):
 - The product's ability to remove soiling from the dishes
 - The product's ability to dry the dishes
 - The respondent's satisfaction with the agreement on customer visits.
- 5) The response must be rates on a scale comprising at least three levels, for example 'insufficiently effective', 'sufficiently effective' or 'very effective'. With regard to how satisfied the test centre is with visit reporting arrangements, the categories must be 'not satisfied', 'satisfied' and 'very satisfied'.
- 6) At least 80 % must rate the product as sufficiently effective or very effective on all points (see point 4) and be satisfied or very satisfied with customer visiting arrangements.
- 7) All raw data from the test must be specified.
- 8) The test procedure must be described in detail.

Most respondents agreed with the current criteria. However, very few had experience with the application of this criterion under this category as the criteria were adopted only in 2012.

The following comments were received from stakeholders:

- Consumer test too restrictive, there are too many repetitions and the testing does not take place at all water levels.

- Because of the variety of different machines and customer situations on the market, field testing is the best way to prove performance of the product.
- A standard formula should be used as the reference detergent instead of the market leader.
- In the consumer test, how is it possible to answer questions on how satisfied they are with customer visiting arrangements if the product is new to the market.
- Consumer testing is recommended.
- Performance tests are long and remain at the goodwill of the tester. The accompaniment by a body is relatively costly. For a manufacturer who does not sell to the end user, it is complicated to find end-users, obligation of intermediaries, not always reliable. It would be interesting and necessary of developing performance tests in the laboratory in the same way as tests for DD.

2.8.4.6 Criterion 6: Automatic dosing systems

Current criteria:

The following shall apply for automatic dosing systems:

- Multi-component systems shall be offered together with an automatic and controlled dosing system.
- To ensure correct dosage in the automatic dosing systems, customer visits must be incorporated as a normal routine for manufacturers/suppliers. These customer visits are performed at all premises at least once a year during the license period; they must include calibration of the dosage equipment. Also, a third party can perform customer visits.
- In exceptional cases customer visits may be dispensed with if the distance and method of delivery make the visit impracticable.

No proposed changes to this criterion.

2.8.4.7 Criterion 7: User information – Information appearing on the EU Ecolabel

Current criteria:

The following must appear on the packaging:

a) Information on the packaging/product information sheet

The following recommendations must appear on the packaging, and/or on product information sheet or equivalent:

- Dose according to the degree of soil, and the water hardness. Follow the dosing instructions.
- Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution and waste production.

b) Information appearing on the EU Ecolabel

The logo should be visible and legible. The use of the EU Ecolabel is protected in primary EU law. The EU Ecolabel registration/licence number must appear on the product; it must be legible and clearly visible.

The optional label with text box shall contain the following text:

- Reduced impact on aquatic ecosystems
- Limited hazardous substances
- Performance tested.

Proposed changes	Further information from stakeholder feedback
1) An additional phrase should be added to encourage low temperature washing	Energy savings can be made by washing at lower temperatures, thus reducing the environmental impact of dishwashing. Therefore, this practice should be recommended on the product packaging and/or information sheet. However, one of the stakeholders from industry commented that, for IIDD encouraging wash temperatures which are too low can lead to a hygiene risk and the need for the use of products with disinfectant components.

	<i>Further discussion is required regarding whether or not low temperature washing should be encouraged for IIDD. The Nordic Swan criteria use the following statement to encourage low temperature washing “wash at the lowest temperature possible resulting in hygienic dishes”.</i>
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2.8.5 **Additional hot spots**

As part of the survey, stakeholders were asked whether they thought further criteria should be developed in order to cover issues which are not already covered or because of recent developments which affect the environmental performance of dishwasher detergents.

The following suggestions were made by stakeholders:

- Sustainable sourcing.
- The use of products containing a certain percentage of renewable carbon in formulations could be promoted (bioingredients).

The review of alternative ecolabels and voluntary schemes for detergents for dishwasher (private use) found that the following issues which are not currently covered by the EU Ecolabel:

- Exclusion for fragrances covered by the Detergents Regulation: The 26 fragrance substances encompassed by the declaration requirement in the Detergents Regulation 648/2004/EEC and its subsequent amendments must not be included in the product at greater than 100 ppm per substance (Nordic Swan).
- Limits on the total amount of phosphorus in the product; this is an alternative strategy to a total ban on phosphates and phosphonates. This approach is taken by the EU Ecolabel for IIDD, Nordic Swan, New Zealand Environmental Choice and Sweden’s Good Environmental Choice.
- A requirement that all surfactants must be readily (aerobically) biodegradable. This approach is taken by the EU Ecolabel for IIDD, Nordic Swan, New Zealand Environmental Choice and Sweden’s Good Environmental Choice.
- Ingredients from palm oil derivatives must be from sustainable palm oil sources. This is a requirement in Sweden’s Good Environmental Choice and New Zealand Environmental Choice.

However, at this point the environmental benefits of these requirements included in other schemes are unclear. For example, in the case of plant-derived chemicals, the market analysis conducted in this report has shown that their use in cleaning products including dishwasher detergents is set to increase as many chemicals companies have pledged to increase their use. Many surfactants are derived from palm oil and palm kernel oil: a requirement for sustainable sourcing of these raw materials should be considered. The Environmental Choice label (New Zealand) has requirements on the sourcing of raw materials derived from palm oil and palm kernel oil.

The impact of these suggestions for new criteria should be further investigated before deciding whether or not they are suitable and feasible (with regard to the verification) for inclusion in the EU Ecolabel. Further stakeholder input and investigation are required.

2.8.6 **Summary of suggested criteria changes to be further examined**

Following the review of stakeholder feedback and alternative ecolabels and voluntary agreements, suggested changes for the existing criteria have been collected. The relevant suggested changes and further actions to be taken are summarised in Table 10 and Table 11 for DD and IIDD, respectively.

Table 10: Summary of suggested criteria changes for DD

Criterion	Suggested Change	Further Action
Total Chemicals	Reduce maximum dosage limits.	Further analysis of suitable dosage limits.
	Clarification on water hardness level for maximum dosage limits	Draft a clarification for the water hardness level at which this requirement is assessed.
Excluded or limited substances	Harmonise with IIDD excluded list	The lists of excluded or limited substances for DD and IIDD will be updated in parallel.
	A new requirement for the	Propose a top limit for the amount of phosphorus in a

	maximum limit of phosphorus	product, if possible by analysing amounts of phosphorus in EU Ecolabel dishwasher detergents.
	Exclude specific nanomaterials of concern	Further investigation on the use of specific nanomaterials and their environmental relevance in dishwasher detergents is required.
Toxicity to aquatic organisms: CDV	Recalculate the CDV limits according to new DID list	Examination of new DID list and revision of CDV limits accordingly.
	USEtox instead of CDV. Input from CBs and stakeholders is required.	Further investigation is ongoing.
	Different CDV values for different product types/forms	Further investigation required; including analysis of information on CDV values of EU Ecolabel dishwasher detergents.
Biodegradability of organics	Limits for anNBO should be changed	Further investigation required. If possible an analysis of anNBO levels of EU Ecolabel dishwasher detergents.
	Clarification on water level hardness for biodegradability limits	Draft a clarification for the water hardness level at which this requirement is assessed.
Washing performance	Update following revision of IKW test method	Update any references to the IKW test method once the revision of this test method is complete.
Packaging requirements	Encourage disassembly and design for recycling	Further investigation required on the suitability of including a criterion on the design for recycling.
	Promote use of sustainably sourced wood fibres	Further investigation is required on the suitability of including a criterion on a percentage of virgin wood fibres used in packaging to be from sustainable sources.
Consumer information	Recommendation on the use of regenerating salt	Further investigation is required on the advantages of recommending the use of regenerative salt on the packaging.
Additional criteria	Sustainable sourcing of palm oil derivatives	Further investigation is required on the advantages of requiring sustainable sourcing of palm oil derivatives.

Table 11: Summary of suggested criteria changes for IIDD

Criterion	Suggested Change	Further Action
Toxicity to aquatic organisms: CDV	Recalculate CDV limits according to new DID list	Examination of new DID list and revision of CDV limits accordingly.
	Explain water hardness in a more international way	Analysis of units used for water hardness in EU legislation. If necessary a clarification of the proposal using a different unit will be drafted.
	Make CDV limits stricter for multi-component systems and dishwasher detergents	Revision will be considered following the revision of CDV limits due to new DID list.
	USEtox instead of CDV for assessing aquatic toxicity	Further investigation is ongoing.
Biodegradability	Explain water hardness in a more international way	See above
	Make the limits for anNBO stricter	As only 1 stakeholder is in agreement with this, further investigation is required.
Excluded or limited substances and mixtures	Harmonise with DD excluded list	The lists of excluded or limited substances for DD and IIDD will be updated in parallel.
	Exclude nanomaterials	Further investigation on the use of specific nanomaterials and their environmental relevance in dishwasher detergents is required.
Packaging requirements	Encourage disassembly and design for recycling	Further investigation is required on the suitability of including a criterion on the facilitating disassembly and design for recycling
	Promote use of sustainably	Further investigation is required on the suitability of

	sourced wood fibres	including a criterion on a percentage of virgin wood fibres used in packaging to be from sustainable sources.
Washing performance (fitness for use)	No suggested changes	n/a
Automatic dosing systems	No suggested changes	n/a
User information – information appearing on the EU Ecolabel	Additional phrase to appear on packaging in order to encourage low temperature washing	Further discussion on whether low temperature washing should be encouraged for IIDD.
Additional criteria	Sustainable sourcing of palm oil derivatives	Further investigation required on the advantages of requiring sustainable sourcing of palm oil derivatives.

DRAFT - WORK IN PROGRESS

3. MARKET ANALYSIS

3.1 Introduction

The aim of this section is to identify any significant changes in the market for dishwasher detergents since the last revision of the EU Ecolabel criteria. The changes are identified and followed by an investigation into whether any such changes need to be reflected in the revised criteria, so that the 10-20 % best environmentally performing products will be selected in accordance with Annex 1 of the Ecolabel Regulation.

The research in this section consists of a desk-based study using a variety of available literature and statistical databases such as Datamonitor, Mintel and Euromonitor data and reports. The market analysis covers the period 2010-14 and includes a forward market forecast to 2015-16, data permitting.

Data and information have also been collated on market structure, public procurement, innovation, supply of raw materials and environmental labelling.

3.1.1 Categorisation of dishwasher detergents

Analysis of PRODCOM data categories compared with the current EU Ecolabel criteria definition and scope indicates that the classifications are irreconcilable. The PRODCOM 'cleaning product' categories are not broken down in such a way that could be useful for analysis of current EU Ecolabel 'dishwasher detergent' criteria (see Table 12).

Table 12: PRODCOM cleaning product categories, code and description

Database	Code(s)	Description
PRODCOM	20.41.20.20	Anionic surface-active agents (excluding soap)
PRODCOM	20.41.20.30	Cationic surface-active agents (excluding soap)
PRODCOM	20.41.20.50	Non-ionic surface-active agents (excluding soap)
PRODCOM	20.41.20.90	Organic surface-active agents (excluding soap, anionic, cationic, non-ionic)
PRODCOM	20.41.31.20	Soap and organic surface-active products in bars, etc, n.e.c.
PRODCOM	20.41.31.50	Soap in the form of flakes, wafers, granules or powders
PRODCOM	20.41.31.80	Soap in forms excluding bars, cakes or moulded shapes, paper, wadding, felt and non-wovens impregnated or coated with soap/detergent, flakes, granules or powders
PRODCOM	20.41.32.40	Surface-active preparations, whether or not containing soap, p.r.s. (excluding those for use as soap)
PRODCOM	20.41.32.50	Washing preparations and cleaning preparations, with or without soap, p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations
PRODCOM	20.41.32.60	Surface-active preparations, whether or not containing soap, n.p.r.s. (excluding those for use as soap)
PRODCOM	20.41.32.70	Washing preparations and cleaning preparations, with or without soap, n.p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations

Source: Eurostat PRODCOM

Furthermore, the composition of the various 'cleaning product' categories is not clearly outlined, and it is therefore not possible to break these down to the category of 'dishwasher detergent', in order to provide data which are wholly applicable to the requirements of EU Ecolabel. A comparison of the categorisation is provided in Table 13.

Table 13: Comparison of criteria for PRODCOM categories (cleaning product-type) and EU Ecolabel for dishwasher detergents

PRODCOM categories (cleaning product-type)	EU Ecolabel for dishwasher detergents product classification (application)
<ul style="list-style-type: none"> • Anionic surface-active agents (excluding soap) • Cationic surface-active agents (excluding soap) • Non-ionic surface-active agents (excluding soap) • Organic surface-active agents (excluding soap, anionic, cationic, non-ionic) • Soap and organic surface-active products in bars, etc., n.e.c. • Soap in the form of flakes, wafers, granules or powders • Soap in forms excluding bars, cakes or moulded shapes, paper, wadding, felt and non-wovens impregnated or coated with soap/detergent, flakes, granules or powders • Surface-active preparations, whether or not containing soap, p.r.s. (excluding those for use as soap) • Washing preparations and cleaning preparations, with or without soap, p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations • Surface-active preparations, whether or not containing soap, n.p.r.s. (excluding those for use as soap) • Washing preparations and cleaning preparations, with or without soap, n.p.r.s. including auxiliary washing preparations excluding those for use as soap, surface-active preparations 	<ul style="list-style-type: none"> • Detergents for dishwashers and products used as rinse aids, whether in powder, liquid or any other form, which are intended to be marketed and used exclusively in consumer automatic domestic dishwashers. • Detergents for dishwashers and products used as rinse aids, whether in powder, liquid or any other form, which are intended to be marketed and used exclusively in automatic dishwashers for professional use, the size and usage of which is similar to that of domestic dishwashers.

Therefore, this section of the report will use cumulative data to analyse the overall dishwasher detergent market in Europe, broken down by Member State. This analysis will include all dishwasher detergent types as well as all other detergent and cleaning products included in the PRODCOM category outlined in the above table. Although this will not allow for specific analysis of dishwasher detergents that fit within EU Ecolabel criteria, it will nevertheless allow for a comprehensive analysis of the European detergent market, including dishwasher detergent.

3.1.1.1 Trade and production data, cleaning products

Table 14 provides the PRODCOM production data (value and volume) for detergents in 2013. The total value of EU-28 detergent production in 2013 is €17 billion with a volume of 16 million tonnes produced.

- Germany has the highest production value (€4 billion) and the second highest volume (3.01 million tonnes)
- Italy has the highest production volume (3.04 million tonnes) and the second highest value (€3 billion)

Note, countries marked with an asterisk (*) exclude some data which is anonymous, figures may therefore be higher than indicated in Table 14.

Table 14: Production of manufactured cleaning products in EU-28, value and tonnes, 2013

EU-28	Value (mEuro)	Sold volume (tonnes)	EU-28	Value (mEuro)	Sold volume (tonnes)
Austria*	98,581	94,169	Latvia*	0	0
Belgium*	494,614	536,875	Lithuania	7,338	10,451
Bulgaria*	51,232	65,347	Luxemburg	0	,
Cyprus	0	0	Malta	0	,
Czech republic*	77,513	102,036	Poland*	800,855	862,263
Denmark	204,735	174,200	Portugal*	163,083	242,051
Estonia	13,560	40,615	Romania*	150,122	229,815
Finland	43,652	30,232	Slovakia*	6,104	6,811
France	1,300,489	1,701,172	Slovenia	6,357	5,503
Germany*	4,164,537	3,010,155	Spain	2,020,008	2,341,911
Greece*	108,892	84,428	Sweden	52,148	31,463
Hungary	213,368	212,220	The Netherlands	1,856,748	307,391
Ireland	15,338	18,657	UK	1,856,748	486,743
Italy	2,738,689	3,038,504	Croatia	97,529	104,690
EU-27	17,099,313	16,090,515	EU-28	17,196,842	16,195,204

* Estimates only – excludes some data which is anonymous. 'Value EU27' includes all data.

Source: PRODCOM

In the same way that PRODCOM data is irreconcilable with current EU Ecolabel definitions for dishwasher detergents, COMEXT⁷² data (international trade data) also consists of different categories which do not clearly match. Table 15 shows the COMEXT codes and description for categories which include detergents. It can also be seen that these do not directly relate to the PRODCOM categories indicated above. Even so, this data can be used to give an overall indication of both intra- and extra-EU trade for detergent products.⁷³

Table 15: COMEXT detergent code and description

Product Code	Description
34012090	soap in paste form "soft soap" or in aqueous solution "liquid soap"
34012010	soap in the form of flakes, granules or powders
34011100	soap and organic surface-active products and preparations, in the form of bars, cakes, moulded pieces or shapes, and paper, wadding, felt and nonwovens, impregnated, coated or covered with soap or detergent, for toilet use, incl. medicated products
34011900	soap and organic surface-active products and preparations, in the form of bars, cakes, moulded pieces or shapes, and paper, wadding, felt and nonwovens, impregnated, coated or covered with soap or detergent (excl. those for toilet use, incl. medicated products)

Table 16 shows the value and volume of intra-EU trade of detergents for 2013. Overall, this totals:

- an import value of €1,090 million
- an export value of €1,150 million
- imports of 623,793 tonnes
- exports of 690,659 tonnes

And the value and volume of extra-EU trade of detergents for 2013. Overall, this totals:

- an import value of €302 million
- an export value of €487 million
- imports of 215,796 tonnes
- exports of 219,224 tonnes.

⁷² COMEXT = statistical database on trade of goods managed by Eurostat

⁷³ Intra-EU trade refers to the trade between the Member States of the European Union, while Extra-EU trade refers to the trade between Member States and partner countries that are not members of the European Union.

Table 16: Intra-EU and Extra-EU trade of detergents, import and exports, 2013

EU-28	Intra-EU trade				Extra-EU trade			
	Imports		Exports		Imports		Exports	
	Value (million €)	Quantity (100kg)	Value (million €)	Quantity (100kg)	Value (million €)	Quantity (100kg)	Value (million €)	Quantity (100kg)
Austria*	43	194,848	8	17,343	6	25,106	2	6,326
Belgium*	71	348,454	65	400,996	22	157,013	7	20,365
Bulgaria*	9	42,852	4	29,439	10	100,764	4	29,543
Croatia	8	47,416	0	692	2	15,546	2	8,804
Cyprus	3	14,960	0	633	1	3,805	0	126
Czech republic*	32	178,434	26	146,934	9	66,150	6	30,143
Denmark	21	139,862	16	79,277	4	22,912	11	42,636
Estonia	4	14,542	1	2,248	0	1,835	0	858
Finland	21	80,538	1	2,107	0	1,166	1	3,434
France	167	966,219	66	274,158	32	276,851	52	153,958
Germany*	133	758,634	304	1,899,952	44	350,637	117	587,966
Greece*	17	94,548	9	49,206	2	17,530	2	12,174
Hungary	28	168,663	10	43,066	2	13,344	3	17,159
Ireland	54	211,946	8	24,810	0	2,457	0	118
Italy	49	299,228	205	1,377,243	13	113,920	37	189,006
Latvia*	5	23,092	1	3,753	1	5,787	3	10,013
Lithuania	6	29,207	2	8,094	1	6,756	5	26,754
Luxemburg	7	23,359	1	4,391	0	1	0	1
Malta	2	9,415	0	0	0	2,141	0	768
The Netherlands	72	420,593	77	362,389	29	186,073	44	178,489
Poland*	56	385,558	120	805,672	19	141,489	30	140,824
Portugal*	49	382,657	9	41,269	2	19,172	12	97,462
Romania*	24	158,425	3	12,126	9	73,520	3	11,029
Slovakia*	13	83,864	4	27,713	2	11,646	0	1,766
Slovenia	10	49,120	4	14,808	1	3,913	2	11,956
Spain	52	323,535	47	340,615	12	82,408	19	108,681
Sweden	33	195,601	24	132,164	5	33,695	20	75,432
UK	100	592,369	136	765,500	73	422,331	104	426,456
EU-28	1,090	6,237,939	1.150	6,906,598	302	2,157,968	487	2,192,247

* Estimates only – excludes some data which is anonymous.

Source: COMEXT trade data, see Annex II for original data

3.1.2 Market overview, dishwasher detergents

3.1.2.1 Global European market overview

Whilst the EU-28 market for dishwasher detergents has seen low, steady growth for the 2005-2009 period, and should continue on this low, steady growth trajectory until the end of 2014, the global dishwashing products market grew by 3.9 % per annum between 2008 and 2012.⁷⁴

In mature markets, such as Western Europe, North America and Japan, higher quality, cost-effective dishwasher detergent products (including more environmentally-friendly detergents) are in greatest demand.⁷⁵ Dishwasher detergent consumption in these markets is linked to standard of living, and lower quality detergents see higher demand in areas with lower quality of life. The state of the dishwasher detergent market generally correlates positively with the health of the economy in these areas.

⁷⁴ Marketline: Global Dishwashing Products, 31 December 2013, <http://www.marketresearch.com/MarketLine-v3883/Global-Dishwashing-Products-7981033/>

⁷⁵ Key Note Ltd - Household Detergents and Cleaners – Market Definition – 2012 available at: <https://www.keynote.co.uk/market-intelligence/view/toc/product/10646/household-detergents-%26-cleaners/2/contents?medium=toc>

Drivers affecting the EU detergents market consist of a broad range of factors: whilst general economic drivers, such as GDP growth and changes in consumer income, have an important impact on the market, there are other factors such as general changes in consumer habits and preferences to consider.⁷⁶ These issues are further explored throughout this analysis, notably in Section 3.7, which focuses on consumer trends.

It should also be noted that the Eastern European market for dishwasher detergents is still a middle-income, emerging market that continues to grow from a relatively low base (below EU-28 average). Growth in the Eastern European market is linked to gradually increasing consumer income – sales of consumer automatic dishwashers in Eastern European are growing slowly, from a comparatively low base (see Section 3.4.1 for further information).

3.1.2.2 Global non-European market overview

The global market in dishwashing products is also expected to continue to grow at a similar rate (3.8 % per annum) between 2012 and 2017.⁷⁰ Current and future global growth rates can be partially explained by a large increase in consumer demand for detergents in the Asia-Pacific region, with growth being predominantly underpinned by China, whose market for household detergents is projected to grow by 6 % per annum between 2014 and 2017.⁷⁷

High growth, emerging markets, such as Brazil, Russia, India and China (BRIC), have also seen large investments from dishwasher detergent manufacturers in recent years.⁷⁸ However, as the BRIC countries' growth rates start to decelerate from recent peaks, detergent manufacturers are expected to see longer-term growth rates stabilise within these markets.⁷⁹

3.2 Market structure

3.2.1 Product overview and market segmentation

The dishwasher detergent products on the European market can be broadly categorised into four different product types:

1. Dishwasher detergents, consisting of:
 - Powdered detergents – made up of granules which are poured into the dishwasher dispenser.
 - Gel/liquid detergents – to be poured into the dishwasher dispenser.
 - Tablet detergents – a compact amount of detergent in a premeasured tablet. These are most commonly in powdered form, but gel tablets are becoming more widely seen.
2. Other dishwasher additives – including water hardness regulators.
3. Rinse aids – used to improve cleaning (particularly for reducing smearing on glasses) and to aid drying.
4. Combined products – for example dishwasher detergents combined with rinse aids or other dishwasher additives. Often, these products come in tablet form.

The market for dishwasher detergents can be broken down into two main segments, DD and IIDD, both of which consume all of the products listed above, the market value of the DD and IIDD sectors in Europe are outlined in Table 17.

⁷⁶ Key Note Ltd - *Household Detergents and Cleaners – Market Definition - 2012*

⁷⁷ Chemical Week, Soaps and Detergents: Consumers Remain Cautious, 17 January 2014, available at

http://www.chemweek.com/sections/cover_story/Soaps-and-detergents-Consumers-remain-cautious_58079.html

⁷⁸ e.g. In 2012, Procter and Gamble (a multinational detergents manufacturer) announced that it planned to add around 20 manufacturing plants between 2010 and 2015 in countries such as Brazil and China. Source: P&G to Build Huge Plant in China, Zacks Equity Research, 19 March 2012, <http://www.zacks.com/stock/news/71529/P&G-to+Build+Huge+Plant+in+China>

⁷⁹ Chemical Week, Soaps and Detergents: Consumers Remain Cautious, 17 January 2014,

http://www.chemweek.com/sections/cover_story/Soaps-and-detergents-Consumers-remain-cautious_58079.html

Table 17: Market value of dishwashing detergents (EU-27 + CH + NO), 2012

Type of Dishwasher detergents	€ million
Household dishwasher detergents	€ 2,480
I&I (all kitchen and catering detergents*)	€ 1,518

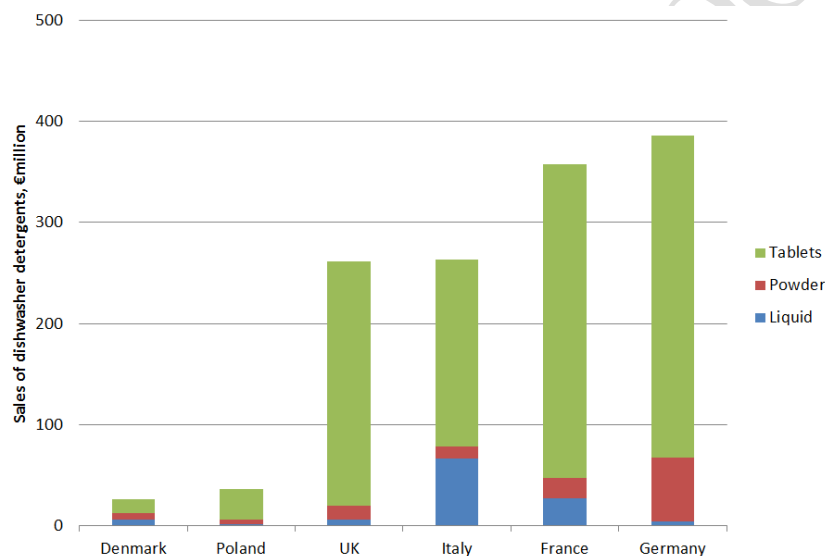
Source: Euromonitor International, cited on A.I.S.E website <http://www.aise.eu/our-industry/market-and-economic-data.aspx>

* includes dishwasher detergents, hand dishwashing detergents, kitchen surface disinfectants, hand hygiene and care

3.2.1.1 All dishwasher detergent products, by category, EU-28⁸⁰

Figure 1 shows the retail value of the dishwasher detergents market by product category in six different European countries, each in a different European region. Assuming the total retail value of the EU-28 market in 2013 is an estimated €2,480 million, these six countries represent circa 40 % of this market. Note that these figures are affected by a number of variables – notably, the countries across Europe have very different population sizes. In this respect, the larger countries (such as Germany and the UK) will be expected to have a higher sales value. This is further evidenced in Section 3.3.1.

Across these six countries, sales of dishwashing detergents are highest in Germany (€386 million), followed by France (€357 million), Italy (€263 million), UK (€261 million), Poland (€36 million) and Denmark (€26 million).

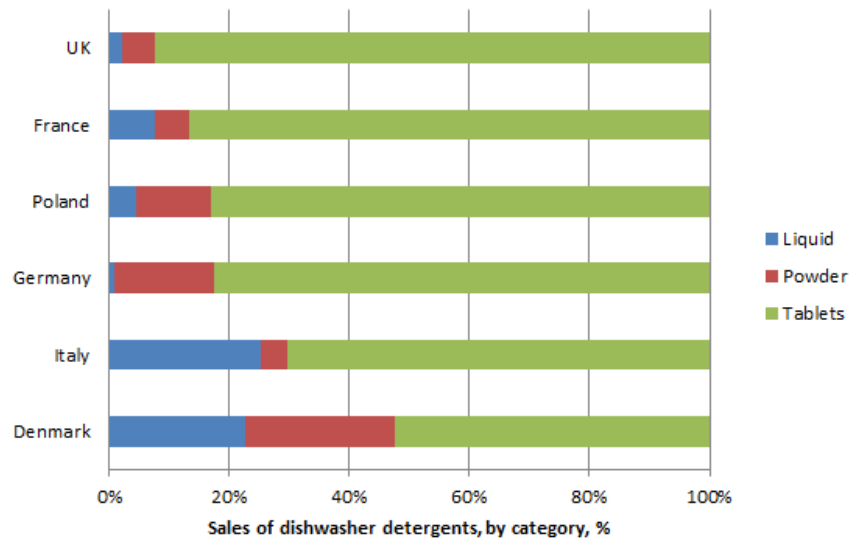


Source: Euromonitor, summarised from 2013 Passport reports for Dishwashing in: Denmark, Italy, Germany, UK, Poland, France

Figure 1: Sales of dishwasher detergent products by category, value (€m), 2012

This information has been further broken down in Figure 2 to show the percentage split of dishwasher detergent sales in each country.

⁸⁰ N.B. Data on the breakdown of the total value of the dishwasher detergent market are not readily available, but throughout this analysis the most recent figure for market size has been used; a 2013 figure of €2,480 million. This figure includes the EU-28 excluding Cyprus, Luxembourg and Malta, for which there is no data. This figure is also assumed to include the total dishwasher detergent market, both household and I&I products.



Source: Euromonitor, summarised from 2013 Passport reports for Dishwashing in: Denmark, Italy, Germany, UK, Poland, France

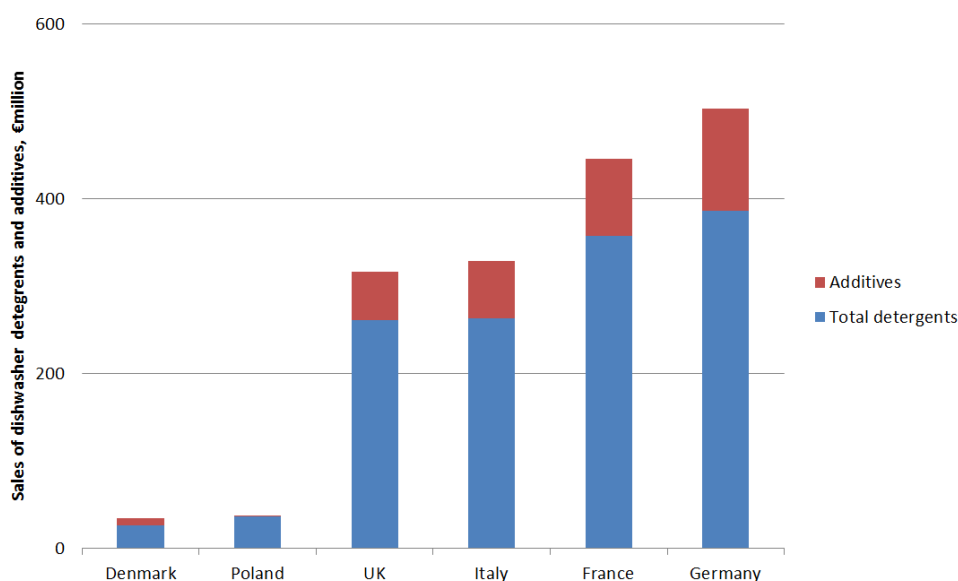
Figure 2: Split of dishwasher detergent products by category (%), 2012

To summarise:

- Across all six countries, dishwasher tablets made up the greatest percentage of all dishwasher detergent sales in 2012; ranging from 92 % of all sales in the UK to 52 % of sales in Denmark. Assuming these countries are representative of Europe, tablet sales accounted for an average of 78 % across Europe. In terms of sales value, France had the highest sales of detergent tablets and Denmark the lowest.
- Powder detergents were the second most popular detergent type across the six countries analysed in 2012, ranging from 25 % of total sales value in Denmark to only 4 % of total sales value in Italy. On average – across the 6 countries – powder detergent sales accounted for 12 % of the detergent market. Across the six countries, Germany had the highest sales of powder detergents by value and Poland the lowest.
- Liquid detergents had the lowest total sales value in 2012, and represented between 25 % of sales value in Italy and only 1 % in Germany. Across the six countries analysed, liquid detergents account for an average of 10 % of total sales value in each country. Italy had the highest liquid detergent sales, by value, of the six countries analysed and Poland the lowest.

3.2.1.2 All dishwasher detergent and additives, by category

Although the figures above only show dishwasher detergent sales, the market for dishwasher additives (such as water hardness regulator, machine cleaning chemicals) is also reasonably significant. Figure 3 shows the sales of these two different products in six European countries.



Source: Euromonitor, summarised from 2013 Passport reports for Dishwashing in: Denmark, Italy, Germany, UK, Poland, France

Figure 3: Sales of dishwasher detergent and dishwasher additives, value (€m), 2012

Although a smaller market in comparison to detergents, additive sales across the six countries in various European regions, accounts for a total of over €300 million. Sales are especially high in Germany and France.

3.2.2 Manufacturers and market shares

3.2.2.1 The domestic dishwashing detergent market

The structure of the dishwasher detergents market has changed little over the past five years. The dishwashing detergents market across Europe (as with the detergents and cleaning market in general) is heavily dominated by a few well-known and globally recognised organisations and brands. The top five brands by retail value across Europe are listed in Table 18.

Table 18: Largest organisations in European* DD market, % breakdown by retail value, 2013**

Manufacturers name	% share of dishwashing detergent market, by retail value
Reckitt Benckiser Plc	23 %
Procter & Gamble Co	14 %
Unilever Group	11 %
Henkel AG & Co KGaA	13 %
Colgate-Palmolive Co	4 %
Private labels	22 %
Other (circa 77 organisation)	6 %

* Europe includes EU-28 excluding Cyprus, Estonia and Malta due to lack of data

** Dishwashing detergent includes both hand dishwashing and machine dishwashing detergents.

Source: Euromonitor International, Data used in Passport report, *Brand share by global brand name (2013)*

The proportion of private label manufacturers in the dishwashing detergent market is relatively high (22 % of the market by retail value). These manufacturers typically produce for supermarkets who sell own brand products. There are a large number of supermarket brands across Europe, and competition between them is intense. Often supermarket brands compete on a low price basis and sell via discounted prices and offers in store. As shown in Table 19, most dishwasher detergent products in Western Europe are sold through supermarkets. Supermarkets are able to control the amount of products on shelves and often price promotions in store and are therefore an important part of the supply chain for the dishwasher detergent manufacturers.

Table 19: Western Europe, distribution channels by value (%), 2009

Channel	%
Supermarkets / hypermarkets	62.4 %
Independent retailers	19.6 %

Pharmacies / drugstores	8.2 %
Convenience stores	4.5 %
Cash & carry and Warehouse clubs	1.8 %
Department stores (incl. Duty-free shops)	1.2 %
Others	2.4 %

Source: Datamonitor (2011) Household products market in Western Europe to 2014

The common brand names for each of the largest manufacturers of dishwashing detergents in Europe are shown in Table 20. Reckitt Benckiser is generally considered to be the market leader in the European market for automated dishwashing products with its product line 'Finish'.⁸¹

Table 20: Common brand name dishwasher detergent products in Europe, 2013

	Reckitt Benckiser Plc	Procter & Gamble Co	Unilever Group	Henkel AG	Colgate-Palmolive Co
% of the EU retail market	23 %	14 %	11 %	13 %	4 %
Top five most common brands	Finish Sole Coral Neophos Down to Earth	Fairy Dreft Jar Ava	Sun Svelto Yes Persil Cif/Jif	Somat Pril Pur Nelsen Mistol	Paic Palmolive Vel Ajax Axion

Source: Euromonitor International, Data used in Passport report, *Brand share by global brand name (2013)*

Not only is the dishwashing detergents market dominated by a small number of large companies, it is also characterised by a small number of brands with the greatest market share. Of the brands indicated in Table 20, the following five have consistently represented the greatest market share since 2008:

Table 21: Common brand name dishwasher detergent products in Europe, % market share (based on retail value)

Brand	Manufacturer	Retail value, % market share of EU market					
		2008	2009	2010	2011	2012	2013
Pril	Henkel AG & Co KGaA	2.4	2.4	2.4	2.4	2.4	2.4
Somat	Henkel AG & Co KGaA	4.5	4.5	4.8	5.2	5.3	5.5
Sun	Unilever Group	7.5	7.7	7.9	8.1	8.2	8.4
Fairy	Procter & Gamble Co	10.7	11.0	11.0	10.9	10.8	10.7
Finish	Reckitt Benckiser Plc	22.6	22.2	22.3	22.0	21.9	21.6

Source: Euromonitor International, Data used in Passport report, *Brand share by global brand name (2013)*

3.2.2.2 The I&I dishwashing detergent market

The global I&I market for cleaning products is dominated by two major players and, together, these companies account for about 24 % of the global market for I&I cleaning products.⁸² These organisations are:

1. **Ecolab** – a US-based global company, providing hygiene and food safety services and products to industrial and hospitality markets.
2. **Diversey** – also US-based, operating globally, providing cleaning and hygiene products to a variety of markets including food service and food and beverage companies.

The remainder of the market is made up of a large number of small local and national companies, each with no more than \$50 million in annual I&I cleaner sales – in many cases much less. However, these smaller companies are beginning to increase their market visibility as a result of recent consolidations⁷⁸. Even so, the market remains fragmented.

⁸¹ Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*

⁸² IHS(2010) *Industrial and Institutional Cleaners*

The global market for I&I cleaning products is expected to grow at an average annual rate of about 3 % by weight.⁷⁸ No specific figures are available for IIDDs, although the I&I market for all kitchen and catering detergents⁸³ is valued at €1,518 million.⁸⁴ If the market for these products increases in line with global expectations for volume growth it will increase by €141 million in the next three years (see Table 22).

Table 22: Expected growth in the I&I market for kitchen and catering detergents

	2013	2014	2015	2016
Market value*	€1,518m	€1,564m	€1,610m	€1,659m

* 3 % average annual growth (2013 base year)

3.2.3 Structure of supply chain

3.2.3.1 Raw materials

Any market is sensitive to the changes in availability, and the impact this can have on price, of the raw materials used in products. The dishwasher detergent market relies on a number of ingredients, including:

- surfactants
- preservatives/biocides
- enzymes
- dyestuffs
- complexing agents
- bleaching agents
- anti-corrosion agents
- anti-foaming agents.

Annex II provides more detail about each of these ingredients.

The market for dishwasher detergent ingredients is in a mature stage, with most opportunities for growth in the development of multifunctional products. There is also scope for market expansion in Eastern Europe. In the home and fabric care speciality ingredient market⁸⁵ there are an estimated 40-50 companies, with the dominant players mainly being specialty surfactants companies. However, the market is also characterised by an increasing degree of consolidation, altering the number of competing organisations.

Table 23 shows the percentage revenues for each of the key ingredients in the home and fabric care speciality ingredients market.⁷⁹ In 2009 the largest market share in terms of revenue was speciality surfactants with 34.4 % of the market, followed by fabric enhancing chemicals (23.2 %), functional polymers (22.6 %) and rheology modifiers (14.1 %). Active ingredients – comprising disinfectants, bactericides and preservatives - held the smallest market share amongst the speciality chemicals with only 6.1 % of the market.⁸⁶

Table 23: Total home and fabric care speciality ingredients market⁷⁹ - share of revenues by chemical type, Europe, 2009

Speciality surfactants	Functional polymers	Fabric enhancing chemicals	Active ingredients	Rheology modifiers
33.9 %	22.6 %	23.2 %	6.1 %	14.1 %

Source: Adapted from Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*.

The specialist chemical market for home and fabric care will be facing a number of challenges over the next decade which may alter current business practises. Table 24 ranks the top eight which the industry is expected to face, along with an indication of the impact that this may have on organisations. The top challenge, 'volatility in oil prices', relates directly to the manufacture of raw materials. This is something which many organisations

⁸³ This includes dishwasher detergents, hand dishwashing detergents, kitchen surface disinfectants, hand hygiene and care.

⁸⁴ Euromonitor International, cited on A.I.S.E website <http://www.aise.eu/our-industry/market-and-economic-data.aspx>

⁸⁵ This includes: dishwashing products; hard surface cleaners; car interior and upholstery cleaners; furniture, shoe and leather polishes; and fabric washing and care.

⁸⁶ Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*.

are now adapting to, and this has helped drive the increasing innovation and research in the use of plant-based chemicals.

Table 24: Home and fabric care speciality ingredients market⁷⁹: impact of top eight industry challenges ranked in order of impact, Europe

Rank	Challenge	Expected Impact 5-7 years
1	Volatility in crude oil prices affects the costs across the supply chain	High
2	REACH creates scepticism in the home and fabric care speciality chemicals market	High
3	The trend for ultra-concentrates substantially lowers the amount of carriers and other chemicals used	High
4	The largest buyers exert pressure backwards in the supply chain	High
5	Consolidation in the industry alters the market dynamics (e.g. larger supplier may have greater control over the market)	High
6	Consumers are increasingly likely to switch to lower priced products	High
7	Increase in multifunctional products that cater for more than one "job"	Medium
8	Increase in the use of natural proteins as fabric enhancers	Medium

Source: Adapted from Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*.

Note, this table was produced in 2009

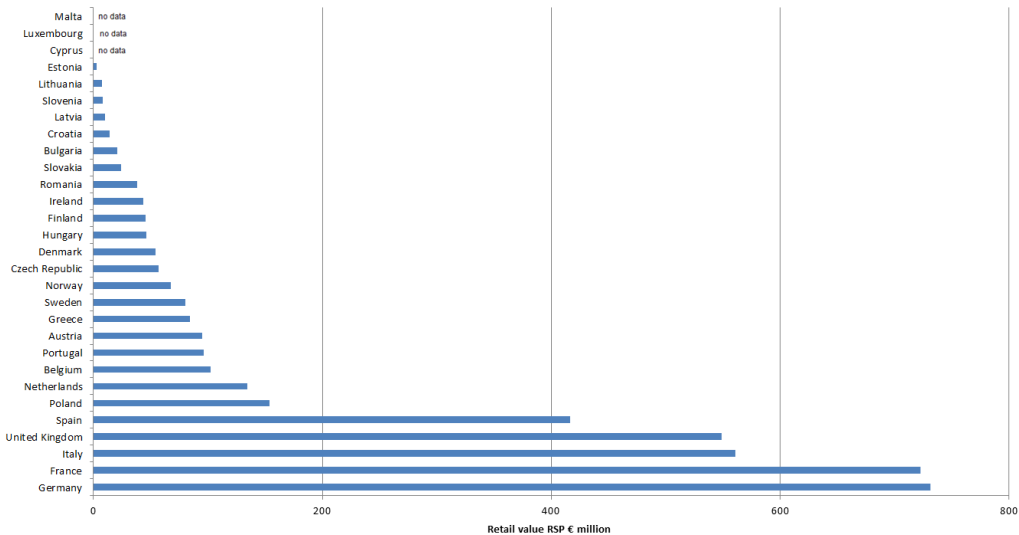
Overall, there is potential for growth in the dishwasher detergent market, which translates to growth in the raw materials market. However, innovation in raw materials is being rapidly driven by a push from consumers who are increasingly demanding more from detergents. For example, the trend in the use of 'green raw materials' has been supported by consumers who are pushing for the use of more natural products. However, in contrast, the continuing development of more compacted products, combined with a global slowdown in the purchase of dishwashing machines (see Section 3.4.1 for further details), may negatively affect the market for raw material providers.⁸⁷

3.3 Sales of dishwashing detergents

3.3.1 EU-28 Sales

The total retail value of the dishwashing detergent market, across Europe (EU-28, excluding Malta, Luxembourg and Cyprus) is €4,167 million. This is broken down by country in Figure 4, below. (Note: this includes hand dishwashing and machine dishwasher detergents.)

⁸⁷ Frost & Sullivan (2009) *Strategic analysis of the home and fabric care speciality ingredients market in Europe*



Source: Euromonitor International, data cited in Passport (2014) *Market sizes Europe, Dishwashing*.

Figure 4: Retail value⁸⁸ (€m) of dishwashing market for EU-28, 2013

The five countries with the greatest value include: Germany (€732 million or 18 % of the total European market), France (€722 million or 17 %), Italy (€561 million or 13 %), United Kingdom (€549 million or 13 %) and Spain (€417 million or 10 % of the total European market). Combined, these countries account for 72 % of total value across Europe (€2,980 million). The remainder of the market accounts for just 28 %, or €1,187 million.

Factors that will affect the purchase of dishwasher detergents comprise, among others:

- Ownership of a dishwasher (this is in turn affected by size of homes, type of home (e.g. apartment, house), number of single person households, income (and disposable income), dishwasher price, etc.).
- Price of detergent.
- Functionality (washing efficacy).
- Marketing of special functions (including reduced environmental impacts).
- Washing 'habit' or preference of washing by hand, rather than using a dishwasher.

3.4 Market trends and projections

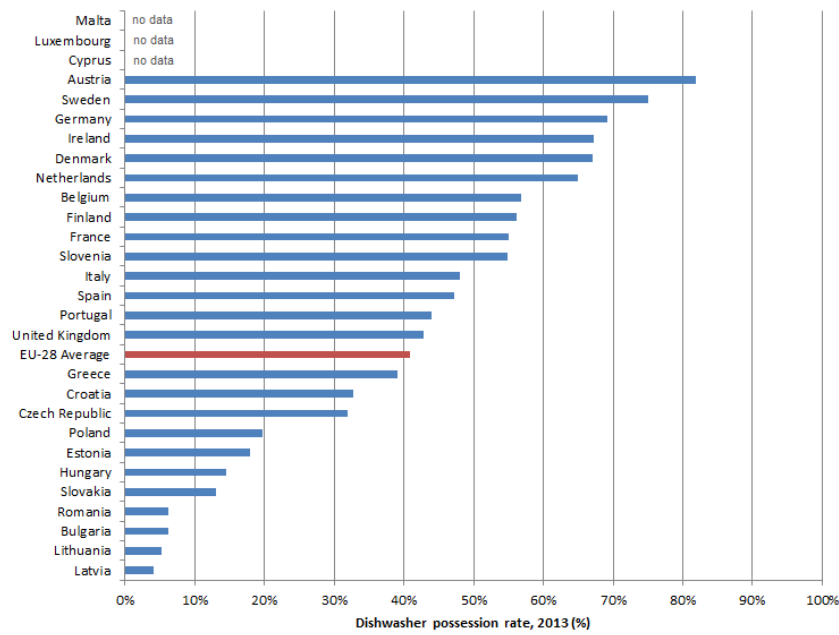
3.4.1 Dishwasher ownership

One of the most important factors which will drive the purchase of dishwasher detergents will be whether or not there is an increase in ownership of dishwashers.

The table below outlines the percentage of households that own dishwashers in 2012. This figure is expected to increase – in the UK, for example, the number of dishwashers increased from 34 % in 2006 to 40 % in 2012. This equates to over 1 million more dishwashers in use that require detergent.⁸⁹

⁸⁸ Retail value = value of sales

⁸⁹ Mintel (2011) *Dishwashing Detergents UK*



Source: Euromonitor International, Data used in Passport report, *Possession rates (2013)*

Figure 5: Dishwasher possession rates (%), EU-28, 2013

Countries with the highest rate of dishwasher ownership include:

- Austria 82 %
- Sweden 75 %
- Germany 69 %
- Ireland 67 %
- Denmark 67 %.

Countries with the lowest rate of dishwasher ownership include:

- Latvia 4 %
- Lithuania 5 %
- Bulgaria 6 %
- Romania 6 %
- Slovakia 13 %.

Although the ownership rate of dishwashers varies by country, across Europe the overall trend is a rise in ownership over the past five years. Figure 6 provides an indication of the average growth of dishwasher possession across Europe.

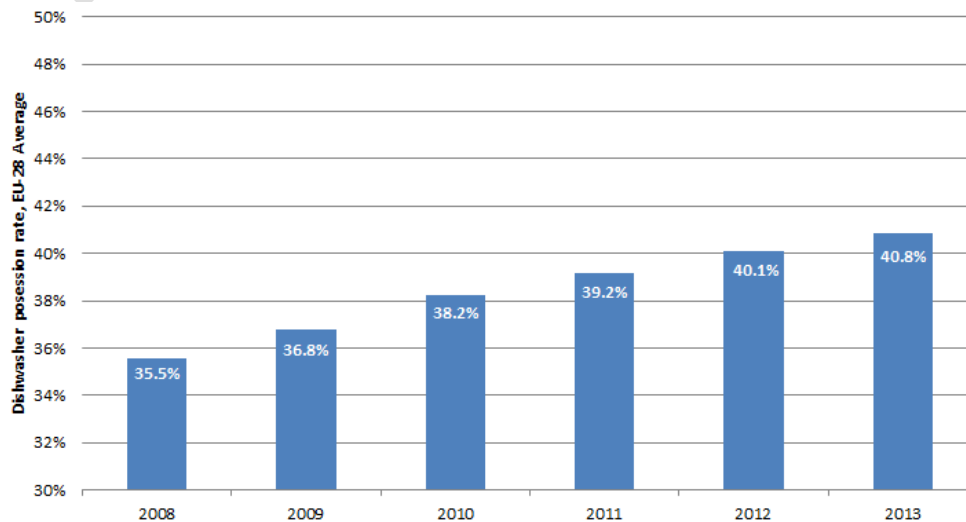


Figure 6: Dishwasher ownership rates (%) EU-28 average, 2008-13

This trend, combined with the current low ownership rate in a number of European countries, suggests that dishwasher possession is likely to continue to rise, driving a rise of dishwasher detergent sales. It should be noted that although ownership rates have grown steadily since 2008, between 2012 and 2013 this rise was only 0.7 % - lower than previous year on year changes, which were between 1 % and 1.4 %. This may suggest that although ownership is predicted to rise, this rise may be increasingly small, e.g. due to market saturation in terms of dishwasher ownership in some Member States.

A number of factors may influence the slowing down of dishwasher acquisitions, including the high price of dishwashers. This is especially the case as technological improvements continue to be made. Manufacturers develop increasingly sophisticated dishwashers and the increased price of manufacture gets passed on to consumers. Recent improvements in the technology of dishwashers include: reduction of energy and water used per wash – this may save the consumer money at the use stage; new functions such as delicate cycles (for glassware), and technology improvements such as touch screen control panels.

Moreover, in some countries there is also an element of ‘habit’ in washing dishes by hand that could have an impact on dishwasher sales. Much of the fast growth in dishwasher ownership since 2008 is due to Eastern European sales – however it is countries such as Poland where the habit of washing dishes by hand still remains.⁹⁰ Many of the consumers that purchase dishwashers here still buy hand dishwashing liquid to use occasionally, and so the impact of increased dishwasher ownership on dishwasher detergent sales is reduced.

The increase of single-person households in many EU countries will also have an impact on dishwasher sales, and therefore detergent sales. In the UK, for example, only 22 % of single-person households own a dishwasher.⁹¹ Currently, the number of single adult households across Europe ranges from 16 % of households in Cyprus to 46 % of households in Denmark.⁹² If these numbers were to increase further, it can be reasonably assumed that dishwasher ownership would stagnate as would sales of DD.

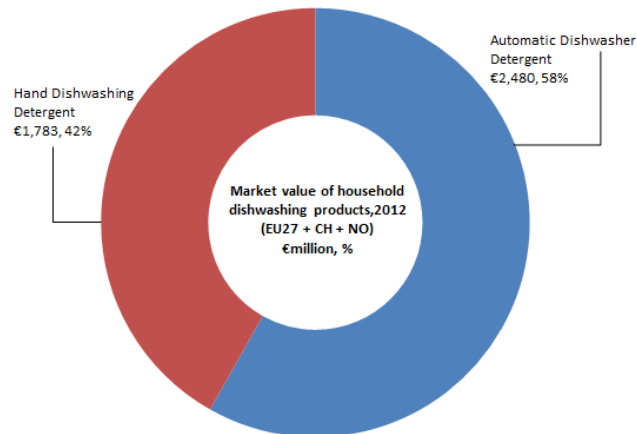
3.4.2 **Hand dishwashing detergents**

When analysing the market for dishwasher detergents, it is important to identify possible links to the hand dishwashing detergent market. Figure 7 provides a comparative overview of the size of the market for each; hand dishwashing detergents are valued at €1,783 million whereas automatic dishwasher detergents are valued at €2,480 million. This equates to a market value of over €4 billion in 2012 for the entire household dishwashing product category.

⁹⁰ Passport (2012) *Dishwashing in Poland* available at : <http://www.euromonitor.com/dishwashing-in-poland/report>

⁹¹ Mintel (2013) *Dishwashing products UK*, April 2013 available at Available at: <http://oxygen.mintel.com/display/638027/>

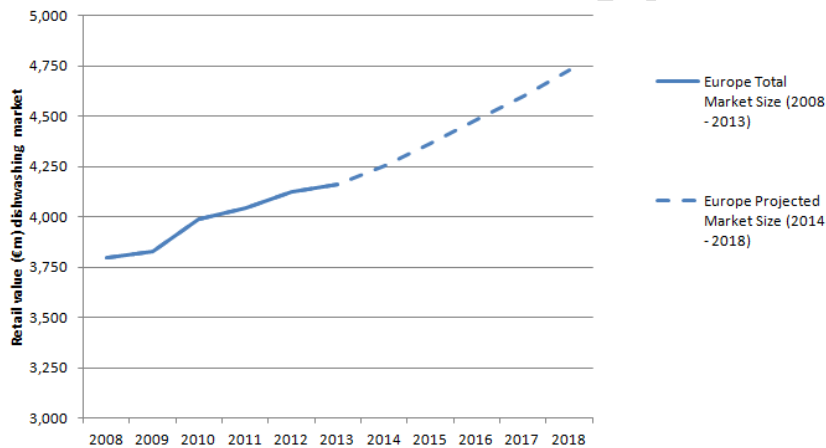
⁹² Eurostat (2011) EU27 Household Living Arrangements. Available at: <http://airo.ie/news/eurostat-study-eu27-households-living-arrangements>



Source: Euromonitor International, data cited in Passport (2014) *Market sizes Europe, Dishwashing*

Figure 7: Market value and % share of all household dishwashing detergents, Europe, 2012

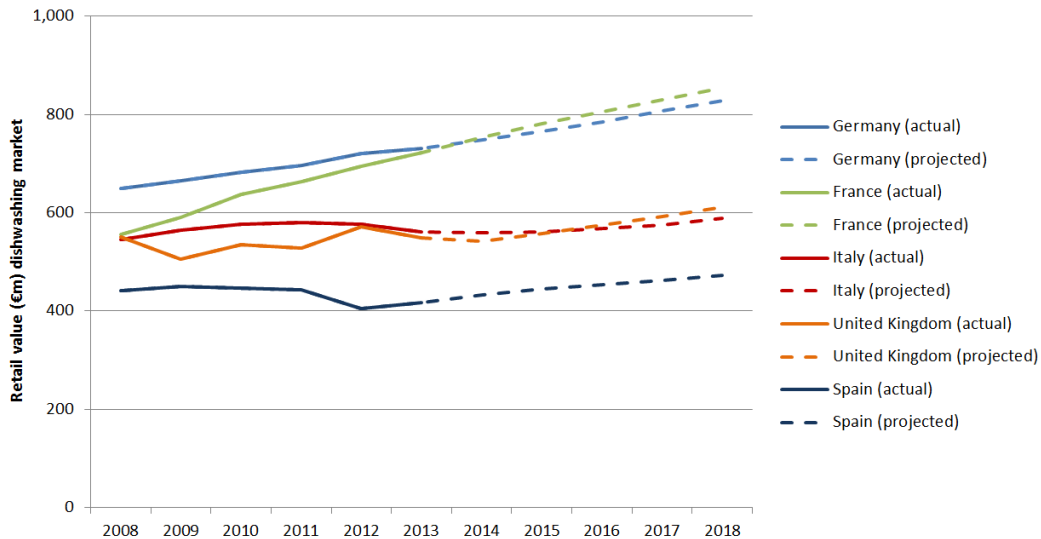
Figure 8 shows the trends in retail value for the dishwashing detergents market (including hand and automatic dishwashing detergents) across Europe. There is a clear upward trend in the product category, showing an expected increase from €3,800 million in 2008 to €4,732 million in 2018, a CAGR of 2.01 %.



* Includes hand dishwashing detergents and detergents for dishwashers ** Total excludes Cyprus, Estonia and Malta due to lack of data
Source: Adapted from Passport data, *Market Sizes (2008-2018)*

Figure 8: Actual and projected total retail value (€m) of dishwashing detergents* in Europe, 2008-18**

To further understand this trend, retail values for this period have been extracted for those countries with the highest market share and, therefore, with a high influence on the trends of the European market as a whole. Actual and expected retail value for Germany, France, Italy, UK and Spain are presented in Figure 9.



* Includes hand dishwashing detergents and detergents for dishwashers

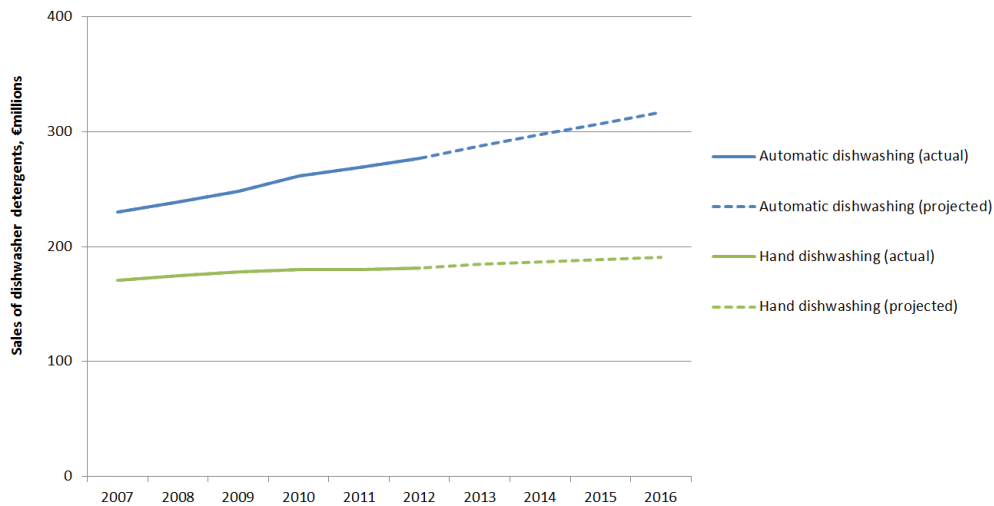
Source: Adapted from Passport data, *Market Sizes (2008-2018)*

Figure 9: Actual and projected retail value (€m) for countries with top five market share in dishwasher detergent* value across Europe, 2008-18

As with the European market as a whole, each country shows a projected increase in retail value for dishwasher detergents, albeit a varying level of increase in each country. To summarise Figure 12:

- Germany shows an expected increase of 27 %, or € 180 million between 2008 and 2018; a CAGR of 2.2 %. From 2014 till 2018 a total increase of 11% is expected.
- France shows the highest increase across all countries; 53 % - an expected increase of almost € 300 million between 2008 and 2018, with a CAGR of 4.0 %. By 2018, France is predicted to overtake Germany as the European country with the highest retail value for dishwasher detergents. From 2014 till 2018 increase of 13 % is expected
- Italy shows an increase of 8 % between 2008 and 2018, an expected increase of € 40 million (a CAGR of 0.7 %). From 2014 till 2018 increase of 5% is expected
- The UK shows an increase of 11 % between 2008 and 2018, an expected increase of € 60 million (a CAGR of 1.0 %). From 2014 till 2018 increase of 13% is expected
- Spain shows an increase of 7 % or an expected increase of € 30 million from €442 million between 2008 and 2018. This is a CAGR of 0.6 %. From 2014 till 2018 increase of 9% is expected

Figure 10 summarises the predicted trends in sales of both automatic and hand dishwasher detergents. These products are often seen as direct competitors, although many householders who own a dishwasher will also occasionally purchase hand dishwashing detergent. Even so, it is predicted that sales of hand dishwashing detergents will slow, while still slightly increasing, but there will be a rise in sales of automatic dishwashing detergent products.

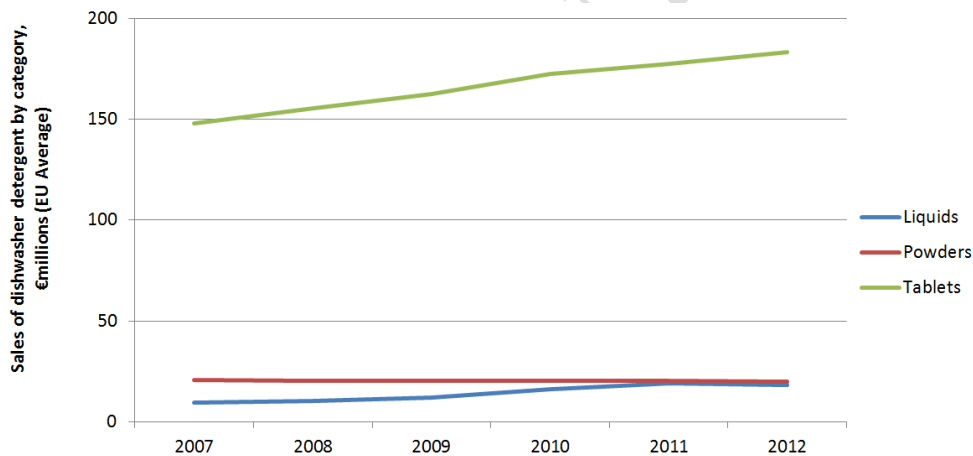


Source: Adapted from Passport data, *Market Sizes (2008-2018)*

Figure 10: Market trends, actual and projected sales (€m) of dishwasher detergents, 2007-16

3.4.3 Types of dishwasher detergent

Although there is a clear upward trend in the dishwasher detergent market as a whole, there are several different product types within this category: liquid, powder and tablet detergents. Figure 11 shows the EU average sales of various dishwasher detergent types, from 2007-12.



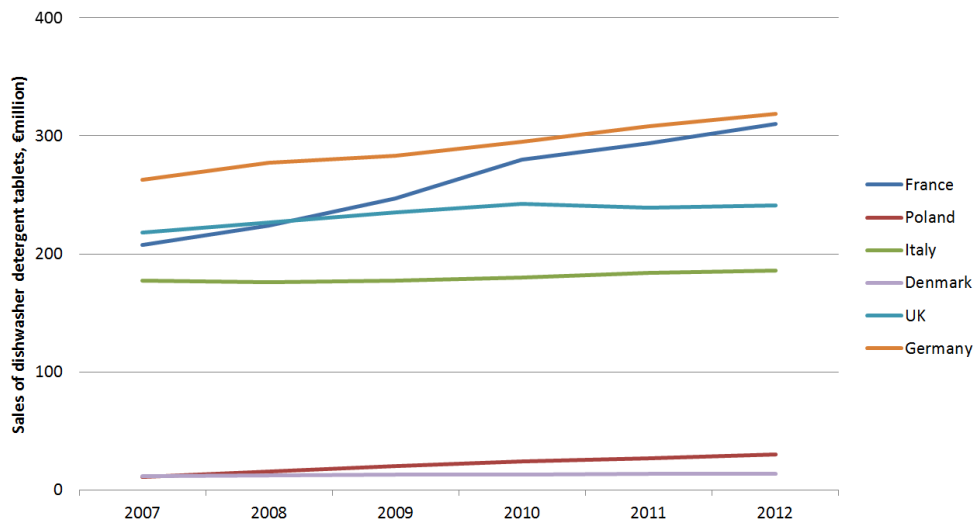
Source: Euromonitor, summarised from 2013 Passport reports for Dishwashing in: Denmark, Italy, Germany, UK, Poland, France

Figure 11: Sales of dishwasher detergents by category, EU average, €m

Overall:

- Sales of detergent tablets are consistently higher than other detergent types. On average, across Europe (based on the six countries analysed) sales of detergent tablets have increased from €148 million in 2007 to €183 million in 2012 – an increase of 24 % or a CAGR of 3.6 %.
- Sales of powder detergents remained relatively steady throughout the period 2007-12, showing a slight decrease of 2 % from €20.6 million to €20.1 million. This equates to a CAGR of -0.41 % across this period.
- Sales of liquid detergents have shown an increase from €10 million to €18 million between 2007 and 2012. This is a significant increase of 96 % with a CAGR of 11.84 %. This is the biggest relative increase in sales of all the detergent types. If this increase continues, sales of liquid detergents are likely to overtake sales of powder detergents.

Across the EU, dishwasher tablets account for the highest sales on average. However, this can vary by country. Figure 12 shows the sales of dishwasher detergent tablets across six countries in different regions of Europe from 2007 to 2012.



Source: Euromonitor, summarised from 2013 Passport reports for Dishwashing in: Denmark, Italy, Germany, UK, Poland, France

Figure 12: Sales of dishwasher detergent tablets by country, €m

Each of the six countries has seen an increase in dishwasher detergent tablet sales between 2007 and 2012:

- Germany has the highest sales value of all six countries between 2007 and 2012, with a growth rate of 21 % and a CAGR of 3.22 %.
- Detergent tablet sales (by value) in France have seen a CAGR of 7 % between 2007 and 2012. France has consistently seen the second highest sales of detergent tablets across all six countries since 2008, when its sales value overtook the UK. Percentage sales value has increased by 49 % in this period.
- The UK has seen a CAGR of 1.69 % between 2007 and 2012, with a percentage value increase of 11 %.
- Of the six countries analysed, Italy has seen the lowest increase in sales of detergent tablets between 2007 and 2012, as sales (by value) have only increased by 5 %, with a CAGR of 0.76 %.
- Poland had the lowest sales value of dishwasher detergent tablets in 2007 (marginally lower than Denmark) but by 2012 this had increased by 173 % with a CAGR of 18.22 %. Although actual sales value is relatively low, this increase is the most significant of all the countries analysed.
- Sales of detergent tablets in Denmark remained reasonably steady between 2007 and 2012 with a CAGR of 2.87 %. By 2012, Denmark had the lowest sales value across each of the six countries analysed.

3.5 Labelling

Table 25 shows the number of products in the EU which have been awarded the EU Ecolabel for 'dishwasher detergents'. The first column – country – indicates the country which awarded the EU Ecolabel to various manufacturers and products; this is also the country in which the product is manufactured. France has the largest number of manufacturers which have been awarded the EU Ecolabel (6 manufacturers, or 30 % of all labelled manufacturers) which also equates to the largest amount of EU Ecolabel products (46 products, or 60 % of all labelled products). However, the EU Ecolabel products manufactured in France are not widely available across Europe, whereas a number of other products (in particular those manufactured in Germany, Denmark and Spain) are.

In addition, the EU Ecolabel for dishwasher detergents has been awarded to manufacturers in:

- Netherlands - 3 manufacturers and 11 products.
- Spain - 3 manufacturers and 8 products.
- Denmark - 3 manufacturers and 6 products.
- Germany - 2 manufacturers and 2 products.
- Austria - 1 manufacturer and 1 product.
- Belgium - 1 manufacturer and 1 product.
- Czech Republic - 1 manufacturer and 1 product.

Table 25: Number of products with the EU Ecolabel for DD, by country

Country	Number of Manufacturers awarded the EU Ecolabel	Number of products awarded the EU Ecolabel	Countries where products are sold (Europe only)
Austria	1	1	Austria
Belgium	1	1	Belgium, France, Portugal, Spain, Netherlands, UK
Czech Republic	1	1	Czech Republic
Germany	2	2	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Norway, Poland, Portugal, Romania, Slovakia, Spain, Sweden, Netherlands
Denmark	3	6	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Netherlands, UK
Spain	3	8	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Netherlands, UK
France	6	46	France
Netherlands	3	11	Netherlands, Germany
TOTAL	20	76	

Source: Ecolabel E-Cat (last viewed on 01/04/2014) - <http://ec.europa.eu/ecat/> - N.B. this is an estimate only, E-cat data is from ca.2012

In comparison, the number of EU manufacturers and products awarded the EU Ecolabel for IIDD is significantly lower; a total of three manufacturers and five products (see Table 26).

Table 26: Number of products with the EU Ecolabel for IIDD, by country

Country	Number of Manufacturers awarded the EU Ecolabel	Number of products awarded the EU Ecolabel	Countries where products are sold (Europe only)
Austria	1	1	Austria, Bulgaria, Czech Republic, Germany, Hungary, Italy, Poland, Romania, Slovakia, Slovenia
Germany	1	3	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Greece, Hungary, Italy, Latvia, Lithuania, Luxemburg, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Netherlands
Spain	1	1	France, Portugal, Spain
TOTAL	3	5	

Source: Ecolabel E-Cat (last viewed on 01/04/2014) - <http://ec.europa.eu/ecat/> - N.B. this is an estimate only, E-Cat data is from ca.2012

In addition to the EU Ecolabel, which operates across the EU-28, there are other national ecolabelling schemes. For example, 'Nordic Swan' has an ecolabel scheme for dishwasher detergents and an ecolabel for dishwasher detergents for professional use. It covers products that are produced and marketed in the five members of the Nordic Council (Sweden, Denmark, Finland - which are also EU Member States - and Norway and Iceland, which are EEA States). Table 27 identifies how many products have been awarded this ecolabel.

Table 27: Number of products with the Nordic Swan, by country

Nordic Swan Country	Domestic Dishwasher Detergent		Professional Dishwasher Detergent	
	Number of Nordic Swan-labelled products on market	Number of manufacturers/brands	Number of Nordic Swan-labelled products on market	Number of manufacturers/brands
Denmark	177	77 (brands)	273	74 (brands)
Norway	0	0	55	24 (brands)

Sweden	59	8 (manufacturers)	1	1 (manufacturers)
Finland*	n/a	n/a	n/a	n/a
Iceland*	n/a	n/a	n/a	n/a
Total	236		329	

* n/a: Data not available on relevant websites (Ecolabelling Finland and Ecolabelling Iceland). Competent Bodies were asked if possible to share this data with the project team.

Source: Danish Ecolabelling website/product catalogue⁹³, Norwegian Ecolabelling website/product catalogue⁹⁴, Swedish Ecolabelling website/product catalogue⁹⁵ - last viewed on 01/04/2014

The high number of Nordic Swan-labelled products may be because for many small Scandinavian producers of dishwasher detergents (private labels), it may be that the local market is more vital than the general European market, and so the Nordic Swan label may be more familiar and accepted by producers and consumers alike. This may result in a lack of incentive for smaller producers to acquire both a regional label (Nordic Swan) and an EU Ecolabel. Moreover, in contrast to the EU Ecolabel, more products have the Nordic Swan for professional dishwasher detergents (or IIDD) than for domestic dishwasher detergents.

However, it does seem that there is a high interest in the EU Ecolabel for both domestic and professional dishwasher detergents judging by the relatively high uptake across the EU, in comparison to other EU Ecolabel products.

A number of labels are also used throughout the rest of the world, including:

- the 'Environmental Choice' (New Zealand) label for "machine dishwashing detergents" (5 ecolabelled products);
- the Hong Kong Green Label for "machine dishwashing detergents".⁹⁶

3.6 Product and process innovation

Within the dishwashing product market, innovation is primarily led by hand-dishwashing rather than automatic dishwashing detergents. To demonstrate this, there have been few new product launches in the dishwasher detergent market and where new products have been launched, these have been as extensions to current product lines. However, a limited number of innovations have been seen:

3.6.1 Dishwasher tablets

In the past few years, the largest dishwasher detergent manufacturers have primarily been focused on promoting sales of tablet detergents, the most recent innovation in the dishwasher detergents market. In the UK, for example, 8 out of 10 new products launched for automatic dishwashers in 2013 were tablets; this reflects the high use of detergent tablets in the UK (see Section 3.2.1).⁹⁷ The increased use of detergent tablets is also reflected across Europe (see Section 3.2.1). The biggest incentive for consumers to switch to these tablets detergents is convenience; the tablets provide an easy to use single dose measure, which often contains both detergent and other additives such as rinse aid (i.e. a combined product).

As a comparison, Western Europeans spend three times more than North American consumers per machine on automatic dishwashing products. This is mainly due to the increased use in Europe of dishwasher tablets, which are typically more expensive but offer greater functionality and convenience.⁹⁸

⁹³ <http://www.ecolabel.dk/da/produkter/rengoering-og-vask/midler-til-husholdning>

⁹⁴ <http://www.svanemarket.no/produkter/producttype/?m1=300005&m2=310053&pt=299109#prodList>

⁹⁵ <http://www.svanen.se/en/Buy-Svanenmarkt/EU-Ecolabelled-products/?categoryID=347&p=5>

⁹⁶ Note, no data is available for the number of products on the market which hold this label

⁹⁷ Mintel (2013) *Dishwashing products UK*, April 2013

⁹⁸ Euromonitor International (2013) *Dishwasher detergents should focus on innovation*. Available at: <http://blog.euromonitor.com/2013/01/dishwasher-detergent-should-focus-on-innovation.html> [Accessed 24 April 2014]

3.6.2 Sustainability trends

A recent (2011) A.I.S.E. consumer study suggests that, across Europe, 72 % of consumers look for advice and commitments on sustainability when buying detergents⁹⁹ – showing the importance for manufacturers to consider the environmental impacts of their products.

However, the dishwasher detergent market is highly sensitive to price. Few consumers are willing to pay more for environmentally friendly products, especially since the recent European-wide economic downturn. There are also very few shoppers who actively look for the environmental performance of dishwasher detergents; performance and price are more important to them.¹⁰⁰ Even so, environmental issues are still widely discussed and many of the larger brands of dishwashing products (including both hand dishwashing and dishwasher detergents) are focusing on promotion of their green credentials. In the UK, for example, nearly half of all product launches in the dishwashing market were promoted alongside claims of environmentally friendly packaging.¹⁰¹ This reflects a wider trend in the household care category, with a number of brands focusing on recycled packaging and including sustainable cleaning logos. Innovation in raw materials is being, at least partially, driven by a push from consumers who are increasingly demanding more from detergents. For example, the trend in the use of 'green raw materials' has been supported by consumers who are pushing for the use of more natural products.

Consumers' increase in environmental awareness has led to the rise in green products entering the dishwashing detergent market, although to date this has mainly been in hand dishwashing detergents. There are a number of well established brands, such as the *Ecover* range of household products¹⁰², which have focused on reducing the environmental impacts of its products. Larger brands have also begun to consider chemical use in their products. For example, Reckitt Benckiser launched 'Finish Power & Free' at the start of 2014. This dishwasher detergent has been developed with the use of hydrogen peroxide and with a reduction in 'harsh chemicals' - no chlorine bleach has been used and the use of fragrances and dyes has been reduced.¹⁰³

In response to this, supermarkets have begun to follow suit by producing own-label rivals, such as Sainsbury's *Cleanhome* range and Tesco's *Naturally*¹⁰⁴ which all include environmentally friendly and reduced chemical use claims. In 2013, own-label brands were responsible for 62 % of products launched (including hand and automatic dishwashing) in the UK¹⁰⁰, showing the significance of supermarket brands in the detergent sector.

3.7 Consumer trends

3.7.1 Trade-off with hand dishwashing detergents

It is expected that the market for all dishwashing products (both hand dishwashing and automatic dishwasher detergent) continues to grow (see Figure 13). These two products are often seen as direct competitors, although many households who own a dishwasher will also purchase hand dishwashing detergent and so the trade-off between these products is not simple to predict. This may be especially true as innovation is primarily focused on hand dishwashing detergents; products are currently focused on 'luxury' and fragrance¹⁰³ and manufacturers are regularly launching new products in this arena. It is expected that the need for hand dishwashing will remain, and so hand dishwashing brands will retain their market penetration. The changes in the hand dishwashing detergent market are therefore not a reliable indicator of the automatic dishwasher detergent market as a whole.

⁹⁹ A.I.S.E (2013) The case for the 'A.I.S.E. low temperature washing initiative'

¹⁰⁰ Mintel (2011) *The greening of dishwashing detergents*, March 2011

¹⁰¹ Mintel (2013) *Dishwashing products UK*, April 2013

¹⁰² Ecover website: <http://uk.ecover.com/>

¹⁰³ Finish website, Available at: <http://www.finishdishwashing.com/products/power-free/> [Accessed 24 April 2014]

¹⁰⁴ Marketing (2008) *Sector insight: Dishwashing detergents*. Available at: <http://www.marketingmagazine.co.uk/article/822570/sector-insight-dishwashing-detergents> [Accessed 16 April 2014]

3.7.2 A 'perfect result every time'

Functionality is one of the biggest drivers for consumer purchases of dishwasher detergents; consumers increasingly demand a 'perfect result every time' from the use of dishwashers, especially in Western Europe. This means that, although consumers are still price-sensitive and driven by price promotions, they are often willing to spend more money on products with a higher efficacy. This links to the increased use of detergent tablets, which are often 'multi-purpose' and include rinse aid and other additives to ensure better cleaning results, especially for glassware.

Dishwasher detergents, in general, have followed this trend of offering multi-functional products, often including rinse aids and salts in the product.⁹⁸ Due to their ability to function as 'multi-purpose', detergent tablets and gels have the potential to cannibalise sales of dishwashing additives – these will now be combined in a detergent tablet/gel and so additives on their own may be considered redundant. However, sales of ancillary products still remain reasonably strong in Europe (see Section 3.2.1) which suggests that consumers are still willing to buy these products separately, perhaps alongside cheaper dishwasher detergent. In the UK, for example, around 50 % of shoppers who bought dishwasher detergents also bought rinse aids.¹⁰⁵

This intense focus on perfect results has enabled detergent manufacturers to convince consumers to buy into premium products. For instance, detergent tablets such as Finish have focused on their ability to effectively clean glassware, making the brand popular across Europe. However, this focus on efficacy may pose a rise to manufacturers due to the 2017 phosphates ban due to the fact that if phosphates are not used in dishwasher detergents the wash efficacy is lowered.¹⁰⁶ Consumers are increasingly expecting improved performance from dishwasher detergents and the ban will mean that manufacturers have to work hard to reformulate detergents in order to please consumers.¹⁰⁷ Manufacturers are under pressure to get the formulation of products right, but not reduce quality.¹⁰⁶

3.8 Market analysis conclusions

This section summarizes and highlights the information outlined in the market analysis, highlighting the main conclusion and identifying key issues and market trends.

3.8.1 Market overview

- The European market for domestic dishwasher detergents is an estimated €2,480 million. Little data is available for the IIDDD market, but the kitchen and catering detergents market (which includes dishwasher detergents¹⁰⁸ has an estimated value of €1,518 million) and is expected to see an estimated 3 % continued annual growth.
- The market for dishwasher detergents is primarily intra EU trade, with five large manufacturers accounting for 65 % of the European market.
- The market for dishwasher detergents is mature in Western Europe with some growth potential in Eastern Europe.

3.8.2 Products available on the market

Dishwasher detergents are most often sold in three formulations:

1. Detergent tablets – these have an estimated market share of 83 % in Europe, based on sales values (ranging from 52 % in Denmark to 92 % in the UK). These products are commonly seen as convenient and are increasingly likely to also contain dishwasher additives. However, they are typically more

¹⁰⁵ Mintel (2013) *Dishwashing products UK*, April 2013

¹⁰⁶ Phosphates in Automatic Dishwasher Detergents, CEEP a sector group of Cefic, August 2007 information sheet. Available at: <http://www.ceep-phosphates.org/Files/Document/83/CEEP%20phosphates%20in%20dishwasher%20detergents.pdf>

¹⁰⁷ Euromonitor International (2013) *Dishwasher detergent should focus on innovation*, January 22, 2013. Available at <http://blog.euromonitor.com/2013/01/dishwasher-detergent-should-focus-on-innovation.html> [Accessed 16 April 2014]

¹⁰⁸ This includes dishwasher detergents, hand dishwashing detergents, kitchen surface disinfectants, hand hygiene and care

expensive and do not allow the consumer to control dosing of the product. Detergent tablets have seen a steady increase in sales value since 2007 and this increase is expected to continue.

2. Powder detergents – this type of product has an estimated market share of 9 % in Europe, based on sales values (ranging from 25 % in Denmark to 4 % in Italy). Across Europe, sales of powder dishwashing detergents remain flat. This means that as the detergent market grows, powdered detergents are losing market share.
3. Liquid detergents – this type of product has the lowest market share in Europe, with an estimated 8 %, based on sales values (ranging from 25 % in Italy to 1 % in Germany). Sales of liquid dishwasher detergents have seen an increase in the past five years, although this increase has levelled since 2011 and is slight compared to the increase in sales value seen in the detergent tablet market.

3.8.3 *Drivers of sales*

The driving force of dishwasher detergent sales includes a number of factors:

- Dishwasher ownership – a number of factors can effect this including: price of the machine, population size, population distribution (e.g. number of single person households), size of living accommodations and preference to wash dishes by hand.
- Price of the detergent - although domestic consumers are very price-sensitive and driven by price promotions, Western Europeans are often willing to spend more money on products with a higher efficacy.
- Functionality (washing efficacy).
- Reduced environmental impacts – although this is still an emerging trend for dishwasher detergents, domestic consumers (especially in Western Europe) are beginning to make purchasing decisions based on this.
- The 'habit/tradition or usual behaviour' or preference of washing by hand, rather than using a dishwasher.

4. TECHNICAL ANALYSIS

A technical analysis of the environmental performance of dishwasher detergents has been carried out and is presented in this chapter. The main objective of this analysis is to identify the environmental hot spots across the whole of the life cycle for dishwasher detergents.

This analysis incorporates:

- An overview of technological aspects – production and ingredients
- A review of existing LCA studies
- A review of non-LCA impacts
- A bespoke LCA analysis
- A sensitivity analysis.

4.1 Technological aspects

4.1.1 Supply chain for dishwasher detergent production

An overview of the supply chain for home and fabric care products, including dishwasher detergents, is shown in Figure 13. Manufacturers of dishwasher detergents (formulators/blenders in Figure 13) such as Procter & Gamble, Unilever and Henkel, acquire ingredients such as surfactants from speciality manufacturers and then blend these to produce dishwasher detergents. Within Europe there are around 40-50 companies active in the market for home and fabric care speciality ingredients.¹⁰⁹ Further information on dishwasher detergent ingredients can be found later in this section.

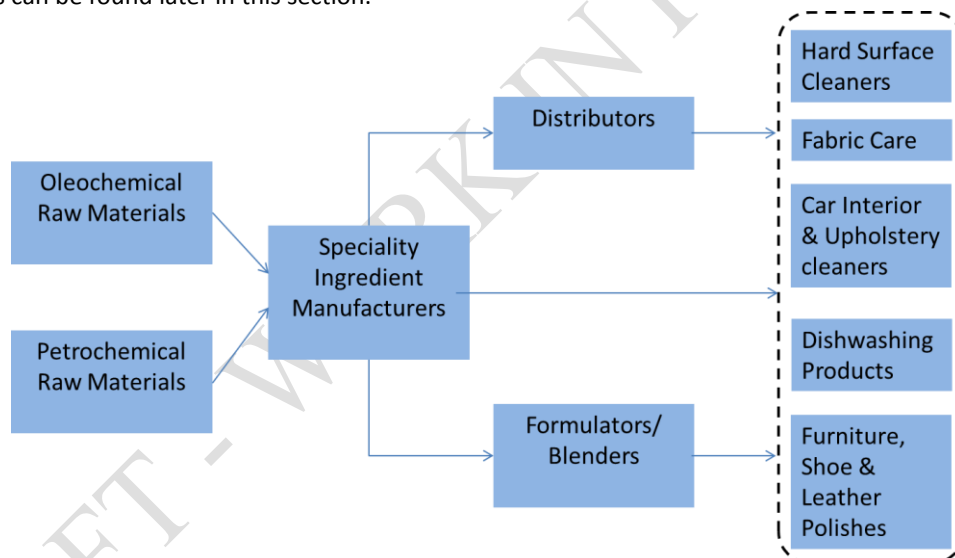


Figure 13: Supply chain for home and fabric care products

The raw materials used for the production of detergent ingredients are obtained either from oleochemical or petrochemical sources. Oleochemical raw materials are derived from plant and animal fats, including coconut oil, tallow, palm kernel oil and palm oil. These raw materials are often referred to as *renewable* raw materials. Petrochemical raw materials are derived from crude oil or natural gas, these materials are often termed *synthetic*. According to the American Cleaning Institute, there is no inherent environmental advantage to using surfactants from one source or the other and there are environmental trade-offs associated with both

¹⁰⁹ *Strategic Analysis of the Home and Fabric Care Speciality Ingredients Markets in Europe*, Frost & Sullivan, July 2009.

oleochemical and petrochemical sources.¹¹⁰ This issue will be discussed in more detail in technical background report.

Companies active in the European market for detergent speciality ingredients include Clariant, Rhodia, Solvay, Rohm & Hass, Cognis, Croda, Dow Corning, Elementis, Alco Chemical and BASF amongst others. Within the home and fabric care ingredients sector, speciality surfactants hold the largest market share in Europe.¹⁰⁸

4.1.2 **Description of the production processes**

The first step of dishwasher detergent production is to select the ingredients. This is done according to several criteria, which will typically include cost, sustainability, human health, environmental safety and performance. Detergent manufacturers use different approaches to ensure that their products have the least impact on the environment and human health. One example of such an approach is the Greenlist™ process developed by SC Johnson, which scores ingredients by their impact on the environment and human health.¹¹¹ Using this process a final product score is obtained that takes into consideration the environmental classifications of both chemical and packaging constituents.¹¹²

The manufacturing process employed for dishwasher detergent products in general consists of mixing and pumping the ingredients into mixing vessels. The exact process employed will depend on the manufacturer and the format of the final product. Different processes will be employed for liquids and powder tablets.

- Powder detergents are produced by spray drying, agglomeration, dry mixing or combinations of these methods.¹¹³ During the spray drying process, liquid and powder ingredients are combined to form a slurry which is then pumped through a tower and sprayed under high pressure to form small droplets. A current of hot air is used to dry the droplets and form hollow granules. Following a screening process to ensure granules are of the correct size, temperature sensitive ingredients such as enzymes are added. An agglomeration process consists of blending dry and liquid ingredients in the presence of a liquid binder. This process leads to higher density powders. For the production of powders, processes are required for densification, to ensure that the final product has the desired bulk density.
- Liquid detergents are produced either in a batch process or a continuous process. A batch process is the simplest as ingredients are introduced to an agitated tank and additional mixing or heating can be provided through a recirculation loop.¹¹⁴ In comparison, continuous processes are more sophisticated and better suited to large-scale operations. In a continuous process both dry and liquid ingredients are added and then blended using in-line mixers.

The final step in the manufacturing process for both tablet (powder) and liquid dishwasher detergents is packaging. Liquid and gel dishwasher detergents are typically packed in detergent pouches and a carton or plastic box. The tablets and powders are packaged in boxes. During the selection process for packaging materials, product compatibility, product stability, cost, safety, solid waste impact, ease of use and shelf appeal are all taken into consideration.

4.1.3 **Dishwasher detergents ingredients**

Dishwasher detergents for both household and professional use are complex formulations. Their ingredients can be categorised as: surfactants, alkalis, builders, bleaching agents and auxiliary agents (See Annex II).

¹¹⁰ Sustainability resources from the American Cleaning Institute, available from: http://www.cleaninginstitute.org/sustainability/some_facts_about_4.aspx

¹¹¹ For more information <http://www.scjohnson.com/en/commitment/focus-on/greener-products/greenlist.aspx>

¹¹² S.C. Johnson's Greenlist Program for raw material selection: pushing the sustainability frontier, presentation by Dr Pat Guiney, S.C. Johnson & Son Inc. at Minnesota Green Chemistry Conference, January 2012. Available from: [http://www.greenchemistrymn.org/sites/greenchemistrymn.org/files/presentations/Pat %20Guiney.pdf](http://www.greenchemistrymn.org/sites/greenchemistrymn.org/files/presentations/Pat%20Guiney.pdf)

¹¹³ Soaps & Detergents: Manufacturing, American Cleaning Institute. Available from: http://www.cleaninginstitute.org/clean_living/soaps__detergents_manufacturing.aspx

¹¹⁴ Handbook of Detergents, Part F: Production, Surfactant Science Series Volume 142, Uri Zoller and Paul Sosis, CRC Press, 2009.

The major components in dishwasher detergents are builders and alkaline silicates. Builders such as phosphates may contribute as much as 30 % by weight. The role of alkalis in the detergent is to emulsify grease and adjust the pH of the water to the optimum level for the other components to work. Commonly-used alkalis include sodium carbonate and sodium metasilicate. Builders serve a number of purposes in dishwasher detergents, such as water softening, buffering and emulsifying.¹¹⁵ Commonly-used builders include tripolyphosphates, other phosphate complexes and sodium citrate.

Automatic dishwashing detergents also contain small amounts of surfactants. These are used to remove and emulsify fats and aid with wetting. Non-ionic surfactants are used in dishwasher detergents, as they have the lowest 'sudsing' characteristic, which is beneficial as suds inhibit the cleaning process. Commonly used non-ionic surfactants include alcohol ethoxylates such as LAS, alkane sulfonates and alkyl polyglycosides. Bleaching agents, such as perborates, are used to remove stains such as coffee and tea. Auxiliary agents are used in small quantities only, each with its own specific purpose. For instance, corrosion inhibitors such as sodium silicate help to protect machine parts, enzymes, both proteases and amylases, are used to break down stubborn stains, defoamers are used to prevent excessive build of suds and other auxiliary agents are used as processing agents, for example to aid with formulation and for production reasons such as modifying the solubility. Further detail on specific detergent ingredients and their environmental performance will be provided in the technical report.

4.2 LCA review

Before performing an LCA analysis of dishwasher detergents (DD) along their life cycle, a detailed LCA screening of publicly available studies was carried out. This screening has allowed the identification of the main environmental aspects for this product group as well as the evaluation of the need for performing additional studies. It will aid the revision of the EU Ecolabel criteria for the DD product groups, allowing for the identification of the environmental hot spots and options for environmental improvement which may be addressed through the criteria.

4.2.1 Selection criteria

Relevant LCA studies were identified in the literature and critically reviewed for the robustness of their results. The criteria considered for this assessment were:

- **Subject of the studies:** This refers to the representative features of the product group, sub-categories, technologies or specifications.
- **Functional unit:** The functional unit refers to a quantified performance of a product system for use as a reference unit in LCA studies.
- **Time-related coverage of data:** This refers to the year the inventory data of the analysis is based on; studies should ideally be less than four years old.
- **Comprehensiveness and robustness:** This refers to the environmental impacts considered in the study. Impact Categories should be comprehensive, ideally reflecting the European Commission's Product Environmental Footprint (PEF)¹¹⁶ methodology or other recognized LCA methodologies and scientifically robust when considered against the evaluation provided in the JRC's ILCD Handbook.¹¹⁷ Studies should also be cradle-to-grave.
- **Reliability:** This refers to the information and the data quality provided by the authors. Studies should ideally be subject to an external critical review.

The different studies' compliance with the ISO standards for LCA (ISO 14040 and 14044) was considered as well as the information provided regarding:

¹¹⁵ Understanding Automatic Dishwashing, American Cleaning Institute. Available from: http://www.cleaninginstitute.org/clean_living/understanding_automatic_dishwashing.aspx

¹¹⁶ Commission recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance and organisations, Official Journal of the European Union 2013/179/EU

¹¹⁷ JRC, IES, International Reference Life Cycle Data System (ILCD) Handbook, general guide for Life Cycle Assessment, first edition 2010

- **Cut-off criteria:** According to the ISO 14040/44:2006 and the ILCD Handbook, cut-off criteria should be documented in an LCA study. The reasons for assuming cut-offs should be stated and their effects on results should be estimated.
- **Allocation:** Allocation rules should be documented in the description of the studies.
- **Data quality requirements and data sources:** Data quality level and sources of primary and secondary data should be documented, e.g. information on the geographical and technological representativeness of the selected LCA studies.
- **Assumptions:** Information and documentation of the important assumptions is crucial to ensure the transparency and reproducibility of the results. Therefore, information about the assumptions made whilst modelling should be provided.

4.2.2 Quality assessment of available studies

The number of publicly available LCAs on dishwasher detergents is very limited. Four studies were identified which described the environmental impacts of dishwasher detergents from a life cycle perspective.

1. The International Association for Soaps, Detergents and Maintenance products carried out a generic LCA on dishwasher detergents.¹¹⁸
2. The Product Sustainability Forum identified some of the key environmental impacts of dishwashing detergents.¹¹⁹
3. Igos et al. performed an LCA of three detergent products in order to evaluate the environmental impact of novel formulations.¹²⁰
4. Nordic Ecolabelling identified the most relevant variables regarding the environmental impact of dishwasher detergents.¹²¹

Table 28: overview of studies on dishwasher detergents

Source	A.I.S.E. 2012	Product Sustainability Forum 2013	Igos et al. 2014	Nordic Ecolabelling 2013
Title	Charter update 2010: ASP substantiation dossier: Automatic dishwashing (adw) detergents - final version 23 February 2012	Dishwashing Products, Hotspots, opportunities & initiatives	Development of USEtox characterisation factors for dishwasher detergents using data made available under REACH	Dishwasher detergents and Rinsing agents, Criteria Version 6.0, Background document
Subject of the study and goal	To get an understanding of the environmental impacts of the various stages of a detergent's life cycle	Identify environmental hotspots, to provide examples of reduction opportunities to improve product sustainability	Characterising the ecotoxicity and human toxicity potential of effluent discharge from dishwashers, after treatment in waste water treatment plant. Three dishwasher detergents were considered: phosphate-based (PB), eco-labelled (EL) and phosphate-free (PF) formulations	Assessment of environmental and health impacts in order to ecolabel the products which: <ul style="list-style-type: none"> - Contain low levels of substances that are harmful to health and the environment - Clean effectively even at low temperatures - Have optimised and well-filled packaging
Study type	LCA	Hotspots analysis	LCA	LCA
Functional Unit	1 washing cycle, normal soil	Not specified	1 washing cycle, considering a standard program of a modern dishwasher	Not specified

¹¹⁸ A.I.S.E., 2012: Charter update 2010: APS substantiation dossier: Automatic dishwashing (ADW) detergents – final version, 23 February 2012

¹¹⁹ Product Sustainability Forum, May 2013. *Dishwashing Products, Hotspots, opportunities & initiatives.*

¹²⁰ Igos E, R Moeller, E Benetto a, A Biwer, M Guiton, P Dieumegard. *Development of USEtox characterisation factors for dishwasher detergents using data made available under REACH.* Chemosphere 100 (2014) 160–166

¹²¹ Nordic EU Ecolabelling, 2014. *Dishwasher detergents and Rinsing agents.* Version 6.0

Source	A.I.S.E. 2012	Product Sustainability Forum 2013	Igos et al. 2014	Nordic Ecolabelling 2013
			(water temperature around 50–60 °C) using one detergent unit (tablet or bag)	
System boundaries	Raw material manufacturing, packaging material production, product formulation, transport, use phase, end of life	Not specified	Gate to grave: Freshwater ecotoxicity and human toxicity for the effluent after one washing cycle and a partial removal in the wastewater treatment plant	Cradle to grave, plus quality, performance/functionality
Time related coverage	Data collection for relevant LCA parameters in 2010 and 2011	Not specified	Inventory of the composition of the effluent discharge is based on data from 2001-2009. For the development of the CFs, in particular the publically available data collected under REACH (2006) were used.	Not specified
Reliability (data quality, external critical review?)	The ASPs and the substantiation dossier were subject to consultation with Charter member companies and other interested parties (industry/external stakeholders)	Not specified. Hotspots were identified using a range of sources – but mainly publicly available life cycle and sector-level research into resource use and environmental impacts	Peer-reviewed scientific publication	External review before the Nordic Ecolabelling Board finalises the criteria
Method	Not specified	Not specified	ReCiPe 2008 (hierachist), freshwater ecotoxicity and human toxicity in USEtox	MECO (Materials, Energy, Chemicals ,Other) analysis
Impact assessment	<ol style="list-style-type: none"> 1. Abiotic resources depletion 2. Acidification 3. Eutrophication 4. Global warming 5. Ozone layer depletion 6. Human toxicity 7. Ecotoxicity 8. Photochemical oxidation 	<ol style="list-style-type: none"> 1. Waste 2. Water 3. Energy 4. Greenhouse gas emissions (GHGs) 5. Material risks 	<ol style="list-style-type: none"> 1. Climate change 2. Ozone depletion 3. Terrestrial acidification 4. Freshwater eutrophication 5. Marine eutrophication 6. Photochemical oxidant formation 7. Particulate matter formation 8. Terrestrial ecotoxicity 9. Freshwater ecotoxicity 10. Marine ecotoxicity 11. Ionising radiation 12. Agricultural land occupation 13. Urban land occupation 14. Natural land transformation 15. Water depletion 16. Metal depletion 17. Fossil depletion 	<ol style="list-style-type: none"> 1. Energy usage 2. Climate aspects 3. Water usage 4. Source of raw materials 5. Use of chemicals 6. Hazardous effluents 7. Packaging 8. Waste

4.2.3 Key findings

A generic LCA on dishwasher detergents was carried out by the International Association for Soaps, Detergents and Maintenance products.¹¹⁷ The most significant impacts on the environment occur during the use and disposal phases due to the significant amounts of energy and water consumed by the dishwasher. The second most important impact is due to the use/depletion of resources used to manufacture the product. By concentrating or compacting automatic dishwashing detergents, the use of chemical ingredients is reduced and this delivers significant savings in energy and waste, as well as transportation.

The Product Sustainability Forum identified some of the key environmental impacts of dishwashing detergents based on five indicators, waste, water, energy, greenhouse gas emissions (GHGs) and material risks.¹¹⁸ The main environmental impacts of dishwashing detergents occur in the use phase followed by ingredients sourcing. The most notable primary and secondary hotspots are as follows:

- Electricity used at home to power dishwashing machines is a key driver of energy use (and GHG emissions, 95 % of footprint).
- Water use in domestic dishwashers (and subsequent wastewater treatment)
- Energy use in the production of key ingredients (e.g. sodium tripolyphosphate) and detergent manufacture process.
- Ingredients used in this product may include salts, by-products of the petro-chemical industry and palm oil derivatives, which may present some land use change risk.

An LCA of three detergent products was performed by Igos et al. in order to evaluate the environmental impact of novel formulations: phosphate-based, phosphate-free and eco-labelled.¹¹⁹ The results highlighted that electricity consumption is the main contributor to the environmental profile of detergents. Results showed that the removal of sodium triphosphate in the phosphate-free and eco-labelled formulations significantly reduced their environmental impacts, as compared to the phosphate-based product. Overall the phosphate-free and eco-labelled detergents showed similar environmental performances and the authors argue that the efforts made to obtain the eco-label certification are poorly recognised from an LCA perspective.

Nordic Ecolabelling identified the most relevant variables in determining the environmental impact of dishwasher detergents.¹²⁰ These were volume and dosing, raw material ingredients and extraction, packaging, and energy and efficiency. Overdosing increases consumption of products and leads to extra release of chemicals. Reducing the amount of raw material ingredients leads to environmental gains since raw material extraction consumes energy as well as finite resources. Selection of ingredients is also an important determinant of impact. Aerobically and anaerobically degradable surfactants do not accumulate in the environment the same way as surfactants that do not degrade. Preservatives and fragrances also potentially have a negative effect on the environment and should be subject to specific requirements. Packaging varies between dishwasher detergents. The amount and type of packaging affects the amount of transport needed for distribution and CO₂ emissions and, thus, a more compact product and better filled packages reduces the impact. Products that clean well at low temperatures also have the potential to significantly reduce the environmental impact since energy consumption is primarily related to the heating of the water.

Table 29: Summary of conclusions and opportunities for improvement from studies on dishwasher detergents

Source	A.I.S.E. 2012	Product Sustainability Forum 2013	Igos et al. 2014	Nordic Ecolabelling 2013
Conclusions	The most significant impacts on the environment occur during the use and disposal phases due to the significant amounts of energy and water consumed by the dishwasher. The second most important impact is due to the use/depletion	The main environmental impacts of dishwashing detergents occur in the use phase followed by ingredients sourcing. The most notable primary and secondary hotspots are: <ul style="list-style-type: none"> • Electricity used at home to power dishwashing 	Electricity consumption is the main contributor to the environmental profile of detergents. Overall the phosphate-free and eco-labelled detergents showed similar environmental performances and the authors argue that the efforts made to obtain	The most relevant variables in determining the environmental impacts are volume and dosing, raw material ingredients and extraction, packaging, and energy and efficiency. Overdosing increases consumption of products and leads to

Source	A.I.S.E. 2012	Product Sustainability Forum 2013	Igos et al. 2014	Nordic Ecolabelling 2013
	of resources used to manufacture the product	machines <ul style="list-style-type: none"> • Water use in domestic dishwashers • Energy use in the production of key ingredients manufacture process. • Ingredients used in this product may include salts, by-products of the petro-chemical industry and palm oil derivatives, which may present some land use change risk 	the eco-label certification are poorly recognised from an LCA perspective	extra emissions of chemicals.
Opportunities for improvement	<ul style="list-style-type: none"> • Determining a maximum dosage of ingredients per wash cycle • Determining maximum dosage of packaging per wash cycle • Allowing the use 50C° or lower wash temperature • Setting a minimum level of recycled content in packaging 	<ul style="list-style-type: none"> • Sourcing palm oil responsibly • Product re-formulation • Improving consumer portioning • Water efficiency 	<ul style="list-style-type: none"> • The midpoint impacts are dominated by the electricity consumption of dishwasher, regardless the type of detergent and the use scenario, therefore the opportunities for improvement are not in the hand of the users. • Removal of sodium triphosphate 	<ul style="list-style-type: none"> • Making dishwasher detergents effective at lower temperatures (e.g. 50C°), • Lower and more correct dosing • Reducing the amount of raw material ingredients • Selection of less environmentally-burdening ingredients

4.3 Non-LCA Impacts

4.3.1 Toxicity to aquatic organisms

The preferred approach for safety and regulatory management of chemicals (e.g. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)) is a chemical-specific environmental risk assessment, based on specific exposure data and tonnages. The toxicity data underlying the assessment are often acute toxicity data from laboratory experiments because of the lack of chronic toxicity data.

However, scientists agree that the critical dilution volume (CDV) chronic gives a more accurate picture of the environmental effects of a given substance.¹²² CDV was originally developed as an evaluation criterion for detergent ingredients in the context of the European Eco-label scheme^{123,124}. It expresses the substance-specific amount of water needed for dilution to a safe level, and is therefore expressed in L per functional unit (FU). The Detergent Ingredient Database (DID) List, a public source of agreed ecological data for detergent production ingredients, can be used to perform CDV calculations as well as laboratory and *in silico* test results.

¹²² Ovesen R.K., M.B. Eskeland, and L. Axelsson. 2013. *Revision of the Detergent Ingredients Database List. Final report.*

¹²³ EU Eco-label 1995. *Commission decision of 25 July 1995 establishing the ecological criteria for the award of the community ecolabel to laundry detergents.* Official J European Communities L217:0014–0030, 95/365/EC

¹²⁴ Van Hoof G., D. Schowanel, H. Franceschini, I. Muñoz, 2011. *Ecotoxicity impact assessment of laundry products: a comparison of USEtox and critical dilution volume approaches.* Int J Life Cycle Assess, 16:803–818

The outcomes can be considered as a product-based relative assessments, on the basis of a functional unit – dose per wash^{125,126}.

CDV calculations are based on the dosage, degradation and toxicity of a substance using the formula below:

$$CDV = \sum CDV_i = \sum (((dosage_i \cdot DF_i) / TF_i) \cdot 1000)$$

Where dosage_i is the recommended dosage expressed in g per wash, DF_i is the degradation factor and TF_i is the toxicity factor.

4.3.1.1 Toxicity

Per chemical, a chronic toxicity 'base set' of three species should ideally be collected (fish, crustaceans and algae). The lowest toxicity value of these three values is then used for CDV calculations. The toxicity test results to be used can be expressed as the effect concentration at different percentages of effect, e.g. EC10 or EC50, which is the calculated effect concentration at 10 % or 50 % effect, or LC50, which is the concentration at 50% lethality. Measured effects may be on for example growth rate, immobility or mortality, depending on the test organism.

As there are substances with very small amounts of chronic toxicity data or which only have been tested for acute toxicity, there is a need to distinguish between these and other substances where the toxicity factors are based on more solid grounds. TF is calculated as the lowest value of toxicity test results complemented by a safety factor (SF) that is based on the availability of aquatic toxicity data and ranges from 10 to 10000.

4.3.1.2 Degradation

Degradation of substances in CDV calculations is taken into account through the Degradation Factor which considers the ready biodegradability of a substance¹²⁷. It can take four discreet values ranging from 0.05, if an ingredient is degraded in under 5 days, to 1, if an ingredient is persistent in the environment. An exceptional 5th value, 0.01, was introduced in the 2014 version of the DID list that is only assigned to very toxic substances that degrade extremely rapidly.

DF only considers biodegradation and not adsorption. This choice was made in the scope of the EU Ecolabel as adsorbed substances end up in sludge and the presence of harmful substances in sludge can cause problems when the sludge is used as a fertilizer.

4.3.1.3 DID list

The DID-list is a public tool containing toxicity and degradation information on over 200 commonly used ingredients in detergents and cosmetics. The DID list is regularly revised to update existing entries and introduce new ones, based on input from industry, competent bodies and ecotoxicology specialists⁸⁰. The list is meant to facilitate the work of companies applying for EU Ecolabel and that of competent bodies reviewing applications. Besides listing input data for CDV calculations, it also provides companies, especially SMEs, with an easy way of comparing and ranking ingredients, making it possible for them to spot a possible substitution that would result in a less impacting product.

Table 28 shows an example of the information available for common detergent ingredients in the DID-list.

¹²⁵ DID list (2007) Detergent Ingredient Database (DID list) – 2007 version.

http://ec.europa.eu/environment/ecolabel/ecolabelled_products/categories/did_list_en.htm (accessed 17/12/2010)

¹²⁶ DID list Part B (2004) Detergent ingredients database version 30 June 2004.

http://ec.europa.eu/environment/ecolabel/ecolabelled_products/categories/did_list_en.htm. Accessed 17 Dec 2010

¹²⁷ OECD Ready Biodegradability test - http://www.oecd-ilibrary.org/environment/test-no-301-ready-biodegradability_9789264070349-en

Table 28: Toxicity values and degradation data for example detergent ingredients in the DID-list 128

DID number	Ingredient name	Acute toxicity			Chronic toxicity			Degradation		
		LC50 / EC50	SF (acute)	TF (acute)	NOEC	SF (chronic)	TF (chronic)	DF	Aerobic	Anaerobic
DID category: Cationic surfactants										
2301	C8-16 alkyltrimethyl or benzyldimethyl quaternary ammonium salts	0,08	1000	0,00008	0,0068	10	0,00068	0,05	R	O
DID category: Other ingredient										
Surfactants										
2505	Zeolite (Insoluble Inorganic)	100	1000	0,1	100	50	2	1	NA	NA
Builders										
2507	Polycarboxylates homopolymer of acrylic acid	40	1000	0,04	12	10	1,2	1	P	N
2508	Polycarboxylates copolymer of acrylic/maleic acid	100	1000	0,1	5,8	10	0,58	1	P	N
Bleachers										
2525	Perborates (as Boron)	14	1000	0,014			0,014	1	NA	NA
2526	Percarbonate	4,9	1000	0,0049	0,7	50	0,014	0,01	NA	NA
Auxiliaries										
2533	Carboxymethylcellulose (CMC)	250	5000	0,05			0,05	0,5	I	N

R = Readily biodegradable according to OECD guidelines, I = Inherently biodegradable according to OECD guidelines, P = Persistent. The ingredient has failed the test for inherent biodegradability, 0 = The ingredient has not been tested, NA = Not applicable, N = Not biodegradable under anaerobic conditions

4.3.2 Risk assessment of chemical release

The emissions that occur during the life cycle of dishwasher detergents may have negative health effects on humans and ecosystems. Air emissions occur primarily during the ingredients sourcing and use phases, with the use phase contributing the most due to the energy required for heating the water and the functioning of the dishwasher.

Energy source plays a role in the environmental impacts and the lower the fossil fuel share in the national mix, the lower the impacts of the overall life cycle.

4.3.3 Sustainable management sourcing.

In order to protect nature and its ecosystem services, sourcing of ingredients for dishwasher detergents and their packaging materials should be done in a sustainable way. This means sourcing in a way that takes into account the consequences for the environment. For instance, ensuring that adverse effects on biodiversity are minimised and positive contributions are made where possible¹²⁹ e.g. by implementing a farmers' code to adopt better agricultural practices that are sensitive to biodiversity without harming agricultural yield or profitability. More discussion on this issue will be included in the technical report.

¹²⁸ Detergents Ingredients Database (DID-list) Part A. List of ingredients 2014

¹²⁹ <http://www.unilever.com/sustainable-living-2014/reducing-environmental-impact/sustainable-sourcing/protecting-biodiversity/index.aspx>

4.4 In-house LCA studies

Due to the scarcity of publicly available studies on the environmental performance of dishwasher detergents, in-house LCA analyses were carried out in this study. This section describes the methodology followed, the sources and assumptions considered as well as the obtained results and their interpretation and discussion.

4.4.1 Methodology

An LCA of a domestic dishwasher detergent was performed by taking into account the *Product Environmental Footprint. General Guide*.¹³⁰ The LCA allowed assessing the relative environmental load of each life cycle stage to have an overall profile of the products' performance. Moreover, several comparative analyses and sensitivity analyses were performed regarding the ingredients, wash temperature, etc., to assess their importance and associated improvement potentials. The LCAs were performed in accordance with the standard methodology of ISO 14040 and 14044 (see Figure 14). The four steps presented Figure 14 were carried out in an iterative process.

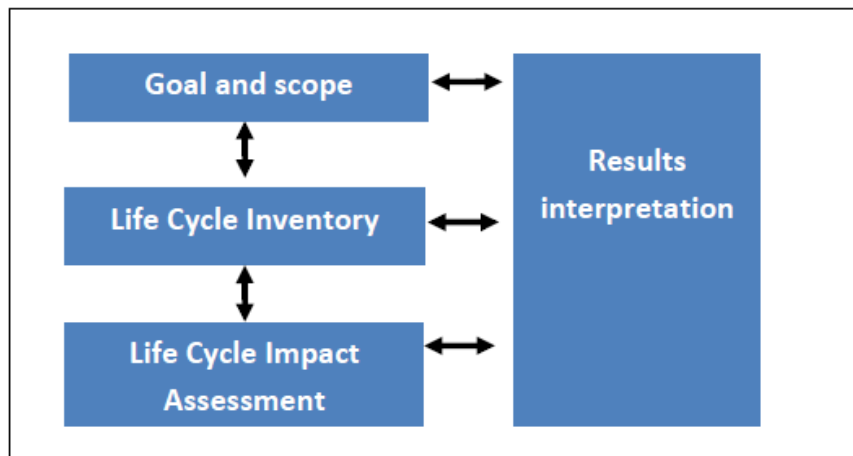


Figure 14: Steps of the life cycle assessment, according to UNE-EN ISO 14040: 2006

4.4.1.1 Goal definition

Goal definition is the first step of an LCA study and defines the general context for the study. In the goal definition, parameters such as the intended application, the reasons for carrying out the study, the target audience, the limitations and assumptions have to be described.

The goal of this analysis is to quantify the potential environmental impacts of products included in the category 'dishwasher detergents' during all their life cycle phases. This analysis does not aim to compare different products or brands, but only to analyse the performance of an average product manufactured in Europe. The main objective is to analyse the impact of each life stage and its contribution in relation to other stages and the global environmental load of the product.

4.4.1.2 Scope of the study

The scope of an LCA study consists of describing the system to be analysed along with the associated considerations and specifications. In the study proposed, an LCA from cradle to grave is considered (Figure 15) and the life stages are: sourcing of the ingredients and packaging materials, manufacture of dishwasher detergent, product packing, distribution to retail, use phase and disposal/end of life.

¹³⁰ Product Environmental Footprint (PEF) Guide. Official Journal of the European Union (2013/179/EU). Commission Recommendation of 9 April 2013 on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations. Available from: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013H0179>

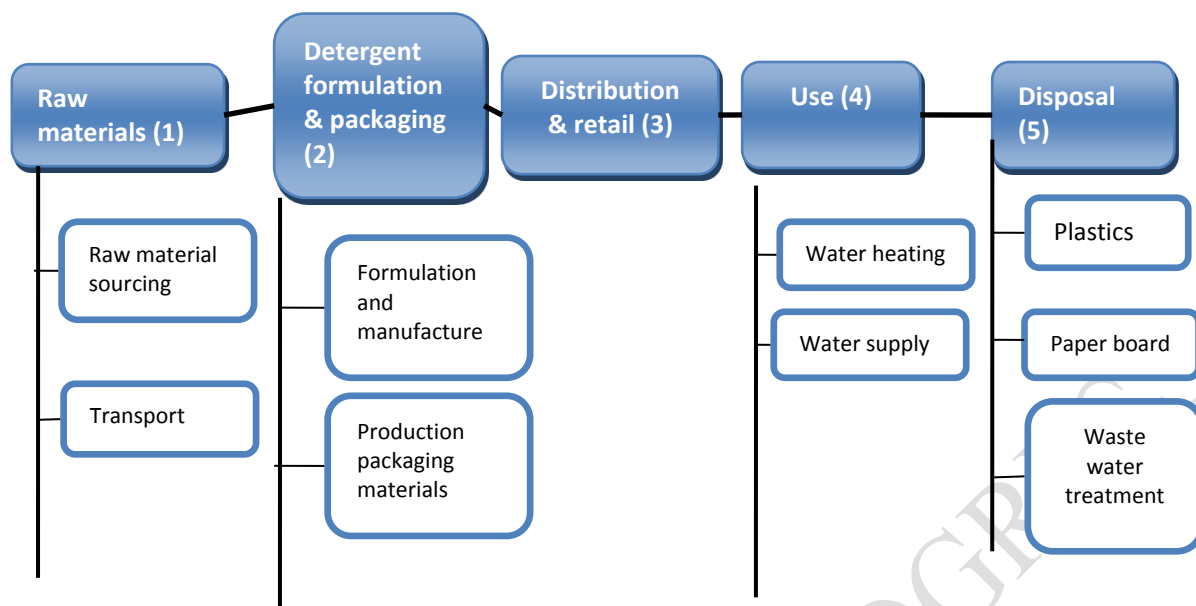


Figure 15: Schematic representation of the life cycle of a dishwasher detergent.

4.4.1.3 Functional unit and reference flow

The functional unit describes qualitatively and quantitatively the function(s) or the service(s) provided by the product analysed. The functional unit is used to define what the LCA is measuring, and provides a reference to which the inputs and outputs can be related. In this case the functional unit chosen is *one dishwashing cycle*. The reference flow describes the amount of the product required to fulfil the functional unit. The reference flow is assumed to be 20 grams of a dishwasher detergent for an average load of normally soiled ware, using medium hardness water. The reference flow is an estimate based on the review of the existing literature and is not based on the performance of a specific dishwasher detergent. The reference wash temperature is 60°C, which is seen as the general desirable temperature for cleaning operations and for machine drying of dishes¹³¹

4.4.1.4 System description and boundaries

The system boundaries were defined following general supply-chain logic, including: raw materials (including raw materials extraction and ingredients manufacturing), product manufacturing, packaging, distribution, use and final disposal.

- **Raw materials:** This sub-system includes raw materials and processing of ingredients. The composition and formulation of these products have been analysed taking into account: origin of substances (e.g. vegetal, petroleum), production processes (energy and resources used) of substances and the performance of substances (toxicity properties to assess potential environmental impacts). Transport processes have been omitted due to lack of data.
- **Manufacturing:** Standard processes and technologies to manufacture the studied products have been analysed. The use of energy and water during manufacturing is reported, together with waste generation, air emissions and water emissions.
- **Packaging:** The primary and secondary packaging have been analysed. Relevant aspects include: weight of material, origin of materials (virgin vs. recycled), recyclability and use of hazardous substances. A common packaging has been considered for all dishwashing detergents.
- **Transport/Distribution:** The average distribution of products in the European market has been analysed, comprising the transport from the plant to the final point of sale, including transport among intermediate storages. Storage processes in the manufacturing plant and intermediary storage have not been included in the system.
- **Use:** During use it is important to investigate whether a risk that the product may have a negative health impacts exists. The potential for negative health impacts could be reduced by increasing the health

¹³¹ Hoak, D.E., Parker D.S., Hermelink A.H., How energy efficient are modern dishwashers, Florida Solar energy Center

requirements on fragrances, preservatives and hazardous compounds. LCA results do not reflect these effects in the use phase (either due to generic use of data or because the inputs are ‘diluted’ with the inclusion of all the LCA inputs); these effects are discussed briefly in Section 4.3 (Non-LCA Impacts). The energy required in the use phase to heat the water falls within the system boundaries.

- **Disposal:** Two kinds of ‘waste’ were included in the system:
 - Disposal of the product into water after use phase. As the products studied are rinsed off, it is assumed that the whole product is released to wastewater after washing action and subsequently the wastewater is purified in a wastewater treatment plant.
 - Disposal of the packaging. A scenario has been defined for each type of packaging in which one part is recycled and the other goes to disposal. Impacts from recycling have been included in a system but balanced with environmental benefits occurring due to avoidance of use of virgin materials (LCA processes pre-defined products’ life cycles allocation rule). All impacts coming from waste disposal are included in the system.

4.4.2 Life cycle inventory (LCI)

Life cycle inventory (LCI) is ‘cradle to grave’ accounting (compilation and quantification) of the environmentally significant inputs and outputs of a system throughout its life cycle (see Figure 16). The environmental burdens in this study include material input requirements, total energy consumed, air and water emissions released, and total solid wastes associated with the product’s life-cycle. LCI data is converted to the study’s functional unit.

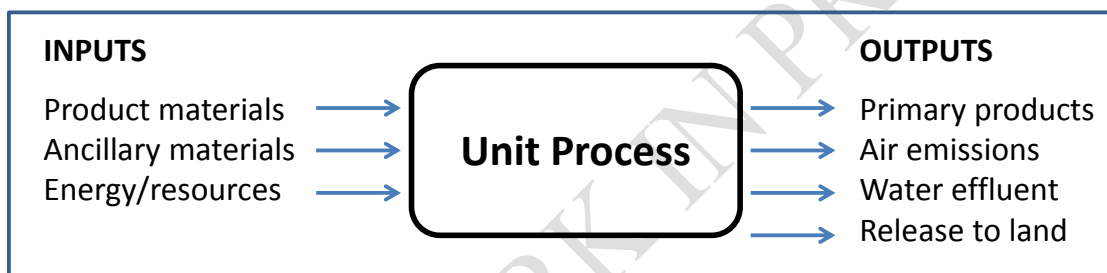


Figure 16: Inventory inputs and outputs

For each sub-system defined, inputs and outputs of the processes have been collected and quantified, when possible, with information gathered from products for primary data and from other studies and existing databases (such as Ecoinvent) for secondary data or other steps such as distribution or use phases.¹³²

4.4.2.1 Raw materials and ingredients manufacturing

There is no ‘standard’ dishwasher detergent formulation. A large number of different ingredients can be used in a variety of combinations giving rise to a large number of detergent formulations. Generally, however, all dishwasher detergents contain the following categories of ingredients in different concentrations: alkalis, bleaches, builders, enzymes, auxiliaries, and surfactants. Table 31 shows the general characteristics of a dishwasher detergent.

Table 31: Generic dishwasher detergent formulation¹³³

Product formulation	Function	Concentration (wt %)
Builder	Sequestration, soil suspension, alkalinity, emulsification, soil peptization	10-20 %
Caustic alkali	Alkalinity, soil hydrolysis, soil removal	10-50 %
Surfactant	Wetting agent, soil removal, soil/film prevention, sheeting	0-3 %

¹³² Ecoinvent Centre. (2010). Ecoinvent database. Retrieved from <http://www.ecoinvent.org/database/>

¹³³ Handbook of Detergents, Part D. Edited by Michael S. Showell. CRC Press 2005

	action, soil dispersion, drying aid	
Silicate (optional)	Anticorrosion, soil hydrolysis, soil removal sequestration	0-20 %
Bleach (optional)	Soil removal, stain removal, sanitation, disinfection	0-3 %
Defoamer (optional)	Foam prevention, wash efficiency	0-1 %
Thickener (optional)	Product stability, aesthetic enhancement, binder	0-2 %
Colour, perfume (optional)	Aesthetic enhancement	< 0.5 %
Water (optional)	Solvent, carrier, flow property	Balance

Given the different possible formulations, it is impractical to assess the environmental impact of all varieties of detergents, and a representative product is needed. The bill of materials for a dishwasher formulation was based on the IEC standard dishwasher detergent type D¹³⁴ selected as the reference formulation. Table 32 shows the inventory data used to model this generic dishwasher detergent.

Table 32: Ecoinvent data inventory for a dishwasher detergent frame formula

Dishwashing product formulation	Concentration (wt %)	Ecoinvent data
Sodium citrate dihydrate	30 %	Citric acid*
Maleic acid/acrylic acid copolymer sodium salt	6 %	RER: Polycarboxylates, 40 % active substance, at plant
Sodium percarbonate	7 %	GLO: Sodium carbonate from ammonium chloride production, at plant
TAED (92 % active)	2 %	ethylene diamine tetracetic acid (EDTA), at plant/RER S
Sodium silicate	10 %	Layered sodium silicate, SKS-6, powder, at plant/RER S
Linear fatty alcohol ethoxylate	2 %	RER: fatty alcohol sulphate mix, at plant**
Protease savinase	1 %	Empty process
Amylase termamyl	0.5 %	Empty process
Sodium carbonate	43.5 %	GLO: Na ₂ CO ₃ from ammonium chloride production, at plant

Ingredients of dishwashing detergents contain very specific substances and although most of the ingredients were present in the Ecoinvent database, some of these substances are not. Where data was lacking, alternative substances that fulfil similar functions in soaps were chosen as a best guess. Polycarboxylate, for example, was used as an alternative for malic acid/acrylic acid co-polymer sodium salt. Both substances are 'builders' in soaps. For sodium citrate dihydrate citric acid, no similar in proxy was found in Ecoinvent and therefore citric acid inventory data from (Moataza, 2009) was used.¹³⁵

4.4.2.2 Manufacturing

This module contains energy inputs for the manufacturing of a dishwasher detergent. As described in Section 4.1.2, the manufacturing process employed for dishwasher detergent products generally consists of mixing and pumping the ingredients into mixing vessels. The exact process employed will depend on the manufacturer and the format of the final product. For the manufacturing of dishwasher detergents, the required energy was

¹³⁴ Wfk –Cleaning Technology Institute e.V., 2013, IEC standard dishwash detergent type D, <http://www.testgewebe.de/index.php?page=gsm-d> (01.07.2013)

* Citric acid LCI data was taken from Moataza (2009)

** Alcohol sulphate (AS) C12-18, 25 % mix of petrochemical, palm kernel oil, coconut oil, palm oil

¹³⁵ Moataza, M. S. (2009). *Citric Acid Production from Pretreating Crude Data Syrup by Aspergillus niger NRRL595*. Journal of Applied Sciences Research, 74-79.

based on a study by Franke et al. 1995¹³⁶ and set to 40.7 kJ. The average EU energy mix in year 2000 from the Ecoinvent database 2.2 was used. We assume the production of the detergent and the subsequent packaging are done at the same location. In the LCA, the required ingredients, packaging and transport are combined under the assembly of the dishwasher detergent. Production of waste and emissions for the production of a dishwasher detergent was not included due to lack of data. Infrastructure has also not been included.

4.4.2.3 Packaging

Packaging can be defined as the materials used for the containment, protection, handling, delivery, and presentation of goods. In accordance with previous studies on similar products (A.I.S.E)¹³⁷, it can be divided into three categories: primary packaging, secondary packaging and transport packaging.

There are different published definitions of packaging; it is proposed that in the context of EU Ecolabel criteria the definitions given in Article 3 of Directive 94/62/EC on Packaging and Packaging Waste¹³⁸ are used (as already occurs for some other product groups e.g. rinse-off cosmetics). These definitions are as follows:

- a) Sales packaging or primary packaging, i.e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase.
- b) Grouped packaging or secondary packaging, i.e. packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics.
- c) Transport packaging or tertiary packaging, i.e. packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packaging in order to prevent physical handling and transport damage. Transport packaging does not include road, rail, ship and air containers. It covers wooden pallets, board and plastic wrapping and containers that are used to collate the groups into larger loads for transport, which facilitates loading and unloading of goods.

In this study, both primary and secondary packaging have been included. Table 33 shows the inventory data used for the packaging materials. The secondary packaging (i.e. cardboard box/carton) consists of recycled material (80 %).¹³⁹

Table 33: Primary and secondary packaging for dishwasher detergent

Packaging	Weight (g)	Ecoinvent data
Flowwrap film	0.35 g	RER: Polypropylene, granulate, at plant
Shrinkwrap	0.18 g	RER: Polyethylene, LDPE, granulate, at plant
Cardboard box	3 g*	Packaging, corrugated board, mixed fibre, single wall, (80 % recycled)

* The weight is allocated based on the functional unit.

4.4.2.4 Transport

Transport of raw materials is assumed to be 5,000 km (boat) for the renewable part in surfactants, and 2,000 km (lorry) for other ingredients. The ingredients come from Asia, hence the large distance. For the distribution phase, secondary and literature data have been used to estimate the transport distance. Normally in the European market products are distributed via lorry, first to an intermediate storage, then to the storage facilities of direct customers (retailers) and from there to the point of sale (e.g. supermarket). Transport from retail to consumer homes was omitted as data were unavailable. This omission should not have significant consequences, as studies for other categories show that these impacts are generally minimal when compared to other activities and typical shopping habits. The average distance from production site to retailer is assumed to be 1,500 km.

¹³⁶ Franke, M., Klüppel, H., & Olschewski, P. (1995). Ökobilanzierung - Sachbilanz für die Waschmittel-Konfektionierung. *Tenside Surf. Det.* 32(2).

¹³⁷ A.I.S.E., 2012: Charter update 2010: APS substantiation dossier: Automatic dishwashing (ADW) detergents – final version, 23 February 2012 (28.03.2013)

¹³⁸ Directive 94/62/EC of the European Parliament and of the Council on 20 December 1994 on packaging and packaging waste

4.4.2.5 Use

Once loaded, a dishwasher performs an automated sequence of operations, filling with water, then providing supplemental electric heating to the desired temperature. Dishes are then sprayed with hot water and detergent, alternately draining and refilling with rinse water. After the final rinse, dishes are passively air dried or with an electric resistance element.¹³⁰ This automated sequence of operations takes for an average dishwasher around 90 minutes.^{130,139} The standard loading size of a dishwasher is a 12 place setting (see Annex VII for description).^{130,137} The energy requirement for these wash temperatures was taken from the *Preparatory studies for eco-design requirements of energy using products (EuPs): Domestic Washing machines and dishwashers*, December 2007.¹⁴⁰ The amount of water used in the use phase was based on a study by Stamminger et al.¹³⁷ Note that the inventory data for water withdrawal is of poor quality: this should be remembered when interpreting the findings of the study. The water inventory does not distinguish between sources of water or water quality.

4.4.2.6 Disposal phase

In this phase, we differentiate the release of the product to water and the waste packaging generation. It is assumed that the whole product is rinsed off, i.e. 20 g of dishwasher detergent is released to water. In this phase the treatment of residential wastewater (water consumed during washing) in a water treatment plant is included. For disposal of packaging waste, the recycling rates for paper and board and plastic were taken from Eurostat. The remaining waste, which is sent to landfill and incinerated, is allocated to the dishwasher detergents. The data on dishwasher detergents - including choices in study assumptions, consumer use, and end of life - are shown in Table 34.

Table 34: Key assumptions

	Reference	Dishwasher Tablet
Functional unit	Review of LCA studies	1 wash
Reference flow	A.I.S.E, 2012	20 g
Transport ingredients to product manufacturing site	Assumed	Renewable part in surfactants 5,000 km (boat) Other ingredients 2,000 km (lorry)
Energy for processing of raw materials	Frank et al. 1995 ¹³⁵	40.7 KJ
Packaging (primary & secondary)	A.I.S.E, 2013	Shrinkwrap (0.18 g) Flowwrap (0.35 g) Cardboard (3 g)
Transport retail	Assumed	1,500 km lorry
Wash temperature	EC, 2007 ¹³³	60°C
Energy use in the use phase	EC, 2007 ¹³³	1.42kWh
Water use in the use phase	Stamminger et al. ¹³⁴	18.5L
Waste water treatment	Based on EU Statistics	100 % connection to secondary treatment
Recycling rates solid waste	Eurostat (2012) ¹⁴¹	Paper & board 83.2 % Plastic 31.9 %
Solid waste treatment	Eurostat (2012) ¹⁴⁰	Landfill 65.3 % Incineration 34.7 %

¹³⁹ Stamminger R, Rummler B, Elschenbroich A, Broil G, 2007. *Dishwashing under various consumer-relevant conditions*. Hauswirtschaft und Wissenschaft, 2, 81–88.

¹⁴⁰ Preparatory studies for eco-design requirements of EuPs: Domestic Washing machines and dishwashers, December (2007). Retrieved from http://www.ebpg.bam.de/de/ebpg_medien/014_studyf_08-12_part6-7.pdf

¹⁴¹ Eurostat. (2012). EU Packaging recycling 2005. Retrieved from <http://epp.eurostat.ec.europa.eu>

4.4.2.7 Data quality

Data quality concerning the ingredients is fair. For some ingredients for which no information was available, proxies were used as a best guess. Data for electricity and production are quite good. Data quality for wastewater treatment is fair, but wastewater treatment does not contribute much to the life cycle impacts. We used typical municipal wastewater treatment data. For the use phase, which is linked with the dominant environmental impact, data quality is good.

4.4.3 Life cycle impact assessment (LCIA)

The LCI assessment is based on the data obtained in the inventory stage and includes the analysis of alternative substances for different products.

4.4.3.1 Impact assessment method used

The impact assessment method used is ReCiPe (Goedkoop et al. 2009).¹⁴² ReCiPe proposes a feasible implementation of a combined midpoint categories and damage approach, linking all types of life cycle inventory results (elementary flows and other interventions) via midpoint categories to four damage categories: human health, ecosystem quality, climate change and resources.

Normalisation can be performed either at midpoint or at damage level. Midpoints are used for a more specific and detailed analysis, whereas damage endpoints are useful to communicate the results obtained to a broader audience. The pre-defined (mathematical) weighting of the different midpoint scores within the ReCiPe assessment method allows us to come to a single score. However, as previously mentioned, this should be used more for communication purposes than for analysis, as weighting is not standardised and it is generally considered more relevant for expert groups to hold discussions in greater detail – on midpoints level.

4.4.3.2 Contribution analysis by life cycle stage

The life cycle stages with the highest contribution to the environmental impacts were identified using characterised midpoint results from ReCiPe. A list of the impact categories, their units and abbreviations are given in Table 35.

Table 35: Glossary

Impact Category	Unit	Abbreviation
Climate change	kg CO ₂ eq	CC
Ozone depletion	kg CFC-11 eq	OD
Terrestrial acidification	kg SO ₂ eq	TA
Freshwater eutrophication	kg P eq	FE
Marine eutrophication	kg N eq	ME
Human toxicity	kg 1,4-DB eq	HTox
Photochemical oxidant formation	kg NMVOC	POF
Particulate matter formation	kg PM10 eq	PMF
Terrestrial ecotoxicity	kg 1,4-DB eq	TTox
Freshwater ecotoxicity	kg 1,4-DB eq	FTox
Marine ecotoxicity	kg 1,4-DB eq	MTox
Ionising radiation	kg ²³⁵ U eq	IR
Agricultural land occupation	m ² *yr	ALO
Urban land occupation	m ² *yr	ULO
Natural land transformation	m ² *yr	NLT
Water depletion	m ³	WD
Metal depletion	kg Fe eq	MD
Fossil depletion	kg oil eq	FD

¹⁴² Goedkoop, M., Heijungs, R., Huijbregts, M., De Schryver, A., Struijs, J., & Van Zelm, R. (2009). ReCiPe 2009. A life cycle impact assessment method which comprises harmonised category indicators at the midpoint and the endpoint level. The Hague, The Netherlands: VROM.

The results for a tablet dishwasher detergent are shown in Figure 20. For more information please see Annex V.

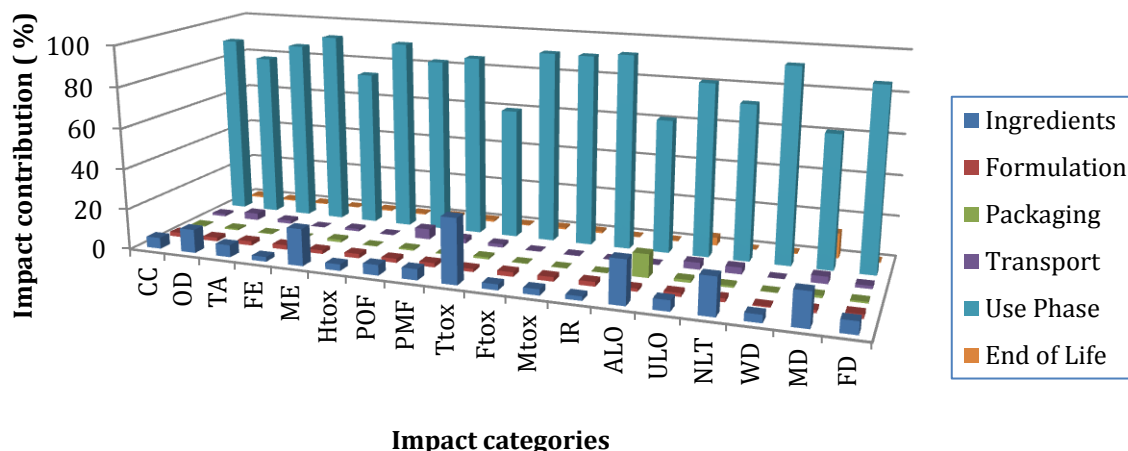


Figure 20: Impact contribution of different life cycle stages a dishwasher detergent (See Table 35 for abbreviations)

Ingredients: The impacts of sourcing of ingredients on terrestrial ecotoxicity (32 %) and natural land transformation (18 %) are due to the surfactant choice. The surfactant modelled in this study is of a mixed origin, i.e. both oleochemical origin (palm and coconut resources) and petrochemical, which has an effect on both natural land transformation and agricultural land occupation. Marine eutrophication (18 %) and metal depletion (16 %) impacts are primarily due to the builder, sodium carbonate, whereas impacts on agricultural land occupation (21 %) and marine ecotoxicity (18 %) are a result of the alkali, citric acid.

Use phase: The life cycle stage with the largest contribution to the overall environmental impact is the use phase. In particular, the energy needed to heat the water during the wash cycle contributes significantly. The impact from the use phase ranged from 65 % to 95 % in all impact categories.

Other life cycle stages: The most significant impacts of packaging are on agricultural land occupation (11 %). The contributing factor is the non-recycled content of the secondary packaging, whereas the wastewater treatment of the water at end of life impacts metal depletion (12 %). Manufacture and transport have a minor contribution towards the total environmental impact when compared to the use phase (for more information see Table 40 and Table 41 in Annex IV).

Table 36: Aggregate midpoint results for a dishwasher detergent (wash temperature at 60°C)

Impact category	Unit	Dishwasher detergent
Climate change	kg CO ₂ eq	8.44E-01
Ozone depletion	kg CFC-11 eq	4.57E-08
Terrestrial acidification	kg SO ₂ eq	3.54E-03
Freshwater eutrophication	kg P eq	7.89E-04
Marine eutrophication	kg N eq	2.77E-04
Human toxicity	kg 1,4-DB eq	5.25E-01
Photochemical oxidant formation	kg NMVOC	1.85E-03
Particulate matter formation	kg PM10 eq	1.12E-03
Terrestrial ecotoxicity	kg 1,4-DB eq	9.04E-05
Freshwater ecotoxicity	kg 1,4-DB eq	1.13E-02
Marine ecotoxicity	kg 1,4-DB eq	1.12E-02
Ionising radiation	kg ²³⁵ U eq	6.27E-01

Agricultural land occupation	m ² a	1.56E-02
Urban land occupation	m ² a	3.14E-03
Natural land transformation	m ²	1.08E-04
Water depletion	m ³	2.85E-02
Metal depletion	kg Fe eq	1.43E-02
Fossil depletion	kg oil eq	2.32E-01

See Table 35 for abbreviations

4.4.3.3 Identification of significant impacts

The magnitude of different environmental impacts cannot be compared to each other because each impact category is expressed in a different unit. However, normalization allows identifying how significant an impact is when compared to a reference: in this case, the average impacts of a European citizen in the year 2000. The results were calculated based on the ReCiPe endpoint method (Goedkoop)¹⁴³ using the hierarchist perspective with European normalisation data from the year 2000 (Sleeswijk).¹⁴⁴ The hierarchist perspective can be seen as a method based on scientific consensus, unlike the more explicit views like egalitarian (precautionary principle) and individualist (short-term impacts only). It is therefore the recommendation of the method developers to use the hierarchist perspective.¹⁴³ Normalization at endpoint helps to identify whether the contribution of an impact indicator is relevant in a damage category (i.e. effect of an indicator such as climate change on human health, ecosystem quality, and resource depletion). The normalised values of the different life cycle stages of a dishwasher detergent are shown in Figure 21.

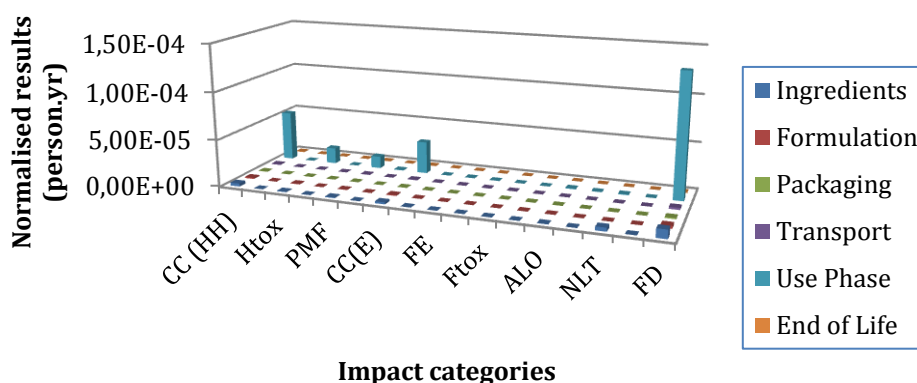


Figure 21: Normalised endpoint results for dishwasher detergent

See Table 35 for abbreviations

For a dishwasher detergent, the most significant normalized impact categories are fossil depletion, climate change (the effect on both human health and ecosystem quality), particulate matter formation, human toxicity and natural land transformation. The level of significance is set by the overall contribution of an impact indicator to an area of protection.

The impacts on climate change, fossil depletion, and particulate matter formation are interrelated and are driven by the same factors, i.e: fossil energy is used to heat the water during the use phase; human toxicity impacts are mainly due to manganese emissions to water; impacts on natural land transformation are mainly driven by the surfactant.

¹⁴⁴ Sleeswijk AW, et al, Normalization in product life cycle assessment: An LCA of the global and European economic systems in the year 2000, *Sci Total Environ* (2007).

4.5 Sensitivity analysis

This section explores the consequences of the assumptions on the overall results. The following variables were analysed: washing program, product dosage, surfactant origin and energy mix. These variables were selected because of their high contribution to the environmental impacts. Since enzymes do not contribute much to the life cycle impacts, and are only a very small percentage of the detergent, no sensitivity analysis was performed on their use in detergents.

4.5.1 Washing program

The 'washing program' takes into account wash temperature and duration, which are both determinants of the amount of energy that is used in the use phase. The energy consumption of 1.42 kWh was used in the reference scenario for a wash temperature of 60 °C. It was seen that reducing the energy use led to substantial reductions in impact for all categories except total water use, which is only affected by the wash temperature to a limited extent.

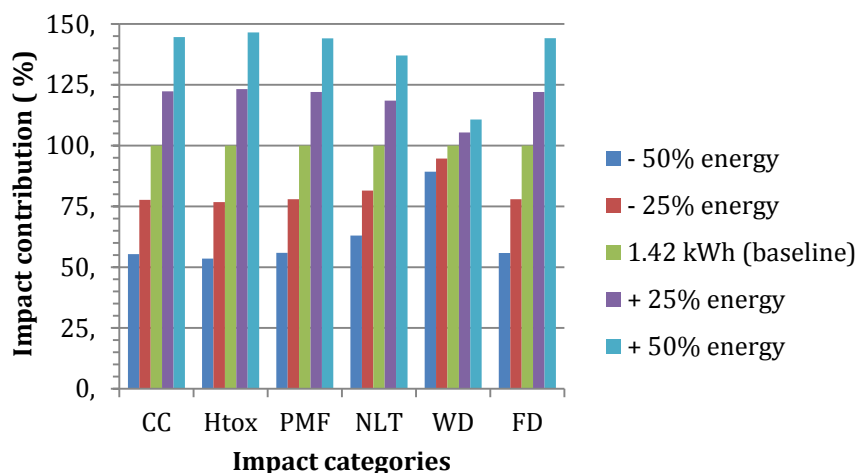


Figure 22: Characterised results for wash temperature sensitivity (tablet).

Impact categories stand for FE: Freshwater eutrophication, HTox: Human toxicity, FTox: Freshwater ecotoxicity, MTox: Marine ecotoxicity, NLT: Natural land transformation, WD: Water Depletion.

4.5.2 Product dosage

In the reference scenario used for the LCA study we assumed a dosage of 20 g of a dishwasher detergent per wash. The effect of using a lower (-20 %) or higher (+20 %) dosage is investigated in the sensitivity analysis. The results are shown in Figure 23.

Varying the dosage, however, does not significantly affect the size of the significant impacts, because the contribution of sourcing of ingredients to these impacts is small. Reducing the dosage by 20 % brings small environmental gains in terrestrial ecotoxicity (7 %), agricultural land occupation (4 %), natural land transformation (4 %) and marine eutrophication (4 %). This is because less raw material is used in the product formulation. This is also a consequence of the high impacts related to product use phase (i.e. energy for heating the water).

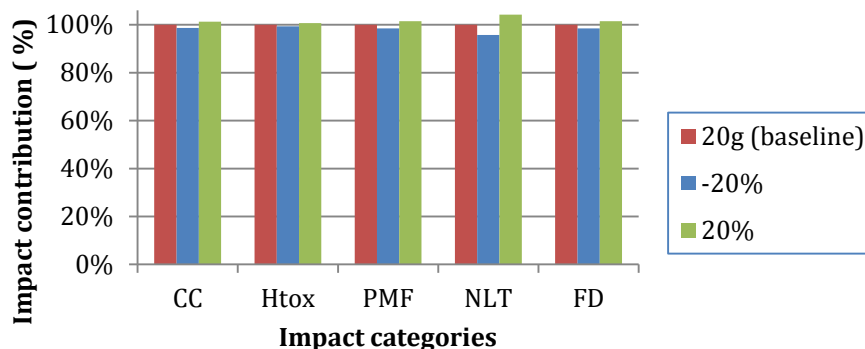


Figure 23: Characterised results of dosage sensitivity

Impact categories stand for FE: Freshwater eutrophication, HTox: Human toxicity, FTox: Freshwater ecotoxicity, MTox: Marine ecotoxicity, NLT: Natural land transformation, WD: Water Depletion

4.5.3 Surfactant origin

For the reference scenario the surfactant modelled is a mix from both oleochemical (palm kernel oil and coconut oil) and petrochemical origins. For the sensitivity analysis, this surfactant was replaced with a petrochemical surfactant and an oleochemical surfactant (only palm kernel oil). The results are shown in Figure 24. For more information about the surfactant used in the reference scenario please see Table 32.

For compliance with the World Resources Institute (WRI) GHG protocol, ILCD and ISO 14040/44, any direct land use change occurring in the previous 20 years should be considered for above- and below-ground biomass and for soil organic matter (differentiated for peat and mineral soil). The best available data for surfactants are 15 years old and they do not contain adequate data relating to direct land use change.

Consequently the results for impact categories relating to direct land use change and its associated GHG emissions are compromised and must be interpreted with caution. However, the available outdated LCI datasets have been included for the purposes of completeness and for future comparison with the updated and improved surfactant inventories which have not been published at the time of this revision.

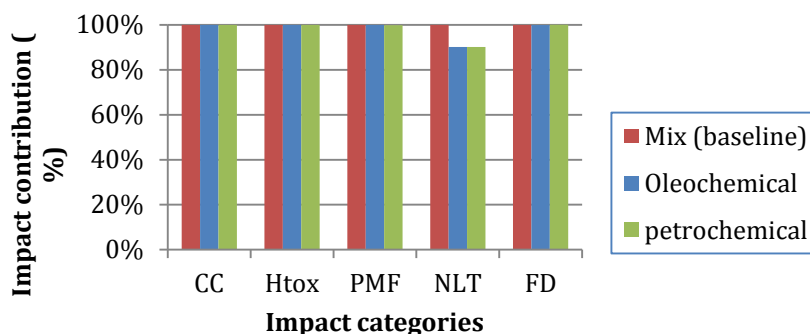


Figure 24: Sensitivity analysis of surfactant origin (tablet)

Impact categories stand for FE: Freshwater eutrophication, HTox: Human toxicity, FTox: Freshwater ecotoxicity, MTox: Marine ecotoxicity, NLT: Natural land transformation, WD: Water Depletion

The impact category affected by the origin of the surfactants used is natural land transformation. Replacing a partly renewable surfactant with a purely petrochemical equivalent will reduce the impact on natural land transformation by 10%. Similarly replacing a partly renewable surfactant with an oleochemical surfactant, based only on palm kernel oil, will reduce the impact on natural land transformation by 10%. This is because the largest impacts on natural land transformation are from the coconut oil in mixed origin surfactant used the baseline scenario.

Impacts of surfactant origin on climate change, human toxicity particulate matter formation, and fossil depletion do not change substantially primarily because these impacts are driven by the use phase. In the case of the climate change indicator, the contribution of raw materials (in total) is approximately 3-5% (for details

see Annex V). These and other numbers will likely undergo some changes as the new surfactant data become available.

4.5.4 Energy source for heating the water

In the baseline scenario we used the average EU energy mix for the year 2000 from Ecoinvent. This value has not significantly changed in the last years. For the sensitivity analysis we used the dataset for electricity production in France (where approximately 50 % is derived from nuclear energy), and in Switzerland (where approximately 50 % is derived from hydropower). The results are shown in Figure 25.

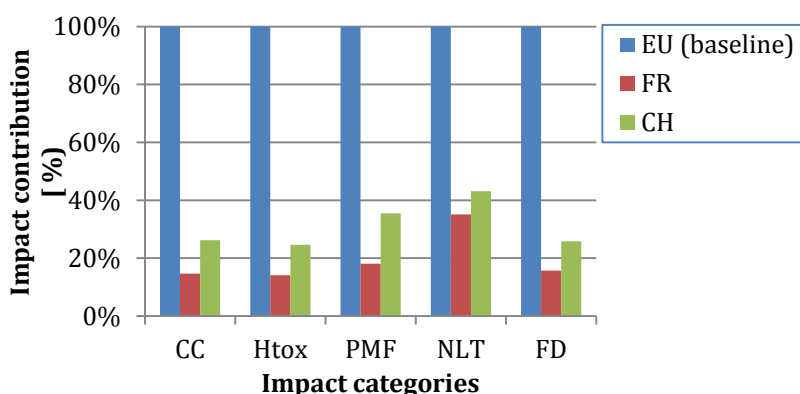


Figure 25: Sensitivity analysis of energy source mix

Impact categories stand for FE: Freshwater eutrophication, HTox: Human toxicity, FTox: Freshwater ecotoxicity, MTox: Marine ecotoxicity, NLT: Natural land transformation, WD: Water Depletion

The results show that an energy mix based mostly on nuclear energy or hydro power significantly reduces the environmental impacts in all significant impact categories. This is because these sources have lower emissions compared to the electricity mix used in the study, which includes coal, crude oil, lignite, etc., which have higher GHG emissions. Nevertheless, there are trade-offs occurring between the other impact categories. Switching to hydro power would significantly increase the impact on ionising radiation and, to a much lesser extent, impacts water depletion and metal depletion impacts. Switching to nuclear energy would only increase impacts in ionising radiation. It should be noted that these results do not indicate the advantages to shift toward nuclear energy based electricity production, since a limited number of environmental indicators have been analysed in this study.

4.5.5 Toxicity impact of ingredients

There is no 'standard' dishwasher detergent formulation. A large number of different ingredients can be used in a variety of combinations giving rise to a large number of possible detergent formulations. Table 37 shows the toxicity impacts of some key ingredients used in laundry detergent formulations. Here the potential impact of an equal quantity (i.e. 1 g) of different ingredients is compared. A full toxicity impact assessment was performed as part of the LCA. The ingredient with the highest impact on human toxicity, freshwater toxicity, and marine ecotoxicity is sodium percarbonate. The ethoxylated alcohols are also among the most toxic ingredients. For terrestrial ecotoxicity the surfactants, fatty alcohol sulphate and ethoxylated alcohols, have the highest impact.

Table 37: Toxicity impacts of key ingredients per gram

1 gram of ingredient	Human toxicity	Terrestrial ecotoxicity	Freshwater ecotoxicity	Marine ecotoxicity
	(kg 1,4-DB eq)			
Alkylbenzene, linear, at plant/RER S	3.78E-03	1.38E-06	8.57E-05	9.71E-05
Bentonite, at processing/DE S	2.87E-03	9.77E-07	1.81E-05	2.61E-05
Sodium carbonate from ammonium chloride production, at plant/GLO S	4.22E-03	1.26E-06	3.12E-05	4.19E-05

Sodium chloride, powder, at plant/RER S	1.60E-03	1.80E-07	1.22E-05	1.51E-05
Sodium hydroxide, 50% in H ₂ O, production mix, at plant/RER U	1.01E-02	1.09E-06	5.65E-05	6.49E-05
Sodium percarbonate, powder, at plant/RER S	1.46E-01	3.02E-04	1.56E-02	2.59E-03
Sodium sulphate, powder, production mix, at plant/RER S	2.02E-03	2.04E-07	1.58E-05	1.82E-05
Layered sodium silicate, SKS-6, powder, at plant/RER S	7.88E-03	8.80E-07	5.04E-05	6.04E-05
Carboxymethyl cellulose, powder, at plant/RER S	1.63E-02	6.23E-06	1.07E-04	1.49E-04
Polycarboxylates, 40% active substance, at plant/RER S	3.57E-03	3.80E-07	2.59E-05	3.02E-05
Fatty alcohol sulphate, petrochemical, at plant/RER S	6.16E-03	1.14E-06	4.32E-05	5.60E-05
Fatty alcohol sulphate, mix, at plant/RER S	6.61E-03	5.82E-04	1.37E-04	6.76E-05
Fatty alcohol sulphate, palm oil, at plant/RER S	6.18E-03	8.14E-04	1.70E-04	6.50E-05
Zeolite, powder, at plant/RER S	2.19E-02	4.20E-06	1.42E-04	1.85E-04
Ethoxylated alcohols (AE3), coconut oil, at plant/RER S	6.22E-03	9.92E-07	1.39E-04	1.48E-04
Ethoxylated alcohols (AE3), palm kernel oil, at plant/RER S	7.65E-03	1.28E-03	3.68E-04	1.93E-04
Ethoxylated alcohols (AE3), petrochemical, at plant/RER S	6.25E-03	9.49E-07	1.49E-04	1.54E-04
Ethylene glycol diethyl ether, at plant/RER S	1.49E-02	3.02E-06	3.03E-04	3.04E-04

4.5.6 *Sensitivity of the surfactant to the database*

In the present screening LCA, the widely used Ecoinvent database Version 2.2 was chosen as a reference for the ingredients data. Recently, another LCI database containing data on palm and coconut oil production became available: the Agri-footprint® database. It is important to note that the differences in data collection methods between these databases result in differences in environmental impact of coconut and palm oil when using the ReCiPe endpoint method. Here we compare the results of the two databases on two renewable surfactants - coconut oil and palm kernel oil - which have been shown to have a significant contribution to the environmental impact of detergents, which is to a large extent due to land transformation.

In general, the Agri-footprint database bases land transformation data on observed changes of palm fruit or coconut cropland for the past 20 years in the countries where they are grown. Ecoinvent bases its inventory data on permanent transformation of primary forest into agricultural land and subsequent transformation into forest (planted forest) when the palm trees are not productive anymore, as reported by the farmers.

4.5.6.1 **Coconut oil**

The Ecoinvent database assumes that for coconut trees, primary forest is permanently transferred into agricultural land. In Agri-footprint it is assumed that coconut area did not increase in the Philippines for the past 20 years, based on observed data. As a result, 1 kg of ethoxylated alcohols from coconut oil in Ecoinvent scores higher on natural land transformation (see Figure 26). Furthermore, the total environmental impact at endpoint level of 1 kg of ethoxylated alcohols from coconut oil is slightly higher in Ecoinvent. This is because the impact from other categories is much higher in Agri-footprint, due to different assumptions on yield per hectare and fossil fuel use. As the difference between the total impact of this ingredient is small, Agri-footprint will lead to the same overall conclusion regarding the importance of the surfactants in the life cycle of detergents.

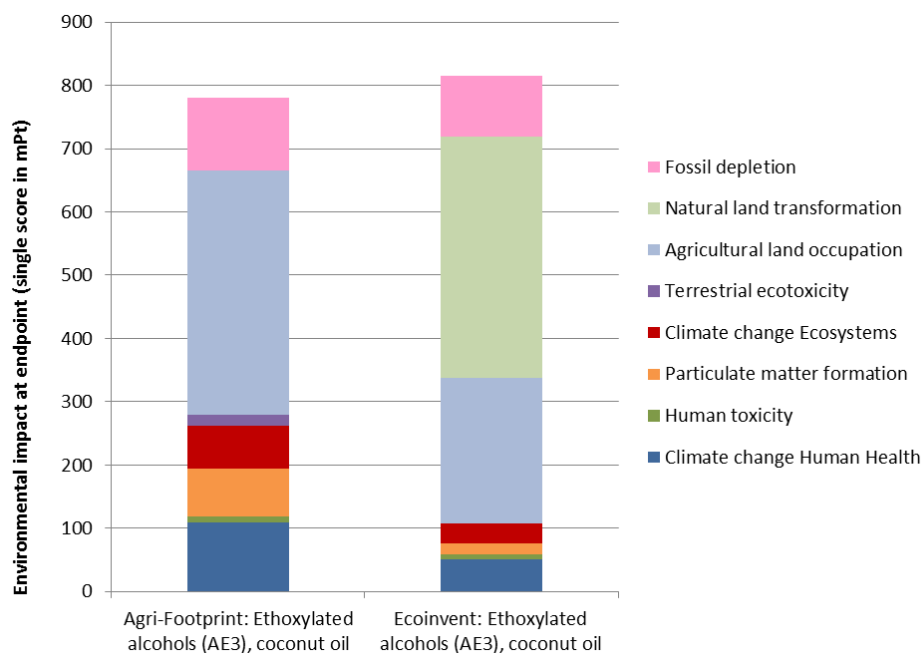


Figure 26: Comparison between the environmental impact at endpoint level of 1 kg of ethoxylated alcohols from coconut oil in Ecoinvent and in Agri-Footprint¹⁴⁵

4.5.6.2 Palm kernel oil

In the Ecoinvent database, the amounts of transformation for palm kernel oil are based on numbers for tropical forest transformed into palm kernel oil cropland and transformation to forest (planted forest), as reported by the farmers. In Agri-footprint, the amounts for palm kernel oil are based on data that indicate there was an increase in palm kernel oil cropland in Malaysia in the past 20 years. In Ecoinvent there is more transformation of tropical forest into palm kernel oil cropland, but there is also transformation to forest (not specified as being tropical forest). In Agri-footprint there is less transformation of tropical forest transformed into palm kernel oil cropland, but there is no planting of new forest.¹⁴⁶ This is because the developers of Agri-footprint calculated the net transformation to palm fruit area.

As the characterisation factor for damage at the end point level for transformation from tropical forest is about 30 times higher than the characterisation factor for transformation from forest (and the negative factor for transformation to tropical rain forest is about 30 times higher than for transformation to forest), the higher number for transformation from tropical forest in Ecoinvent leads to a higher impact on natural land transformation for 1 kg of ethoxylated alcohols from palm kernel oil in Ecoinvent (see Figure 27). Furthermore, the total environmental impact at endpoint level of 1 kg of ethoxylated alcohols from palm kernel oil is higher in Ecoinvent.

The information that is currently available does not give insights as to which of the methods leads to more realistic results. However, as natural land transformation is also the most important impact category in our study when using coconut or palm oil from Agri-footprint, just as it is when using Ecoinvent, from the use of Agri-footprint can also be concluded that the surfactants are an important contributor to the life cycle impact of detergents. The magnitude of the impact, however, is variable.

¹⁴⁵ Impact categories that are not shown contribute less than 1%

¹⁴⁶ A bug correction in the current version of Agri-Footprint was made for the process oil palm fruit bunch: "Transformation, from forest" changed into "Transformation, from tropical rain forest".

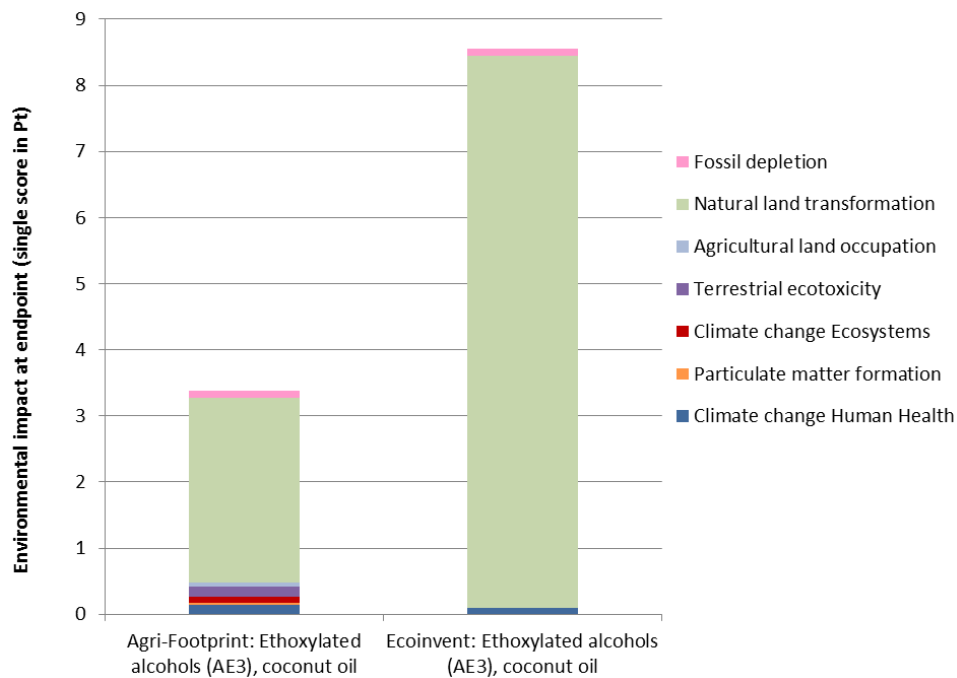


Figure 27: Comparison between the environmental impact at endpoint level of 1 kg of ethoxylated alcohols from palm kernel oil in Ecoinvent and in Agri-Footprint.¹⁴⁴

4.6 Summary of findings

The following conclusions can be derived from the screening LCA:

- I. The life cycle stage with the largest contribution to the environmental impact profile of dishwasher detergents is the use phase, particularly the energy needed to heat the water for the wash cycle.
- II. Based on the normalisation assessment, the most significant impact categories for dishwasher detergents in Europe are fossil depletion, climate change, human toxicity and particulate matter formation. Natural land transformation is relevant if ingredients are sourced from oleochemicals.

These impacts are strongly correlated to each other via the energy use in the use phase (with the exception of natural land transformation). The use phase dominates the impact categories fossil depletion, climate change, human toxicity and particulate matter formation whereas natural land transformation is dominated by ingredients sourcing.

Based on the results of this study, the key environmental performance indicators (KPIs - i.e. those variables that mainly drive the results) for dishwasher detergents in Europe are:

- amount of product used
- choice and amount of surfactant (but there are trade-offs between impact categories)
- wash temperature
- energy source used to heat the water
- emissions to water.

Based on this information, the following conclusions can be made about the key environmental considerations that should be linked to the ecolabel criteria of dishwasher detergents (Table 38):

Table 38: Overall summary of the key environmental considerations and the possibilities of being addressed by the EU Ecolabel criteria

Conclusion	Significance	Improvement measures
The use phase has the most significant contribution to the environmental impact, driven by energy needed to heat water. Therefore, the environmental impact can be lowered by encouraging low temperature washing.	Very high	Indirectly through consumer information on the packaging on the benefits of washing at lower temperatures
Raw materials extraction and processing are the second largest contributor to environmental impact. Surfactants and builders are responsible for most of the impact.	High	Directly by restricting the use of the worst performing builders and surfactants.
Concentrated products perform better than other product formats, across all impact categories.	High	Indirectly by encouraging the use of concentrated products.
An important environmental impact arises from the end of life, specifically related to municipal wastewater treatment.	Medium	Yes, through the toxicity to aquatic organisms and biodegradability criteria.
Impacts of detergent formulation and packing are very low.	Low	Directly, through the packaging requirements criteria.
The impacts of distribution and transport are low.	Low	No, would require specification for local sourcing.

DRAFT - WORK IN PROGRESS

5. PRODUCT INNOVATIONS AND IMPROVEMENT POTENTIAL

5.1 Introduction and approach

The aim of this section of the report is to indicate the areas of potential improvement that might be delivered by the application of revised criteria for the EU Ecolabel for dishwasher detergents.

In order to assess the potential improvement of dishwasher detergents, the following have been undertaken:

- a sensitivity analysis using the results from the LCA study
- an identification of recent product innovations
- an estimation of the potential benefits associated
- an identification of the possible measures to be undertaken in the EU Ecolabel.

The sensitivity analysis conducted using results from the LCA study are presented in Section 4.5. We have chosen to conduct the sensitivity analysis on the attributes which showed significant contribution to the environmental impact. These are product dosage, surfactant origin, washing program (wash temperature) and toxicity impact of ingredients.

5.2 Dishwasher detergent product innovations

In order to understand the scope of improvement options for dishwasher detergents, recent product innovations which lead to enhanced environmental performance have been identified. It should be noted that one of the findings of the market analysis was that only a limited number of innovations have been seen for this product. The relevant innovations are: low/no harmful chemicals formulations, and environmentally friendly packaging. Innovations and improved formulation to effectively wash at lower temperatures would be investigated.

5.2.1 Low/no harmful chemicals

According to Euromonitor International, the shift towards home care products with lower levels of harmful chemical ingredients is gaining momentum, and this includes dishwasher detergents.¹⁴⁷ For dishwasher detergents, this has included the move to phosphate-free products which use zeolites. The Detergents Regulation which takes effect from 2017 (for dishwasher detergents) will catalyse the move to phosphate-free detergents. The move to zeolite-based detergents will reduce phosphorus loading in the environment and, in doing so, reduce problems of eutrophication.¹⁴⁸ In 2010, 40 % of new automatic dishwasher detergent products introduced in Europe were phosphate-free compared to 2007 (13 %)¹⁴⁹: the move to phosphate-free dishwasher detergents is a growing trend.

5.2.2 Environmentally friendly packaging

Many larger brands of dishwasher detergents are focussing on promoting their green credentials; for example, in the UK nearly half of all product launches in the dishwashing market were promoted alongside claims of environmentally friendly packaging.¹⁰⁵ Packaging innovations included increased use of post-consumer paper and board, plant plastic made from oleochemical sources such as sugar cane, and plastic packaging recycled from ocean waste.¹⁵⁰

¹⁴⁷ *Global Household Care: Green Cleaning – Still an Oxymoron*, Euromonitor International, September 2009.

¹⁴⁸ *Non-surfactant organic ingredients and zeolite based detergents*, Final report prepared for the European Commission, RPA June 2006. Available from: http://ec.europa.eu/enterprise/sectors/chemicals/files/studies/rpa_non_surf_organ_zeolites_en.pdf

¹⁴⁹ *Phosphate-free ADW products – from a technical challenge to consumer value*, Nely Vlasblom, SEPAWA Nordic Conference 2011. Available from: <http://www.sepawa.org/dokument/7.%20Genencor-%20Presentation%20SEPAWA%20Nordic.pdf>

¹⁵⁰ For more information on ocean plastic see: <http://methodhome.com/ocean-plastic/>

5.3 Conclusions

A summary of the results from the sensitivity analysis and the LCA analysis for dishwasher detergents, with suggestions for how these issues can be addressed by the EU Ecolabel and an estimate of the potential benefits associated, is presented in Table 39. The outcomes are presented by life cycle stage.

As results of the LCA and sensitivity analysis have shown that the highest environmental impacts are associated with the use phase and the ingredients used, the focus for improvement should be for these phases.

The high environmental impact of the use phase can be addressed in different ways, including by encouraging consumers to wash dishes at lower temperatures.

The review of LCA studies also showed that phosphate-free formulations have a reduced environmental impact compared to formulations containing phosphate. This can be attributed to the impact from the production of sodium triphosphate.

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Table 39: Outcomes of sensitivity analysis and actions in EU Ecolabel criteria

Stage	Environmental impact	Potential environmental gain	Good environmental practices/restrictions	Improvement potential
Ingredients	2-32 % impact contribution, the highest for score goes for terrestrial ecotoxicity and natural land transformation.	High	For each functional group in the product composition, promote the use of substances which are less harmful in terms of ecotoxicity, aquatic toxicity and biodegradability.	Sensitivity analysis has shown that for terrestrial ecotoxicity the surfactants fatty alcohol sulphate and ethoxylated alcohols have the highest impact. The restriction of phosphates has also been shown to be beneficial.
			Restrict the use of surfactants which have a significant impact on natural land transformation.	Sensitivity analysis has shown that impact can be reduced by excluding surfactants from coconut oil.
Packaging	0-11 % impact contribution, the highest for score goes for agricultural land occupation	Moderate	Reduce the use of packaging materials from virgin sources by encouraging post-consumer materials for packaging.	As the majority of the environmental impact from packaging is due to the material a decrease in the use of virgin materials will result in direct decrease of environmental impact.
Transport	0-5 % impact contribution has a minor impact in comparison to use phase.	Low	Decrease product weight and improve transport efficiency and logistics.	Saving of fossil fuel used in transport.
Use phase	64-95 % impact contribution, the energy used to heat the water is the highest contributor to this.	Moderate – can only be addressed indirectly.	Wash the dishes at lower temperatures. Encourage the use detergents that are effective at 50°C (at least for the private use detergents). Hygiene restriction for IIDD should be regarded.	Sensitivity analysis has shown that reducing the wash temperature by 10 % reduces the impacts in all environmental categories by 13-19 %.
			Do not overdose the product as this increases the overall chemical load.	Reducing the dosage brings modest reductions to the overall environmental impact. The overall chemical load of the product in the use phase is reduced and fewer raw materials are consumed.
Treatment of	0-12 % impact contribution, highest for metal depletion.	Moderate	Encourage the use of packaging which is recyclable and easy to disassemble.	Recycling or packaging waste is generally environmentally preferable than other waste treatment options.

ANNEXES

ANNEX I: Stakeholder survey



JOINT RESEARCH CENTRE

Institute for Prospective Technological Studies (IPTS)

QUESTIONNAIRE TO ANALYSE THE EXISTING SCOPE, MARKET SEGMENTATION AND ENVIRONMENTAL PERFORMANCE FOR DETERGENTS FOR DISHWASHERS

Stakeholders Consultation Document

1. INTRODUCTION

1.1 Objectives

The EU Ecolabel is a key policy instrument in promoting environmentally friendly products and services. The objective of this first questionnaire relating to the existing EU Ecolabel and GPP criteria for dishwashers detergents, is to determine whether the scope definition is still appropriate and which criteria need to be amended, prolonged or withdrawn. In order to evaluate the current criteria in a successful and meaningful fashion, contact with relevant stakeholders is of utmost importance.

The EU Ecolabel criteria for 'detergents for dishwashers' were adopted:

- in 2011 (2011/263/EU) for detergents for dishwashers,
- and in 2012 (2012/720/EU) for industrial & institutional detergents for dishwashers.

The aim of these criteria was to promote detergents for dishwashers that correspond to the best 10-20 % of the products available on the community market in terms of environmental performance considering whole life-cycle (from production, through the use phase and until disposal). These criteria are due to expire in April 2015 and November 2016, respectively.

One of the goals of the revision is to obtain simplified criteria addressing the most important (from a life cycle perspective) environmental impacts of detergents for dishwashers. This questionnaire covers both domestic and industrial and institutional dishwasher detergents.

1.2 Analysis of existing criteria

The framework of the Commission Decisions 2011/263/EU and 2012/720/EU that sets out the EU Ecolabel criteria for detergents for dishwashers defines the aims of the criteria as promoting products that have a reduced impact on aquatic ecosystems, contain a limited amount of hazardous substances and whose performance has been tested.

The current criteria are set for each of the following aspects of detergents for dishwashers:

Domestic dishwasher detergents	Industrial and institutional dishwasher detergents
1. Total chemicals	1. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)
2. Excluded or limited substances	2. Biodegradability
3. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)	3. Excluded or limited substances and mixtures
4. Biodegradability of organics	4. Packaging requirements
5. Washing performance	5. Washing performance (fitness for use)
6. Packaging requirements	6. Automatic dosing systems
7. Consumer information	7. User information – information appearing on the EU Ecolabel
8. Information appearing on the EU Ecolabel	

In the following sections the following abbreviation is used: for domestic products– DDD; for industrial and institutional – IIDDD.

1.3 Confidentiality and contact details

All responses received through this questionnaire will be treated as confidential. Where data is published, this will be in an aggregated format only. Comments will not be attributed to an individual person or organisation unless this is specifically requested.

We rely strongly on stakeholder consultation, so your time and expertise are greatly appreciated and valued.

For further information regarding this questionnaire, please contact us writing to **Josie Arendorf** to the following e-mail address: josie.arendorf@oakdenehollins.co.uk.

Once this survey has been completed, please email to : JRC-IPTS-DISHWASH-DETERGENT@ec.europa.eu

Thank you for your participation!

2. QUESTIONNAIRE

2.1 Your contact details

First name:	<input type="text"/>	Surname:	<input type="text"/>
Email:	<input type="text"/>		
Company/ Organisation:	<input type="text"/>		
Organisation type:	<input type="checkbox"/> Industry <input type="checkbox"/> Government		
	<input type="checkbox"/> Environmental Agency <input type="checkbox"/> Trade Association		
	<input type="checkbox"/> Competent body		
<input type="checkbox"/> Other (please specify)	<input type="text"/>		
Company/Organisation details:			
Email address	<input type="text"/>		
Country	<input type="text"/>		
Telephone Number	<input type="text"/>		

2.2 Scope and definition

a) Domestic dishwasher detergents

At present the product group “**detergents for dishwashers**” comprises dishwasher detergents and products used as rinse aids in domestic dishwashing machines which fall under the following definitions:

Detergents for dishwashers and products used as rinse aids, whether in powder, liquid or any other form, which are intended to be marketed and used exclusively in automatic domestic dishwashers and in automatic dishwashers for professional use, the size and usage of which is similar to that of domestic dishwashers.

1. Do you agree with the existing products in scope?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
2. Is the current definition appropriate and suitable for this product category?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
3. Are there any dishwasher detergent products which are excluded by this definition which, in your opinion should be included?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please indicate. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
4. Is the current definition of ‘which are intended to be marketed and used exclusively in automatic domestic dishwashers and in automatic dishwashers for professional use, the size and usage of which is similar to that of domestic dishwashers’ clear? How could this be improved?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

b) Industrial and institutional dishwasher detergents

At present the product group “**industrial and institutional automatic dishwasher detergents**” comprises single and multi-component dishwasher detergents, rinse and pre-soaks, designed for use in professional dishwashers.

The following products are **excluded** from the scope of this product group: **consumer automatic dishwasher detergents**, detergents intended to be used **in washers of medical device or in special machines for cleaning of industrial equipment**, including in special machines for the food industry.

Sprays not dosed via automatic pumps are excluded from this product group.

<p>5. Do you agree with the existing products in scope?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If no, please explain why and/or propose modification.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>6. Is the current definition appropriate and suitable for this product category?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If no, please explain why and/or propose modification.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>7. Are there any dishwasher detergent products which are excluded by this definition which, in your opinion should be included?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If yes, please indicate.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

c) All dishwasher detergents

<p>8. Should the criteria for domestic and industrial and institutional dishwasher detergents be merged? Or remain as two separate criteria?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If yes, please indicate the reasoning behind. If you have a proposal of a joint definition, please share it. If possible, please indicate also expected pros and cons.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>9. Are differences in definition and scope necessary for the Ecolabel and GPP?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If yes, please explain why and/or propose modification.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

These questions are specifically addressed to the EUEB members and Competent Bodies:

10. Have producers or any other interested party had difficulty in understanding the scope of the product group, or encountered difficulties because the product was not covered within the current scope and definition?

Yes No

If yes, please specify:

11. Have you ever denied the EU Ecolabel licence for the detergents for dishwashers' product group because of a product not being covered by the current scope and definition?

Yes No

If yes, please specify:

These questions are specifically addressed to the stakeholders/licence holders:

12. Do you have any difficulty in understanding the scope of the product group?

Yes No

If YES, please specify:

13. Have you ever been denied the EU Ecolabel licence for detergents for dishwashers because of a product not being covered by the current scope and definition?

Yes No

If YES, please specify:

2.3 The need for criteria revision

Please indicate which of the criteria you believe may need revision and, where appropriate, please explain how in your opinion the criteria should evolve:

a) Domestic dishwasher detergents

14. Total chemicals:	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
15. Excluded or limited substances or mixtures	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
16. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
17. Biodegradability of organics	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
18. Washing performance	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
19. Packaging requirements	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
20. Consumer information	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

21. Information appearing on the EU Ecolabel	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <input type="text"/>

b) Industrial and institutional dishwasher detergents

22. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <input type="text"/>
23. Biodegradability	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <input type="text"/>
24. Excluded or limited substances or mixtures	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <input type="text"/>
25. Packaging requirements	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <input type="text"/>
26. Washing performance (fitness for use)	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <input type="text"/>

27. Automatic dosing systems	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 50px; width: 100%;"></div>
28. User information – Information appearing on the EU Ecolabel	<input type="checkbox"/> Keep	<input type="checkbox"/> Modify/remove Please give further details: <div style="border: 1px solid black; height: 50px; width: 100%;"></div>

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2.4 Questionnaire on currently valid criteria

In order to assist with the revision of the criteria, questions for the stakeholders regarding preliminary issues identified for consideration in the revision of the current criteria are outlined in this section.

Criterion 1: Total chemicals (DDD only)

The total chemicals (TC) are the recommended dosage in g/wash minus the water content. The current criteria specify that the total chemicals shall not exceed the following amounts:

- For single-functional dishwasher detergents TC_{max} = 22.0 g/wash
- For multi-functional dishwasher detergents TC_{max} = 22.0 g/wash

29. Are the total chemicals criteria strict enough for promoting the best 10-20 % (in terms of environmental performance) of dishwasher detergent products currently available on the market?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
30. Are additional total chemicals criteria for rinse aids required?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
31. Are additional dosage requirements needed? For example dosage depending on water hardness or level of soiling?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

Criterion 2 (for DDD): Excluded or limited substances and mixtures (criterion 3 for IIDD)

Under the existing criteria, the following ingredients must not be included in the product:

Substance	Domestic dishwasher detergents	Industrial and institutional dishwasher detergents
Phosphates	X	
EDTA	X	X
Nitromusks and polycyclic musks	X	
DTPA	X	
Perborates	X	
Reactive chlorine compounds	X	X
APEO and APD		X
Fragrances		X

In addition, the most critical substances regarding human health and environment must also not be included in the product. This is a standard requirement for ecolabelled washing and cleaning products. However, there are certain substances which are specifically exempted from this requirement:

Substance	Domestic dishwasher detergents	Industrial and institutional
-----------	--------------------------------	------------------------------

		dishwasher detergents
Surfactants (in concentrations < 25 % in the product)	X	
Surfactants (in concentrations < 15 % in the product)		X
Fragrances	X	
Biocides used for preservation	X	X
Enzymes	X	X
NTA as an impurity in MGDA and GLDA	X	X

32. Are there any additional ingredients which should be excluded or limited from EU Ecolabel detergents for dishwashers (domestic, professional, industrial and institutional)?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
33. Should the list of exempted substances be reviewed?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

Criterion 3 (for DDD): Toxicity to aquatic organisms: Critical Dilution Volume (CDV) (Criterion 1 for IIDD)

a) Domestic dishwasher detergents

The current criteria specify that the critical dilution volume of the product must not exceed the following limits (CDV_{chronic}):

Product type	CDV _{chronic}
Single-functional dishwasher detergent	25,000 l/kg wash
Multi-functional dishwasher detergent	30,000 l/kg wash
Rinse aid	10,000 l/kg wash

34. Are the CDV criteria effective in distinguishing between the state of the art and the best performing products in dishwasher detergents product group?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
35. Should different CDV limits be set for different forms of dishwasher detergent, for example powder, liquid or tablets?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

36. Should CDV limits be set for different levels of water hardness?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
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b) Industrial and Institutional dishwasher detergents

The current criteria specify that the critical dilution volume of the product must not exceed the following limits (CDVchronic):

CDV at the highest recommended dosage, l/kg wash	Soft	Medium	Hard
Product type	0-6 °dH	°dH	> 14 °dH
Pre-soaks	2,000	2,000	2,000
Dishwasher detergents	3,000	5,000	10,000
Multi-component system	3,000	4,000	7,000
Rinse aid	3,000	3,000	3,000

37. Are the CDV criteria strict enough for promoting the best 10-20 % (in terms of environmental performance) of dishwasher detergent products currently on the market?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
38. Are any additional CDV limits required in order to capture all dishwasher detergent products in scope?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

Criterion 4 (for DDD): Biodegradability of organics (criterion 2 for IIDD)

a) Domestic dishwasher detergents

The current criteria specify that the content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

Product type	aNBO	anNBO
Dishwasher detergents	1.0 g/kg wash	5.50 g/kg wash
Rinse aid	0.15 g/kg wash	0.50 g/kg wash

39. Are the current limits set for the maximum amounts of aerobically and anaerobically non-biodegradable strict enough for dishwasher detergents?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
40. Are the current limits set for the maximum amounts of aerobically and anaerobically non-biodegradable strict enough for rinse aids?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
41. Are the current limits effective in distinguishing between the state of the art and the best performing products in dishwasher detergents product group?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
42. Should the limits be set for different levels of water hardness?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

b) Industrial and institutional dishwasher detergents

The current criteria specify that the content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable aNBO) and/or anaerobically non-biodegradable (anNBO) shall not exceed the following limits:

For aerobically non-biodegradable (aNBO) organic substances:

Product type (g/l washing solution)	Soft 0-6 °dH	Medium 7-13°dH	Hard > 14 °dH
Pre-soaks	0.4	0.4	0.4
Dishwasher detergents/Multi-component system	0.4	0.4	0.4
Rinse aid	0.04	0.04	0.04

For anaerobically non-biodegradable (anNBO) organic substances:

Product type (g/l washing solution)	Soft 0-6 °dH	Medium °dH	Hard > 14 °dH
Pre-soaks	0.4	0.4	0.4
Dishwasher detergents/Multi-component system	0.6	1.0	1.5
Rinse aid	0.04	0.04	0.04

The criteria also state that all surfactants must be biodegradable under aerobic and anaerobic conditions.

43. Are the current limits set for the maximum amounts of aerobically and anaerobically non-biodegradable strict enough for promoting the best 10-20 % of dishwasher detergent products currently on the market?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
44. Should separate limits be set for dishwasher detergents and multi-component systems?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
45. Are the current limits effective in distinguishing between the state of the art and the best performing products in dishwasher detergents product group?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please explain why and/or propose modification. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

Criterion 5: Washing performance (fitness for use)

a) Domestic dishwasher detergents

The existing criteria state that tests shall be carried out to ensure that the product has a satisfactory washing performance at the recommended dosage according to the standard test developed by IKW or the modified standard EN 50242.

46. Please provide us with your comments on the washing performance test and, if appropriate, proposals for modification

b) Industrial and Institutional dishwasher detergents

The existing criteria state that tests shall be carried out to ensure that the performance and efficiency of the product must satisfy the requirements for the user test or internal testing in accordance with Appendix II (of the criteria).

47. Please provide us with your comments on the washing performance test and, if appropriate, proposals for modification

Criterion 6 (for DDD): Packaging requirements (criterion 4 for IIDDD)

a) Domestic dishwasher detergents

The current criteria for detergents for dishwashers state the following requirements for packaging:

Packaging	Requirements
Primary packaging	Shall not exceed 2.0 grams per wash
Cardboard packaging	Shall consist of $\geq 80\%$ recycled material
Labelling of plastic packaging	Must be marked in accordance with DIN 6210 Part 2 or the equivalent. Caps and pumps are exempted from this requirement
Plastic packaging	Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 2 b (hazardous substances and mixtures) may be used in the plastic packaging.

48. Are the packaging requirements sufficient and are additional requirements needed?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
49. Should additional criteria be set to further promote the use of recycled materials in packaging?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
50. Should the criteria be set using limits weight/utility ratio (WUR) by product type?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
51. Should there be restrictions on combinations of materials used for packaging? For instance to encourage ease of disassembly for recycling.	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
52. Should additional criteria be set to promote the use of sustainably sourced virgin wood fibres for paper and cardboard packaging?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please explain why and/or propose modification <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

b) Industrial and Institutional dishwasher detergents

The current criteria for dishwasher detergent products specify that the weight/utility ratio (WUR) must not exceed the following values:

Product type	Soft	Medium	Hard
	0-6 °dH	7-14°dH	> 14 °dH
Powders (g/l washing solution)	0.8	1.4	2.0
Liquids (g/l washing solution)	1.0	1.8	2.5

The existing criteria state the following requirements for plastic packaging:

- Only phthalates that at the time of application have been risk assessed and have not been classified according to criterion 3b (excluded or limited substances and mixtures) may be used in the plastic packaging.
- Plastic parts in primary packaging must be marked in accordance with DIN 6210, Part 2 or the equivalent. Caps and pumps are exempted.

The exemptions to the packaging requirements are:

- Plastic/paper/cardboard packaging containing more than 80 % recycled material
- Plastic packaging where more than 80 % of the plastic is from renewable origin

<p>53. Should the criteria be set using limits weight/utility ratio (WUR) by product type?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If yes, please explain why and/or propose modification</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>54. Should additional criteria be set to further promote the use of recycled materials in packaging? Should there be restrictions on combinations of materials used for packaging? For instance to encourage ease of disassembly for recycling?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If yes, please explain why and/or propose modification.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
<p>55. Should additional criteria be set to promote the use of sustainably sourced virgin wood fibres for paper and cardboard packaging?</p>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<p>If yes, please explain why and/or propose modification.</p> <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

Criterion 7: Consumer information (DDD) / User information – information appearing on the EU Ecolabel (IIDD)

a) Domestic dishwasher detergents

Information on the packaging

Under the existing criteria, the following text shall appear on or in the product:

This EU Ecolabel detergent works well at low temperatures (). Select low temperature washing cycles on the dishwasher, wash full loads and do not exceed the recommended dosage. This will minimise both energy and water consumption and reduce water pollution.*

(* The applicant shall insert here the recommended temperature or range at temperatures that shall not exceed 55 °C.

56. Is this information on the packaging sufficient for encouraging low temperature washing?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
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Dosage instructions

Under the existing criteria, dosage instructions shall appear on the product packages. Recommended dosages shall be specified for the ranges of water hardness appropriate to where the product is marketed. The instructions shall specify how to make best use of the product according to the soil.

57. Are the dosage instructions for dishwasher detergents sufficient?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
58. Is there any other information which should be included on the packaging/product information sheet?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

b) Industrial and institutional dishwasher detergents

Information on the packaging/product information sheet

Under the existing criteria, the following recommendations must appear on the packaging, and/or on product information sheet or equivalent:

- Dose according to the degree of soil, and the water hardness. Follow the dosing instructions
- Using this EU Ecolabel product according to the dosage instructions will contribute to the reduction of water pollution and waste production.

59. Is this information on the packaging sufficient for encouraging low temperature washing?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If no, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>
60. Is there any other information which should be included on the packaging/product information sheet?	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, please specify. <div style="border: 1px solid black; height: 40px; width: 100%;"></div>

2.5 Additional questions

These questions are for all dishwasher detergents

2.5.1 Measurement thresholds

The framework of the current EU Ecolabel defines the concentration of ingredients in the product which implies documentation at a threshold of more than or equal to 0.010 % by weight of the preparation.

Should the threshold be:

lower, such as: % higher, such as: % Remain at 0.010 %

Please, specify your reason if you propose any change in the current threshold:

2.5.2 Further issues or hot spots for dishwasher detergents

The current criteria are set for 8 different aspects of dishwasher detergents (7 for IIDD), with the aim of promoting products which have a reduced impact on aquatic ecosystems, contain a limited amount of hazardous substances and whose performance has been tested.

Should further criterion be developed? Either because all the issues are not already covered or because of recent developments which affect the environmental performance of dishwasher detergents.

2.5.3 Market data

The market analysis forms an integral part of the criteria revision process, as it identifies important drivers, trends and innovations in the market for dishwasher detergents.

If you have any information on market statistics for dishwasher detergents product group please mention this here so that we can get in touch with you and collect the details needed for the project. Thank you in advance for your cooperation.

ANNEX II: Dishwasher detergent ingredients

Surfactants

Surfactants (surface active agents) are the active cleaning ingredients found in detergent products. They function by changing the surface tension of water to assist with cleansing, wetting surfaces, foaming and emulsifying. In dishwasher detergents they help to remove and emulsify oil based soils such as butter and cooking fat. Non-ionic surfactants are the primary surfactants used in dishwasher detergents, these are chosen for their low-foaming properties. In general low-foaming surfactants are not readily biodegradable and therefore will remain in water ways.¹⁵¹

Preservatives/biocides

Preservatives are used to prevent the product from spoiling during storage by preventing the growth of microorganisms. Biocides are often used for preservation purposes; however, they can present significant risk to the environment and human health when used for purposes beyond preserving the product.

Enzymes

Enzymes are used in dishwasher detergents to improve washing performance. They function by targeting specific food deposits, which they break down into smaller parts so that they can then be removed by other ingredients in the detergent. As enzymes do not lose functionality after use, they can replace large quantities of other chemicals with the same function. Amylase and protease are commonly used in dishwasher detergent formulations.

Dyestuffs

Dyestuffs are added to the detergent formulations in order to give the detergents colour and for marketing purposes. They do not necessarily serve a purpose in the wash process.

Complexing agents

Complexing agents are used for their water softening abilities; this is particularly important in areas with hard water as this can prevent other ingredients in the detergent from functioning properly. They work by dissolving calcium and magnesium ions to prevent the build-up of limescale deposits. Builders help to maintain a desirable level of alkalinity, which is necessary for efficient soil removal. Traditionally phosphates have been used as complexing agents in dishwasher detergents. They have been largely replaced by other agents such as citrate and polycarboxylate, which do not contribute to eutrophication in water systems.

Bleaching agents

Bleaching agents are used to dissolve and oxidise organic deposits. In dishwasher detergents, oxygen-based bleaching agents are commonly used.

Anti-corrosion agents

Over time, glass is dissolved by the strongly alkaline nature of dishwasher detergents. Zinc salts and sodium silicates are commonly used as anti-corrosion agents, which prevent the corrosion of glass by other detergent ingredients.

Anti-foaming agents

Anti-foaming agents are used to reduce the formation of foam during the wash process. This is necessary as foam decreases the effectiveness of the washing process.

¹⁵¹ *Commercial and Institutional Dishwashing Detergents*, The New Zealand Ecolabelling Trust, January 2014

ANNEX III: Market analysis data

A: COMEXT trade data

Table 40: Intra EU-28, Import, 2013

	Intra EU - Import							
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	9,860,816	62,034	1,124,141	7,340	26,174,482	107,439	5,764,565	18,035
BE	25,664,690	129,710	1,566,479	8,758	32,046,592	160,771	11,920,610	49,215
BG	905,873	5,503	752,468	2,793	5,952,192	25,297	1,724,299	9,259
CY	690,700	4,314	64,553	484	2,153,361	7,192	314,136	2,970
CZ	6,873,642	52,329	2,378,855	9,761	18,439,363	90,784	3,829,189	25,560
DE	21,195,747	162,789	1,694,411	11,611	88,930,730	497,277	21,558,555	86,957
DK	10,535,994	76,164	1,550,330	9,494	4,657,139	22,385	4,656,260	31,819
EE	1,757,755	6,956	431,086	2,331	1,198,503	3,539	628,852	1,716
ES	13,325,759	90,187	969,078	4,849	30,545,978	188,778	6,977,603	39,721
FI	7,287,388	38,846	460,024	1,635	10,834,368	33,551	2,119,857	6,506
FR	67,417,126	455,955	2,590,283	18,018	68,393,144	374,015	28,936,326	118,231
UK	29,481,643	203,910	9,428,590	82,943	45,901,601	206,401	15,039,155	99,115
EL	5,237,123	33,215	857,724	5,250	9,173,623	49,960	1,706,128	6,123
HR	1,917,315	15,218	43,436	169	5,290,281	28,277	1,114,701	3,752
HU	6,956,298	49,954	85,424	494	16,888,678	103,202	3,914,903	15,013
IE	13,136,920	49,862	12,970,485	53,878	22,761,315	84,656	5,496,298	23,550
IT	10,388,226	59,742	5,670,541	65,435	25,702,018	123,039	7,697,502	51,012
LT	1,829,651	10,078	305,318	3,149	2,965,470	10,297	1,373,456	5,683
LU	2,763,987	8,865	266,810	1,119	2,311,999	10,715	1,164,788	2,660
LV	2,919,171	11,981	137,630	1,120	1,636,046	6,070	742,721	3,921
MT	695,420	5,240	116,791	715	731,756	2,661	214,708	799
NL	11,816,657	79,981	1,999,497	11,650	43,765,012	243,412	14,872,990	85,550
PL	16,182,112	108,465	8,230,003	101,387	24,722,433	134,031	7,083,988	41,675
PT	16,531,568	154,776	4,403,310	42,243	15,060,772	89,111	12,871,024	96,527
RO	6,682,534	72,204	715,009	3,319	14,164,858	71,005	2,583,951	11,897
SE	16,275,142	108,426	430,921	4,050	13,116,281	73,894	2,833,061	9,231
SI	2,730,381	19,026	126,615	778	5,801,524	25,590	984,461	3,726
SK	3,140,560	39,003	86,403	640	7,591,582	36,677	1,806,229	7,544
EU-28	314,200,198	2,114,733	59,456,215	455,413	546,911,101	2,810,026	169,930,316	857,767

Table 41: Intra EU-28, Export, 2013

	Intra EU - Export							
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	1,094,700	4,845	192,903	603	4,718,597	7,502	1,580,637	4,393
BE	27,477,138	255,379	4,403,867	30,035	17,822,614	86,541	15,177,706	69,041
BG	949,131	14,150	493,366	1,413	2,781,554	13,042	256,791	834
CY	12,104	49	0	0	192,796	584	46	0
CZ	3,336,662	22,931	2,663	21	21,321,582	118,392	1,060,645	5,590
DE	47,386,021	392,547	9,028,764	67,457	226,578,415	1,387,417	21,400,132	52,531
DK	11,242,005	67,628	22,467	70	3,932,153	9,280	1,070,521	2,299
EE	405,345	1,778	8,815	51	59,681	211	58,425	208
ES	9,908,208	97,737	2,657,162	17,194	9,972,946	53,802	24,080,173	171,882
FI	374,918	1,683	90	0	73,045	160	84,416	264
FR	27,882,645	114,877	2,025,873	25,365	19,440,672	43,955	16,897,062	89,961
UK	23,490,863	114,139	20,181,125	128,050	56,572,423	251,280	35,999,204	272,031
EL	3,375,052	21,669	277,761	1,049	1,747,191	6,316	3,269,659	20,172
HR	79,443	446	0	0	293,872	246	5,375	0

HU	1,408,276	12,494	16,677	82	6,476,464	25,488	1,722,603	5,002
IE	1,177,435	4,816	1,161,750	5,694	2,098,506	6,673	3,158,113	7,627
IT	122,879,067	895,849	3,485,510	30,698	35,231,803	123,782	43,383,588	326,914
LT	395,514	1,941	12,987	65	596,157	2,017	584,720	4,071
LU	670,501	2,592	65,879	303	313,102	1,092	307,084	404
LV	138,757	717	16,398	123	1,099,836	2,295	144,924	618
MT	0	0	0	0	0	0	0	0
NL	14,176,639	75,784	1,359,995	10,276	31,147,877	154,328	30,498,680	122,001
PL	25,051,772	258,898	182,434	582	73,844,810	437,245	20,752,106	108,947
PT	940,288	6,594	1,134,634	8,052	7,047,479	25,613	140,059	1,010
RO	528,651	3,637	81,374	415	2,073,865	6,487	321,089	1,587
SE	18,196,810	112,707	542,152	2,402	4,109,648	16,079	682,902	976
SI	433,869	3,275	361,124	3,452	2,498,055	6,737	416,488	1,344
SK	292,570	1,237	2,700	14	3,773,695	26,193	112,146	269
EU-28	343,304,384	2,490,399	47,718,470	333,466	535,818,838	2,812,757	223,165,294	1,269,976

Table 42: Extra EU-28, Import, 2013

Extra EU - Import								
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	246,195	1,553	11,999	80	5,022,528	23,157	221,476	316
BE	816,756	7,302	764,777	9,019	10,307,464	73,591	9,915,524	67,101
BG	637,037	8,186	2,415,358	32,491	3,741,211	28,992	2,768,199	31,095
HR	605,945	6,932	9,329	18	1,551,290	7,958	147,388	638
CY	17,291	72	227,227	2,213	208,714	1,097	99,296	423
CZ	155,165	1,169	31,296	254	7,931,812	54,491	1,364,856	10,236
DK	362,049	1,549	5,406	9	1,067,266	4,375	2,310,784	16,979
EE	41,662	381	0	0	107,750	689	115,885	765
FI	88,554	442	104	0	184,879	673	21,488	51
FR	7,087,629	74,931	6,159,096	77,272	13,200,985	85,339	5,814,483	39,309
DE	12,932,777	136,276	3,112,561	40,009	25,084,913	162,740	2,544,635	11,612
EL	494,439	3,194	295,164	3,950	768,467	3,418	898,726	6,968
HU	172,617	847	0	0	1,548,461	10,180	328,175	2,317
IE	253,569	2,056	8,774	14	83,309	311	107,769	76
IT	665,500	2,860	4,398,303	57,936	5,901,760	38,371	2,043,344	14,753
LV	88,088	700	67	0	394,950	1,813	565,887	3,274
LT	3,808	12	269,537	3,601	321,255	1,557	241,131	1,586
LU	3,310	1	0	0	368	0	1,304	0
MT	31,714	109	0	0	391,931	1,955	16,318	77
NL	2,848,966	13,695	757,995	9,980	17,185,365	120,928	8,439,748	41,470
PL	1,430,124	14,996	1,213,620	13,217	15,367,611	107,950	747,361	5,326
PT	83,108	973	96,520	1,940	2,049,035	15,273	149,786	986
RO	329,168	3,586	665,918	2,750	5,520,286	46,929	2,063,374	20,255
SK	143,331	1,372	476	0	1,360,324	9,991	82,582	283
SI	155,853	616	73,441	1,280	1,094,165	2,017	640	0
ES	1,227,394	11,949	1,182,972	14,518	6,472,729	28,622	3,616,779	27,319
SE	1,641,364	11,383	772,982	8,472	2,530,516	12,857	335,935	983
UK	22,440,645	112,045	1,853,675	20,864	37,414,669	225,237	10,970,544	64,185
EU-28	55,004,058	419,187	24,326,597	299,887	166,814,013	1,070,511	55,933,417	368,383

Table 43: Extra EU-28, Export, 2013

Extra EU - Export								
	34012090		34012010		34011100		34011900	
	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)	Value (€)	Quantity (100kg)
AT	399,586	958	2,062	2	1,113,568	2,561	624,208	2,805
BE	3,726,420	9,726	281,159	2,013	2,176,500	7,286	642,924	1,340
BG	1,291,330	14,903	33,992	273	2,034,154	11,890	392,756	2,477
HR	58,358	391	0	0	2,064,688	8,334	55,951	79
CY	50	0	0	0	42,312	126	0	0
CZ	284,908	1,941	83	0	5,579,107	23,425	629,699	4,777
DK	8,926,081	35,579	504,221	3,863	770,952	2,025	460,424	1,169
EE	1,066	6	0	0	99,778	422	106,848	430
FI	761,726	3,098	0	0	82,844	139	84,077	197
FR	13,276,215	44,909	436,236	2,676	29,392,256	72,597	9,268,074	33,776
DE	11,800,258	71,363	5,150,878	24,039	93,553,880	477,675	6,204,430	14,889
EL	137,441	833	0	0	282,278	677	1,922,056	10,664
HU	569,107	5,060	660	0	2,310,404	9,182	593,934	2,917
IE	2,684	2	4,964	22	153,716	52	51,207	42
IT	11,731,905	72,310	837,540	2,839	13,375,321	33,338	11,241,019	80,519
LV	82,096	418	19	0	1,979,052	3,580	948,620	6,015
LT	1,491,223	7,349	630,394	6,291	1,016,481	3,793	1,572,536	9,321
LU	413	1	11	0	530	0	515	0
MT	175,185	768	0	0	0	0	0	0
NL	2,861,688	14,757	427,105	1,355	33,332,357	135,171	7,039,630	27,206
PL	4,289,527	35,350	230,445	2,009	23,320,411	95,959	1,834,435	7,506
PT	977,221	5,946	316,416	1,854	5,213,924	13,709	5,078,806	75,953
RO	283,368	2,037	0	0	2,787,585	8,954	42,816	38
SK	21,293	134	0	0	117,035	388	249,529	1,244
SI	770,917	4,675	16,623	200	1,138,156	5,825	152,001	1,256
ES	4,344,861	37,698	173,484	1,978	10,088,300	47,191	4,460,650	21,814
SE	8,973,983	46,283	160,248	303	8,082,921	22,948	2,309,127	5,898
UK	20,533,995	81,185	4,475,081	22,135	60,878,460	236,819	18,599,162	86,317
EU-28	97,772,905	497,680	13,681,621	71,852	300,986,970	1,224,066	74,565,434	398,649

ANNEX IV: Life cycle impact assessment

For each substance, a schematic cause-and-effect pathway needs to be developed that describes the environmental mechanism of the substance emitted. Along this environmental mechanism an impact category indicator result can be chosen either at the midpoint or endpoint level. Endpoint results have a higher level of uncertainty compared to midpoint results but are easier to understand by decision makers.

- **Midpoint** impact category, or problem-oriented approach, translates impacts into environmental themes such as climate change, acidification, human toxicity, etc.
- **Endpoint** impact category, also known as the damage-oriented approach, translates environmental impacts into issues of concern such as human health, natural environment, and natural resources.

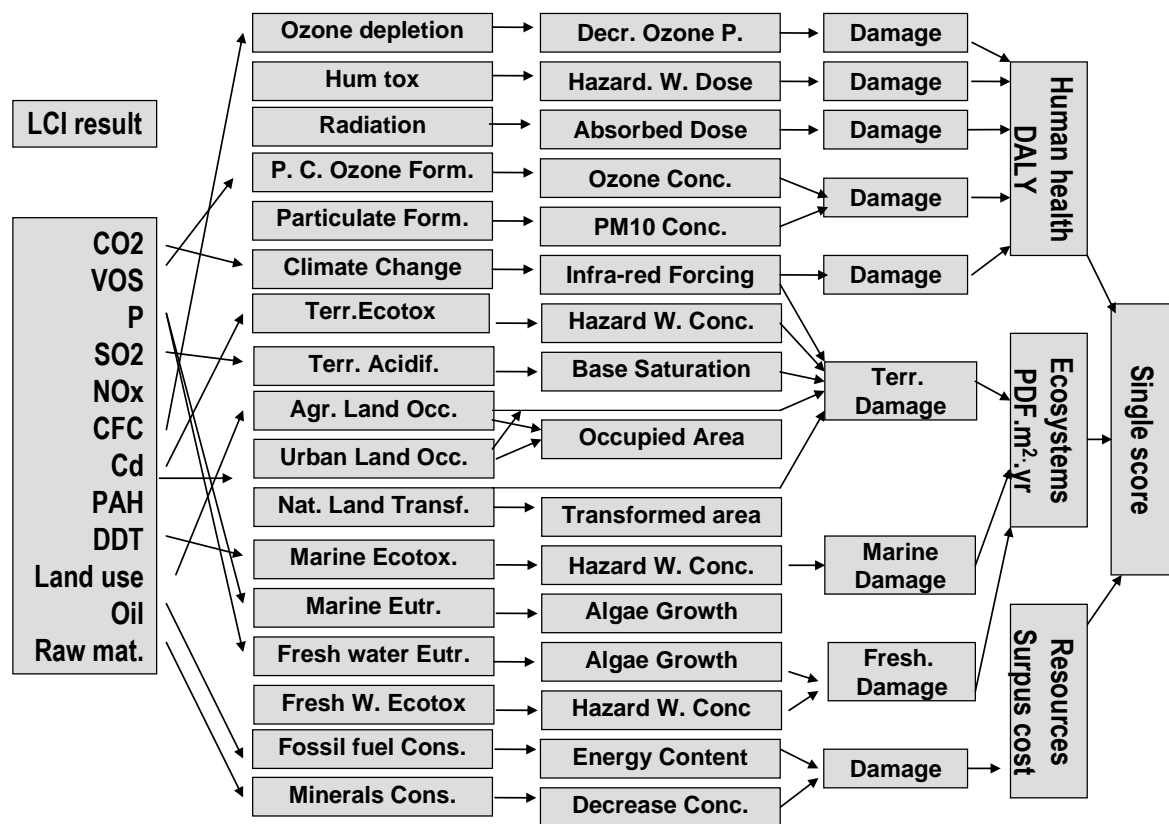


Figure 28: Relationship between LCI parameters (left), midpoint (middle) and endpoint indicator (right) in ReCiPe 2009

ANNEX V: Contribution analysis of different life cycle stages

Table 44 and Table 45 show the life cycle impact contribution of dishwasher detergent.

Table 44: Life cycle impact contribution of a dishwasher detergent

Impact category	Unit	Ingredients	Formulation	Packaging	Transport	Use phase	End of life
CC	kg CO ₂ eq	4.55E-02	1.77E-02	4.56E-03	9.75E-03	7.60E-01	4.55E-02
OD	kg CFC-11 eq	5.28E-09	8.70E-10	3.60E-10	1.56E-09	3.73E-08	5.28E-09
TA	kg SO ₂ eq	2.12E-04	7.37E-05	1.30E-05	5.90E-05	3.16E-03	2.12E-04
FE	kg P eq	1.81E-05	1.75E-05	1.22E-06	9.54E-07	7.50E-04	1.81E-05
ME	kg N eq	5.03E-05	4.97E-06	3.48E-06	3.40E-06	2.13E-04	5.03E-05
Htox	kg 1,4-DB eq	1.65E-02	1.15E-02	1.00E-03	1.24E-03	4.93E-01	1.65E-02
POF	kg NMVOC	9.43E-05	3.70E-05	1.44E-05	9.63E-05	1.59E-03	9.43E-05
PMF	kg PM10 eq	6.05E-05	2.33E-05	4.56E-06	2.56E-05	1.00E-03	6.05E-05
Ttox	kg 1,4-DB eq	2.86E-05	1.33E-06	9.00E-07	1.48E-06	5.78E-05	2.86E-05
Ftox	kg 1,4-DB eq	3.19E-04	2.47E-04	2.54E-05	2.67E-05	1.06E-02	3.19E-04
Mtox	kg 1,4-DB eq	3.25E-04	2.44E-04	2.15E-05	3.13E-05	1.05E-02	3.25E-04
IR	kg ²³⁵ U eq	1.30E-02	1.39E-02	4.45E-04	8.97E-04	5.98E-01	1.30E-02
ALO	m ² a	3.31E-03	2.29E-04	1.78E-03	3.98E-05	1.01E-02	3.31E-03
ULO	m ² a	1.64E-04	5.57E-05	4.19E-05	1.05E-04	2.65E-03	1.64E-04
NLT	m ²	1.98E-05	1.88E-06	9.71E-07	3.56E-06	8.22E-05	1.98E-05
WD	m ³	1.07E-03	1.44E-04	3.82E-05	3.88E-05	2.71E-02	1.07E-03
MD	kg Fe eq	2.36E-03	2.10E-04	1.59E-04	5.05E-04	9.30E-03	2.36E-03
FD	kg oil eq	1.40E-02	4.81E-03	1.89E-03	3.49E-03	2.06E-01	1.40E-02

Table 45: Life cycle impact contribution of a dishwasher detergent (in percentages)

Impact category	Unit	Ingredients	Formulation	Packaging	Transport	Use phase	End of life
CC	%	5	2	1	1	90	1
OD	%	12	2	1	3	82	1
TA	%	6	2	0	2	89	0
FE	%	2	2	0	0	95	0
ME	%	18	2	1	1	77	1
Htox	%	3	2	0	0	94	1
POF	%	5	2	1	5	86	1
PMF	%	5	2	0	2	89	1
Ttox	%	32	1	1	2	64	0
Ftox	%	3	2	0	0	94	1
Mtox	%	3	2	0	0	94	1
IR	%	2	2	0	0	95	0
ALO	%	21	1	11	0	65	0
ULO	%	5	2	1	3	84	4
NLT	%	18	2	1	3	76	0
WD	%	4	1	0	0	95	1
MD	%	16	1	1	4	65	12
FD	%	6	2	1	2	89	1

ANNEX VI: Sensitivity analysis

Dosage sensitivity:

Table 46 shows the results of the dosage sensitivity analysis.

Table 46: Impact contribution of the dosage sensitivity

Impact category	Unit	-20 %	Baseline	+20 %
Climate change	kg CO ₂ eq	8.34E-01	8.44E-01	8.55E-01
Ozone depletion	kg CFC-11 eq	4.43E-08	4.57E-08	4.70E-08
Terrestrial acidification	kg SO ₂ eq	3.48E-03	3.54E-03	3.59E-03
Freshwater eutrophication	kg P eq	7.85E-04	7.89E-04	7.93E-04
Marine eutrophication	kg N eq	2.67E-04	2.78E-04	2.89E-04
Human toxicity	kg 1,4-DB eq	5.22E-01	5.25E-01	5.29E-01
Photochemical oxidant formation	kg NMVOC	1.81E-03	1.85E-03	1.89E-03
Particulate matter formation	kg PM10 eq	1.11E-03	1.12E-03	1.14E-03
Terrestrial ecotoxicity	kg 1,4-DB eq	8.44E-05	9.04E-05	9.64E-05
Freshwater ecotoxicity	kg 1,4-DB eq	1.13E-02	1.13E-02	1.14E-02
Marine ecotoxicity	kg 1,4-DB eq	1.11E-02	1.12E-02	1.13E-02
Ionising radiation	kg ²³⁵ U eq	6.24E-01	6.27E-01	6.30E-01
Agricultural land occupation	m ² a	1.49E-02	1.56E-02	1.62E-02
Urban land occupation	m ² a	3.09E-03	3.14E-03	3.19E-03
Natural land transformation	m ²	1.04E-04	1.08E-04	1.13E-04
Water depletion	m ³	2.83E-02	2.85E-02	2.87E-02
Metal depletion	kg Fe eq	1.37E-02	1.43E-02	1.49E-02
Fossil depletion	kg oil eq	2.44E-01	2.47E-01	2.51E-01

Wash temperature sensitivity

Table 43 shows the results of the wash temperature sensitivity analysis.

Table 47: Impact contribution of wash temperature sensitivity

Impact category	Unit	50 °C	60 °C (baseline)
Climate change	kg CO ₂ eq	6.90E-01	8.44E-01
Ozone depletion	kg CFC-11 eq	3.81E-08	4.57E-08
Terrestrial acidification	kg SO ₂ eq	2.89E-03	3.54E-03
Freshwater eutrophication	kg P eq	6.37E-04	7.89E-04
Marine eutrophication	kg N eq	2.35E-04	2.78E-04
Human toxicity	kg 1,4-DB eq	4.26E-01	5.25E-01
Photochemical oxidant formation	kg NMVOC	1.53E-03	1.85E-03
Particulate matter formation	kg PM10 eq	9.21E-04	1.12E-03
Terrestrial ecotoxicity	kg 1,4-DB eq	7.89E-05	9.04E-05
Freshwater ecotoxicity	kg 1,4-DB eq	9.19E-03	1.13E-02
Marine ecotoxicity	kg 1,4-DB eq	9.07E-03	1.12E-02
Ionising radiation	kg ²³⁵ U eq	5.06E-01	6.27E-01
Agricultural land occupation	m ² a	1.36E-02	1.56E-02
Urban land occupation	m ² a	2.66E-03	3.14E-03
Natural land transformation	m ²	9.20E-05	1.08E-04
Water depletion	m ³	2.72E-02	2.85E-02
Metal depletion	kg Fe eq	1.25E-02	1.43E-02
Fossil depletion	kg oil eq	2.03E-01	2.47E-01

Surfactant sensitivity

Table 48 shows the results for the data source sensitivity analysis.

Table 48: Impact contribution of surfactant sensitivity

Impact category	Unit	Oleochemical	Mixed origin	Petrochemical
Climate change	kg CO ₂ eq	8.44E-01	8.44E-01	8.44E-01
Ozone depletion	kg CFC-11 eq	4.57E-08	4.57E-08	4.57E-08
Terrestrial acidification	kg SO ₂ eq	3.54E-03	3.54E-03	3.54E-03
Freshwater eutrophication	kg P eq	7.89E-04	7.89E-04	7.89E-04
Marine eutrophication	kg N eq	2.77E-04	2.77E-04	2.76E-04
Human toxicity	kg 1,4-DB eq	5.25E-01	5.25E-01	5.25E-01
Photochemical oxidant formation	kg NMVOC	1.85E-03	1.85E-03	1.85E-03
Particulate matter formation	kg PM10 eq	1.12E-03	1.12E-03	1.12E-03
Terrestrial ecotoxicity	kg 1,4-DB eq	9.99E-05	9.04E-05	6.67E-05
Freshwater ecotoxicity	kg 1,4-DB eq	1.13E-02	1.13E-02	1.13E-02
Marine ecotoxicity	kg 1,4-DB eq	1.12E-02	1.12E-02	1.12E-02
Ionising radiation	kg ²³⁵ U eq	6.27E-01	6.27E-01	6.27E-01
Agricultural land occupation	m ² a	1.49E-02	1.56E-02	1.45E-02
Urban land occupation	m ² a	3.14E-03	3.14E-03	3.14E-03
Natural land transformation	m ²	9.78E-05	1.08E-04	9.78E-05
Water depletion	m ³	2.85E-02	2.85E-02	2.84E-02
Metal depletion	kg Fe eq	1.43E-02	1.43E-02	1.43E-02
Fossil depletion	kg oil eq	2.32E-01	2.32E-01	2.32E-01

Energy source sensitivity

Table 45 shows the results for the energy source sensitivity analysis.

Table 49: Impact contribution of energy source sensitivity

Impact category	Unit	France	EU	Switzerland
Climate change	kg CO ₂ eq	1.24E-01	8.44E-01	2.21E-01
Ozone depletion	kg CFC-11 eq	2.99E-08	4.57E-08	1.51E-08
Terrestrial acidification	kg SO ₂ eq	7.41E-02	5.25E-01	1.29E-01
Freshwater eutrophication	kg P eq	3.66E-04	1.85E-03	6.91E-04
Marine eutrophication	kg N eq	2.03E-04	1.12E-03	3.99E-04
Human toxicity	kg 1,4-DB eq	8.02E-01	6.27E-01	1.64E+00
Photochemical oxidant formation	kg NMVOC	4.92E-04	3.54E-03	1.08E-03
Particulate matter formation	kg PM10 eq	5.56E-05	7.89E-04	1.08E-04
Terrestrial ecotoxicity	kg 1,4-DB eq	7.17E-05	2.78E-04	9.80E-05
Freshwater ecotoxicity	kg 1,4-DB eq	4.34E-05	9.04E-05	5.83E-05
Marine ecotoxicity	kg 1,4-DB eq	1.23E-03	1.13E-02	2.11E-03
Ionising radiation	kg ²³⁵ U eq	1.28E-03	1.12E-02	2.23E-03
Agricultural land occupation	m ² a	6.61E-03	1.56E-02	8.51E-03
Urban land occupation	m ² a	1.01E-03	3.14E-03	1.60E-03
Natural land transformation	m ²	3.81E-05	1.08E-04	4.68E-05
Water depletion	m ³	2.76E-02	2.85E-02	3.06E-02
Metal depletion	kg Fe eq	1.38E-02	1.43E-02	1.63E-02
Fossil depletion	kg oil eq	3.88E-02	2.47E-01	6.39E-02

ANNEX VII: Place settings

Average size dishwashers are specifically designed for an 'average' family for 2 adults and 2 children. A dishwasher should have enough capacity for a whole day's dirty plates, utensils, glasses and cups. With most families eating three meals a day, with an average of four family members, an average dishwasher has space for 12 place settings (3*4=12). According Stamminger et al. one place setting consists of a dinner plate, soup plate, dessert plate, a glass, tea cup and saucer, a knife, fork, soup spoon, dessert spoon, teaspoon and additional serving pieces.

This means a normal dishwasher with 12 place settings can hold on average:

- 12 Dinner plates
- 12 Dessert plates
- 12 Glasses
- 12 Tea cup and saucer
- 12 Knives, forks, soup spoons, dessert spoons and teaspoons
- 3-4 Serving plates and serving spoons
- 12 Bowls.

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