ReSolve
SAFE AND EFFECTIVE BIO-BASED SOLVENTS

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D4.2 Report on labelling requirements for hazard communication and ecolabelling possibilities

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OTHER		☐			

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Glossary

aNBO	Aerobically Non-Biodegradable
anNBO	ANaerobically Non-Biodegradable
BONSUCRO	BONSUCRO - The global sugarcane platform
CEN	European Committee for Standardization
CLP	Classification, Labelling and Packaging of substances and mixtures
DSD	Dangerous Substances Directive
EC	European Commission
EN	European Standard
EU	European Union
EUEB	EU Ecolabel Board
GHG	Greenhouse Gas
GHS	Globally Harmonised System
GreenPalm	Certified sustainable palm oil
ISCC	International Sustainability & Carbon Certification
ISO	The International Organization for Standardization
JRC	Joint Research Centre
LCA	Life Cycle Assessment
NMP	*N*-Methyl-2-pyrrolidone
prEN	Draft European Standard
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RSB	Roundtable on Sustainable Biomaterials
RSPO	Roundtable on Sustainable Palm Oil
RTU	Ready-to-Use product
SVOC	Semi-volatile Organic Compounds
SVHC	Substances of Very High Concern
tpa	Tonnes per year
TVOC	Total Volatile Organic Compounds
VOC	Volatile Organic Compounds

1 Executive summary

The work programme set for ReSolve is dedicated to pre-commercial, bio-based solvents products. Bio-based solvents have been recognised as a key contributor to the bio-based economy and have been highlighted in EC appointed reports as such (European Renewable Resources and Materials Association, 2007 and Ad-hoc Advisory Group for Bio-based Products EC, 2009). Although the market for bio-based solvents is projected to grow by approximately 5-6% per year, their use is still rather limited; i.e. approximately 20% of the total current solvent market (Industrial Biotechnology. 2016). This limited share of bio-based solvents consists predominantly of solvents like bio-ethanol, ethyl acetate, citrus oil, alkyl lactates, etc., which are useful in a wide range of applications, but face severe limitations as alternatives for some of the current solvents that have been classified as Substances of Very High Concern (SVHC). The ReSolve project aims to replace at least two types of SVHC solvents, namely toluene and the polar aprotic solvent N-methyl-pyrrolidone (NMP) by safer, bio-based alternatives that provide the same useful properties at a largely reduced risk for human health and the environment.

This report focusses on relevant European regulation in a global context to assess and give recommendations for labelling requirements for hazard communication and ecolabelling possibilities for bio-based solvents. The information collected on the ecolabel will serve as a baseline for comparing the actual properties of the solvents in the project and will thus facilitate the selection of the high-potential candidates.

Hazard communication for chemicals is regulated horizontally for the European market both by the REACH Regulation (EC 1907/2006) and by the Classification, Labelling and Packaging (CLP) Regulation (EC 1272/2008). The requirements laid down in these two regulations are binding for all companies producing, importing or selling substances or mixtures on the EU market. Deliverable D4.1 from the ReSolve project has already described the requirements for registration, testing and also labelling constituted by REACH and CLP in great detail.

The European Standard EN 16766/2017 on bio-based solvents does not provide a lot of binding or helpful information for ecolabelling of bio-based solvents. The EU Ecolabel, showing environmentally friendly products, is end-product specific and there are no EU Ecolabel criteria specifically for solvents, as usually consumers do not get purchase solvents directly. Instead, they are either used as process agent or as part of a formulation of which the end-product consists. The most relevant aspect for any labelling activity provided by EN 16766/2017 is the section on determining the bio-based content. In order to be classified as a bio-based solvent, the content of bio-based carbon in the material needs to be at least 25%. Furthermore, as for any chemical, a bio-based solvent shall be fully in compliance with REACH regulation (EC 2006), especially for their registration and classification, and with GHS/CLP regulation for the labelling. In addition, a bio-based solvent shall comply with any other EU regulations related to chemicals (CEN 2015).

Summing up, ecolabelling is application-specific, so the learnings from this report can only be preliminary. They can be used to further select the many solvents being screened in the project; more detailed analysis can only be made when the products, their properties and the targeted end-applications are known.

2 Introduction

The main objective of developing the new bio-based solvents portfolio within ReSolve is to replace the bulk solvents toluene and NMP (*N*-Methyl-2-pyrrolidone) by options that provide the same useful properties at a largely reduced risk for human health and the environment. While the toxicity testing and the Life Cycle Assessment (LCA) included in the project will ensure that these objectives are met, it is of course also of crucial importance to a) fulfil legal obligations on chemical safety communication as well as b) provide additional information on the improved profiles in order to facilitate market access, i.e. in the form of an ecolabel. This report will provide information on both aspects. The information collected on the ecolabel will serve as a baseline for comparing the actual properties of the solvents in the project and will thus facilitate the selection of the high-potential candidates.

It should be noted that the two aspects mentioned in the Deliverable title “requirements for hazard communication” and “ecolabelling possibilities” address very different aspects. Hazard communication for chemicals is regulated horizontally for the European market and is legally binding for companies producing or importing chemicals, while ecolabelling is completely voluntary. These two aspects are therefore split in the report.

3 Labelling requirements for hazard communication

Hazard communication for chemicals is regulated horizontally for the European market both by the REACH Regulation (EC 1907/2006) and by the Classification, Labelling and Packaging (CLP) Regulation (EC 1272/2008). The requirements laid down in these two regulations are binding for all companies producing, importing or selling substances or mixtures on the EU market.

Deliverable D4.1 from the ReSolve project has already described the requirements for registration, testing and also labelling constituted by REACH and CLP in great detail. The REACH requirements differ depending on the volume of produced/imported chemical, with 1000 tones production per year (tpa) as the highest level, and the report concluded that “given the fact that tonnage levels of toluene and NMP by far exceed this highest level, information requirements for any substitutes for these substances, though perhaps replacing not all applications, will be expected to easily exceed this 1000 tpa level as well. For human health endpoints, as an example, this implies that all endpoints are to be addressed for the candidate substituting substances. This means that the information and testing requirements therefore cover all those mentioned in Table 1 from D4.1. (Kroese et al. 2018).

This report therefore puts its focus on the ecolabelling possibilities and limitations for new bio-based solvents. Section 4.4 of this report summarizes the restrictions of hazardous substances and mixtures relevant for the EU Ecolabel.

4 Ecolabelling possibilities

Product labels, and ecolabels in particular, represent important instruments for promoting markets for environmentally friendly products. By providing information on the environmental product characteristics, they offer potential buyers the possibility to select a product based on features that would otherwise remain unobservable or very difficult to assess (Bleda & Valente, 2009; Teisl & Roe, 1998). If the label enjoys a high level of credibility and communicates relevant information to buyers, it may even offer the basis for a mark-up in price compared to similar products (Keeping & Shiers, 1996; Morris, 1997; Rotherham, 2005).

The International Organization for Standardization (ISO) distinguishes three different categories of environmental labels and declarations.

- Type I labels are multi-criteria-based third-party programmes that award a license to use environmental labels on products indicating overall environmental preferability of a certain product within a particular product category based on life cycle considerations (ISO 14024:1999). There are also Type I-like labels that have a similar verification and certification process but focus on single issues (e.g. energy consumption, sustainable forestry, etc.).
- Type II (ISO 14021) labels are self-declared environmental claims that producers, distributors or importers make about specific attributes of their products. The main difference to the previous category is that they are not awarded by an independent authority.
- Environmental declarations of Type III (ISO 14025) are voluntary programmes that provide quantified environmental data of a product, under pre-set categories of parameters set by a qualified third party and based on life cycle assessment and verified by that or another qualified third party. These declarations are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded.

Within the scope of the project, only the EU Ecolabel (the Flower) (Figure 1) and its opportunities for bio-based solvents will be evaluated. Previous research in the Open-Bio (2017) project (2013-2016, www.open-bio.eu) already conducted a first assessment of the EU Ecolabel and its potentials for bio-based solvents; however, this was done on a very general level only. It did not specify thresholds or specific values for certain applications. The general assessment done in Open-Bio (2017) will be used as a basis for this report on which the more detailed information per application group and potential threshold values will then be elaborated and discussed.

Figure 1: Products with EU Ecolabel flower carry arguments about the environmental benefits

(source: EU Ecolabel Digital Toolkit 2018)

4.1 An overview of the EU Ecolabel

The EU Ecolabel was established in 1992, involving all EU Member States in close cooperation with the national label authorities and national label organisations. The scheme is governed by Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009.

The process of the development and review of existing EU Ecolabel criteria catalogues follows the scheme illustrated in Figure 2. Member States, the European Commission (EC – DG Environment), and Competent Bodies can present suggestions for new introductions or reviews in consultation with the EU Ecolabel Board (EUEB). In addition, any interested party can make suggestions for new criteria or product groups to be included in the EU Ecolabel scheme. These are checked by the EC. The EC then gives a mandate and a working plan to the EUEB for the development of new criteria or for the revision of existing criteria. Revisions are done regularly approximately every 5 years.

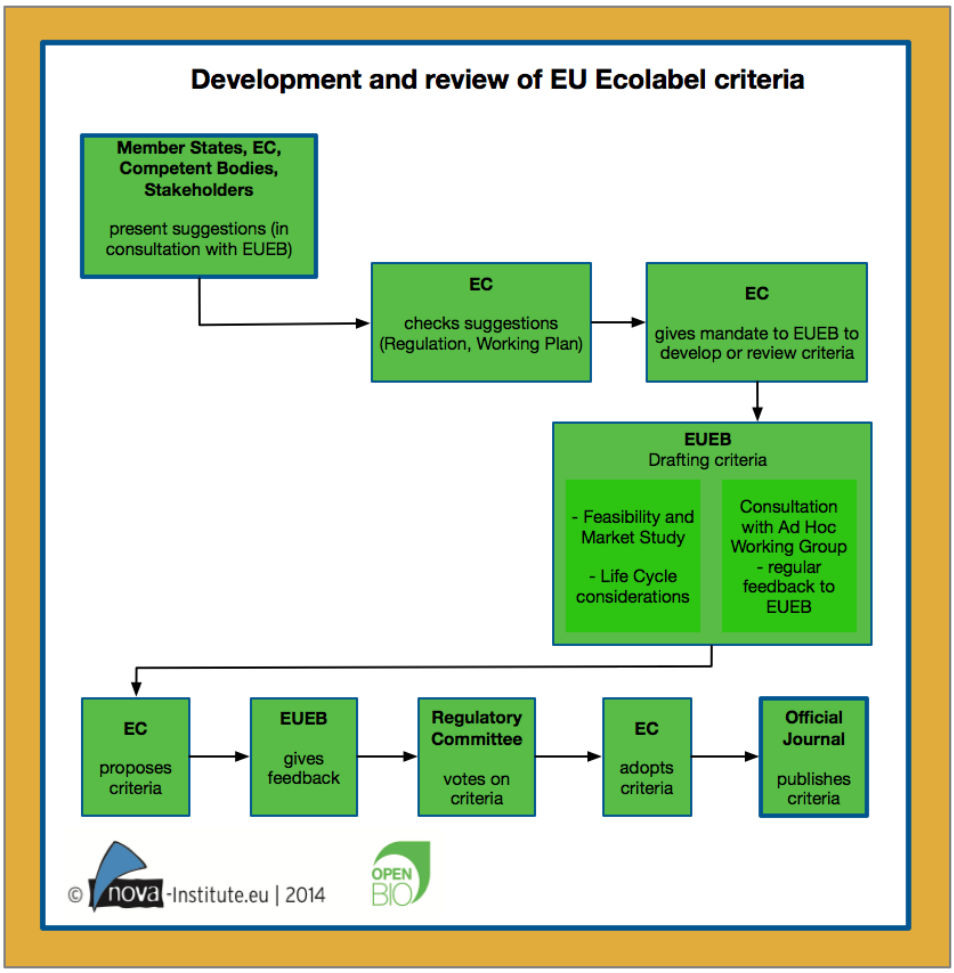

Figure 2: Development and review process of EU Ecolabel criteria
(source: Dammer et al. 2014)

The most important thing to note in the context of solvents is that the EU Ecolabel is **end-product specific**. The relevance of environmental criteria differs widely depending on the typical use of a product, its potential loss in the environment, its contact to humans, its end-of-life options. Solvents themselves are not usually the consumer end-product. Instead, they are either used as a process agent or as part of a formulation of which the end-product consists. Therefore, the analysis needs to cover a range of potential end-applications in which the targeted bio-based solvents of ReSolve could appear.

As mentioned above, the Open-Bio project (2017) considered the ecolabel criteria for bio-based solvents in a more general fashion. This was done in the form of a hypothetical “intermediate module”. Since solvents are such a common intermediate in many chemicals and materials processes, it was attempted to design a widely applicable framework of criteria that might be relevant for the environmental impacts of bio-based solvents independent of their end application. There is one example of such a module already utilised by ecolabels such as the EU Ecolabel or the Nordic Ecolabel (Nordic Swan). Lignocellulosic pulp is also used in a multitude of products and processes and there is a catalogue of criteria for this intermediate determining its potential environmental advantageousness. If an end-product made from lignocellulosic pulp (e.g. printing paper) desires to obtain the EU Ecolabel and the producer can

show that the pulp used for the manufacture of this product has been certified according to criteria of the intermediate catalogue, there is no extra testing or certification necessary for the pulp raw material. Similarly, the Open-Bio project produced a list of criteria that can be relevant for solvents used in a multitude of applications (Dammer et al. 2016).

This report will first illustrate the more general observations before going into more detail per product group.

4.2 A general framework for ecolabelling of bio-based solvents as intermediates

4.2.1 Market data and environmental preferability of bio-based solvents

As explained above, solvents are used in a multitude of applications, constituting an important intermediate in many processes and products. Solvents are used to dissolve, thin and disperse materials without altering them chemically. As such, thousands of producers and millions of workers use solvents every day in Europe. The total European solvents market is estimated at 5 million tonnes yearly (Busch and Wittmeyer 2014). Different sources (Dechema, Fraunhofer Institute, ESIG) estimate today's bio-based solvents production within the range 50,000 to 100,000 tonnes/year (1 to 2% of the total market) (Busch and Wittmeyer 2014). A JRC report estimates the European annual production for 2012 of bio-based solvents to be of 630,000 tonnes (JRC 2013). The factor 10 difference in these figures is identified to be related to the bioethanol supply chain. The European market of 630,000 tonnes of bio-based solvents can be confirmed if direct usage of bioethanol is considered as well as the use of bioethanol as a building block for other solvents (Busch and Wittmeyer 2014).

The global market volume of bio-based solvents is expected to reach 3.3 million tons by 2020 (Environmental Leader 2015) With 43.6%, the paints and coatings application segment accounted for the largest share of use of bio-based solvents in 2014, which is driven by the low Volatile Organic Compounds (VOC) emissions and environmental impact of the bio-based solvents compared to their fossil-based counterparts (Environmental Leader 2015). Industrial and household cleaners are the fastest growing segment in demand of bio-based solvents. Overall, solvents account for a market of almost 20 million tonnes today (Bergemann 2010) and also here, paints make up for the by far largest share of applications.

In terms of environmental advantages, the diversity of bio-based solvents and their applications makes it challenging to make general claims. Several instances of research, however, show that many bio-based solvents have a lower carbon footprint and hold the potential to be safer, more readily biodegradable and less toxic than their fossil counterparts (Briassoulis et al. 2015).

For example, a study carried out on the production of bio-based bulk chemicals found that ethyl lactate, which is a bio-based solvent used in a multitude of applications such as pharmaceutical products or fragrances, has the potential to save up to 80% of GHG emissions compared to its fossil-based counterpart (Hermann et al. 2007).

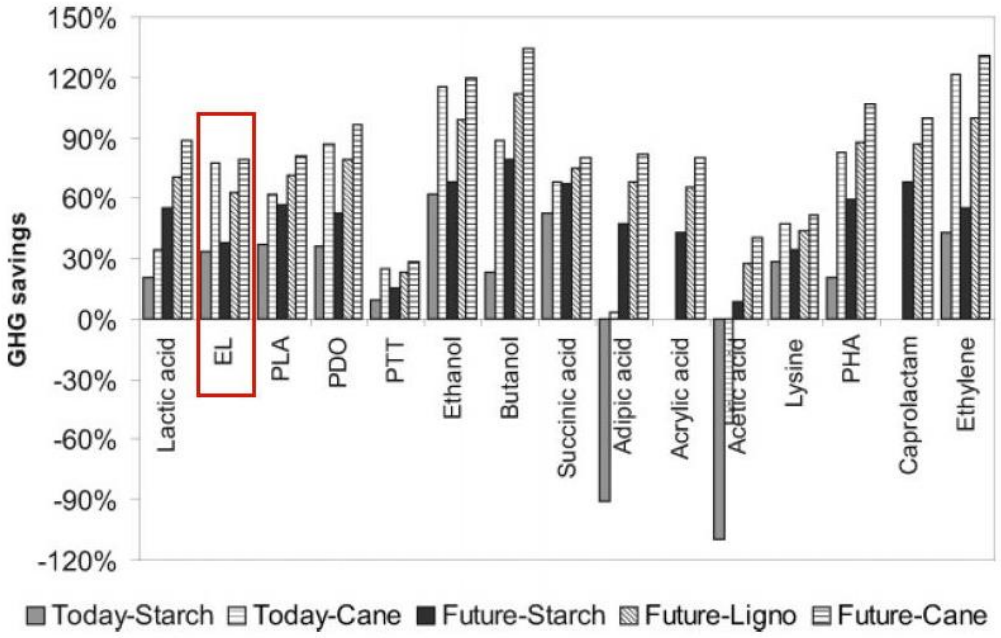

Figure 3: Greenhouse gas emission savings per ton of ethyl lactate compared to its petrochemical counterpart for current future technology cradle to grave

(source: Hermann et al. 2007).

4.2.2 Information requirements according to EN 16766/2017 (bio-based solvents standard)

The European Standardization Body CEN has developed a standard on bio-based solvents (EN 16766/2017) which lays down several information criteria that bio-based solvents should fulfil. The application of industry standards is just as voluntary as the certification with an ecolabel, but the standard provides valuable baselines to which ecolabelling activities can refer. The standard describes different performance characteristics of solvents that should be included in product communication but does not provide any threshold values. Regarding health, safety and environmental requirements the standard states that “bio-based solvents, just as any chemicals, are to follow relevant regulations in terms of health, safety and environment. These include for example REACH regulation for health, safety and environmental assessment, and GHS/CLP regulation for classification and labelling.”

However, regarding overall sustainability information, the standard also defines that “In order to clarify the environmental, social and economic impacts (positive and negative), information on the sustainability aspects of the biomass used for the production of a bio-based solvent shall either be given according to EN 16751[1] or according to a relevant internationally recognized standard or certification system. The standard or certification system(s) used shall be stated.” The standard cited in this section can be used for two applications; either to provide sustainability information about the biomass production only or to provide sustainability information in the supply chain for the bio-based part of the bio-based product. It should be noted that EN 16751 does not set any minimum values for sustainability, it purely lays down the

[1] EN 16751, Bio-based products - Sustainability criteria

categories of information regarding sustainability that should be reported. While this requirement in the bio-based solvents standard therefore does not set any threshold values, it is still stricter than what is required for conventional fossil-based solvents which do not need to provide information on the sustainability of their feedstocks.

The most relevant aspect for any labelling activity provided by EN 16766/2017 is the section on determining the bio-based content. In order to be classified as a bio-based solvent, **the content of bio-based carbon in the material needs to be at least 25%.** The standard differentiates between three classes in total:

Table 1: Solvent class according to its bio-based content

Solvent class	**Bio-based carbon content** [a] % (*m/m*)	**Bio-based content** [b] % (*m/m*)	**Comments**
A	≥ 95	≥ 95	Applicable for solvents, where all raw material part can be considered as bio-based [d]
B	≥ 50	≥ 50	Applicable for solvents, where the major raw material part can be considered as bio-based
C	≥ 25 [c]	≥ 25 [c]	Applicable for solvents, where the minor raw material part is bio-based

[a] As determined by EN 16640[2].

[b] As determined by EN 16785-1[3] or prEN 16785–2:2016[4] and expressed in relation to the total mass of the product.

[c] To allow harmonisation with other bio-based initiatives like surfactants, lubricants, polymers, etc. and to be in line with (legal) drivers such as the United States Department of Agriculture, the minimum threshold of 25% bio-based carbon content has been set.

[d] For test method capability reasons, 100% bio-based is not realistic, so an acceptable and reproducibly comfortable level is set.

There are two different ways of determining the fraction of biomass in a product: the bio-based carbon content and the bio-based content. It is important to clearly distinguish between these two approaches as, for the same product, the values can differ.

For solvents, a determination of bio-based content via EN 16785-1 might not always be relevant.

[2] EN 16640, Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method

[3] EN 16785-1, Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis

[4] prEN 16785-2:2016, Bio-based products - Bio-based content - Part 2: Determination of the bio-based content using the material balance method

Reasons for this are:

— the nature of (bio)chemical processes;
— the different requirements of the applications of solvents;
— the complex supply/value chain of the solvents; and
— the existence of interlinked production systems (co-production, mixture, etc.).

In such cases, prEN 16785-2 (material balance) should be used to determine the bio-based content of a bio-based solvent.

Regarding product communication and labelling, the standard requests that "a bio-based solvent shall be labelled with its class as defined in Clause 7. Both the bio-based carbon content and the bio-based content shall be declared. For business-to-business declarations, EN 16848[5] shall be used and for business-to-consumer declarations, EN 16935[6] shall be used."

4.2.3 Further general criteria for bio-based solvents in ecolabelling

Raw materials

According to Dammer et al. 2016, the sustainable sourcing of bio-based raw materials is an important aspect for the overall environmental impact, provided that the bio-based share of the product compromises a significant part of the raw material use. Dammer et al. 2016 proposed to include for bio-based solvents of the classes A and B (see section on bio-based content, 4.2.2), a criterion on sustainable sourcing of bio-based feedstocks:

A minimum of 50% of bio-based raw materials used in the product must be sourced from cultivation practices (agriculture, forestry or marine) that meet criteria for sustainable management that have been developed by multi-stakeholder organisations that have a broad-based membership including NGOs, industry and government.

For certification, applicants shall provide third-party certification such as ISCC, RSB, RSPO, BONSUCRO or any equivalent scheme based on multi-stakeholder management criteria. For chemical derivatives of palm oil and palm kernel oil, it is acceptable to demonstrate sustainability through book and claim systems such as GreenPalm or equivalent.

Such a criterion would be stricter than the information requirements described in the standard, which only prescribes information needs, while this suggested criterion sets a minimum threshold.

Volatile Organic Compounds (VOCs)

Bio-based solvents can have the advantage of containing less VOC content than petrochemical alternatives, thus posing less danger to human health and ecosystems. However, this is not always the case. A maximum limit of VOCs should be included in a module of bio-based solvents. See section 4.3 for VOC EU Ecolabel threshold values for specific end-products in which solvents are used.

[5] EN 16848, Bio-based products - Requirements for Business to Business communication of characteristics using a Data Sheet

[6] EN 16935, Bio-based products - Requirements for Business-to-Consumer communication and claims

Another option could be to request producers to use non-VOC solvents, and if a VOC must be used, producers would need to provide justifications why volatile substances are needed for the performance of the product.

Excluded or limited substances and mixtures

For this criterion, the module can again refer to the EN standard 16766 which contains a passage like:

"As any chemical, the substance(s) composing the bio-based solvent shall be fully in compliance with REACH regulation (EC 2006), especially for their registration and classification, and with GHS/CLP regulation for the labelling. In addition, a bio-based solvent shall comply with any other EU regulations related to chemicals." (CEN 2015)

Biodegradation

For products that are likely to end up in the environment, complete biodegradability makes sense. In the case of solvents, these are typically products such as cleaning products (household cleaners, personal care) or formulations of agricultural chemicals (see for details section 4.3). However, the biggest product groups in which solvents are used are paints and coatings, in which the solvents evaporate after the paint has been applied, thus dissipating into the air. In such cases, biodegradability is not a relevant environmental impact factor. Low levels of VOCs are much more important here. Dammer et al. 2016 therefore recommended to not include the issue of biodegradability in a broad module that is supposed to include solvents for all types of applications and only address this topic in the specific end application labels if they are developed or used.

Information appearing on the EU Ecolabel

The optional label with text box shall contain, where relevant, the following text regarding aspects which may be influenced by the use of solvents:

- Minimized content of hazardous substances
- Reduced content of volatile organic compounds (VOCs): x g/l

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 (EU Ecolabel Helpdesk, 2017).

4.3 Product group specific criteria of the EU Ecolabel relevant to solvents

One of the goals of ReSolve is to create solvents that are designed to have high performance. To that end, it is important to consider properties of the ReSolve solvent portfolio and applications carefully and in detail. It is quite likely that a different bio-based solvent will be the optimum choice (on a technical basis) for each application. However, this becomes impractical, and in reality, the solvent candidates that are most similar to the properties of the target solvents to be replaced (toluene and NMP) will have the broadest appeal. Based on the segmentation market of toluene and NMP for solvents the following applications were determined as the most promising for the potential target products of the ReSolve project in the very first stage:

- Paints & Coatings (cellulose nitrate lacquers, heat curing paints, alkyd resins)
- Cleaning products

- Inks
- Adhesives & Sealants
- Personal care products
- Automotive sector (de-icing, anti-freezing, production of tyres)
- Pharma industry – synthetic chemistry

The further selection of high-potential product applications will be based on the functional and safety testing as well as the label analysis presented in this report. From this first list of applications, it was checked which ones of these are already represented in product catalogues of the EU Ecolabel criteria. The following existing product groups in the EU Ecolabel were identified as relevant:

- Paints & Coatings (cellulose nitrate lacquers, heat curing paints, alkyd resins)
    - Product group “Paints and varnishes”
- Cleaning products
    - Product group “Hard surface cleaning products”
    - Product group “Detergents for Dishwashers”
    - Product group "Industrial and Institutional Automatic Dishwasher Detergents"
    - Product group “Hand dishwashing detergents”
    - Product group “Laundry detergents”
    - Product group “Industrial and institutional laundry detergents”
- Inks
    - Product group “Imaging equipment”
- Personal care products
    - Product group “Rinse-off cosmetic”

For the targeted application sectors “Adhesives and sealants”, “Automotive (de-icing, anti-freezing, production of tyres)” and “Pharma industry – synthetic chemistry” no existing EU Ecolabel product groups could be found. For a complete overview of existing EU Ecolabel product groups, please see http://ec.europa.eu/environment/ecolabel/products-groups-and-criteria.html.

In the following, each criteria catalogue for the identified relevant product groups will be analysed from the perspective of solvents’ application requirements and how they can influence the outcome of an ecolabel rating. This will help to analyse the most important properties that solvents should possess in order to facilitate the usage in ecolabelled products.

4.3.1 Targeted application: Paints and coatings

4.3.1.1 EU Ecolabel product group “Paints and varnishes”

The criteria for awarding the EU Ecolabel to paints and varnishes cover the following aspects (European Commission 2014a):

1. White pigment and wet scrub resistance
2. Titanium dioxide
3. Efficiency in use
    a. Spreading rate

   b. Resistance to water
   c. Adhesion
   d. Abrasion
   e. Weathering
   f. Water vapour permeability
   g. Liquid water permeability
   h. Fungal resistance
   i. Crack bridging
   j. Alkali resistance
   k. Corrosion resistance
4. Volatile and Semi-volatile Organic Compounds (VOCs, SVOCs)
5. Restriction of hazardous substances and mixtures
   a. Overall restrictions that apply to hazard classifications and risk phrases
   b. Restrictions that apply to Substances of Very High Concern
   c. Restrictions that apply to specific hazardous substances
6. Consumer information
7. Information appearing on the EU Ecolabel

The EU Ecolabel criteria reflect the best environmental performing products on the market of paints and varnishes. High quality and performance standards of the paint are required to ensure the longevity of the product and contribute that way to the significant reduction of the paints' overall life cycle impacts. Whilst the use of chemical products and release of pollutants is part of the production process, a product that bears the EU Ecolabel guarantees the consumer that the use of such substances has been limited to the extent technically possible without prejudice to its fitness for use. Moreover, the final paint or varnish product may not be classified as being an acute toxin or hazardous to the environment under European legislation on the labelling of products.

Solvents can indirectly influence many criteria. Out of these seven criteria above, the following criteria are more directly influenced by the solvents used in the manufacture of paints and coatings:

Criterion 4. Content of Volatile and Semi-volatile Organic Compounds (VOCs, SVOCs)

The Ecolabel criteria aim at minimizing the use of volatile and semi-volatile organic substances in the paint formulation. The content of VOCs and SVOCs is determined in EU Ecolabel criteria for the ready-to-use paints and varnishes product and shall include any recommended additions prior to application such as colorants and/or thinners. Products with a VOC content that is in accordance with the limits in the Table 2 may display the text ‘reduced VOC content’ and the VOC content in g/l next to the Ecolabel. The following table shows the different threshold values for the different relevant paints and varnishes:

Table 2: The content limits of VOCs and SVOCs for the EU Ecolabelled paints and varnishes (source: European Commission 2014a)

VOC and SVOC content limits

Product description (with subcategory denotation according to Directive 2004/42/EC)	VOC limits (g/l including water)	SVOC limits (g/l including water)
a. Interior matt walls and ceilings (Gloss < 25@60°)	10	30 (1)/40 (2)
b. Interior glossy walls and ceilings (Gloss > 25@60°)	40	30 (1)/40 (2)
c. Exterior walls of mineral substrate	25	40
d. Interior/Exterior trim and cladding paints for wood and metal	80	50 (1)/60 (2)
e. Interior trim varnishes and woodstains, including opaque woodstains	65	30
e. Exterior trim varnishes and woodstains, including opaque woodstains	75	60
f. Interior and Exterior minimal build woodstains	50	30 (1)/40 (2)
g. Primers	15	30 (1)/40 (2)
h. Binding primers	15	30 (1)/40 (2)
i. One-pack performance coatings	80	50 (1)/60 (2)
j. Two-pack reactive performance coatings for specific end use such as floors	80	50 (1)/60 (2)
l. Decorative effect coatings	80	50 (1)/60 (2)
Anti-rust paints	80	60

(1) Indoor white paints and varnishes
(2) Indoor tinted paints/outdoor paints and varnishes

The VOC content shall be determined either by calculation based on the ingredients and raw materials or by using the methods given in ISO 11890-2 or, alternatively for products with a VOC content of less than 1.0 g/l, the methods given in ISO 17895. The SVOC content shall be determined using the method given in ISO 11890-2.

Criterion 5. Restriction of hazardous substances and mixtures

The hazardous substance restriction and derogation list are important in all EU Ecolabel product categories and will be analyzed further in section 4.4.

Criterion 7. Information appearing on the EU Ecolabel

The optional label with text box shall contain, where relevant, the following text regarding aspects which may be influenced by the use of solvents:

- Minimized content of hazardous substances
- Reduced content of volatile organic compounds (VOCs): x g/l

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 (EU Ecolabel Helpdesk, 2017).

The information appearing on the EU Ecolabel of paints and coatings offers an easy recognition of properties, like low emission values, required by the used bio-based solvents.

4.3.2 Targeted application: Cleaning products

4.3.2.1 EU Ecolabel product group “Hard surface cleaning products”

The criteria for awarding the EU Ecolabel to “Hard surface cleaning products” cover the following aspects (European Commission 2017a):

1. Toxicity to aquatic organisms
2. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic compounds
    c. Weight/utility ratio (WUR)
    d. Design for recycling
3. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
4. Excluded and restricted substances
    a. Specified excluded and restricted substances
    b. Hazardous substances
    c. Substances of very high concern (SVHCs)
    d. Fragrances
    e. Preservatives
    f. Colouring agents
    g. Enzymes
    h. Micro-organisms
5. Packaging
    a. Products sold in spray bottles
    b. Packaging take-back systems
6. Fitness for use
7. User information
    a. Dosing instructions
    b. Packaging disposal information
    c. Environmental information
8. Information appearing on the EU Ecolabel
    a. Limited impact on the aquatic environment
    b. Restricted amount of hazardous substances
    c. Tested for cleaning performance

Out of these eight criteria above, the following criteria are more directly influenced by the use of solvents in the manufacture of cleaning products:

Criterion 2. Biodegradability

Different thresholds to measure the biodegradability of hard surface cleaning products are given for the following sub-groups: surfactants and organic compounds.

All surfactants shall be readily degradable (aerobically). All surfactants classified as hazardous to the aquatic environment: Acute Category 1 (H400) or Chronic Category 3 (H412), in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council shall be in addition anaerobically biodegradable.

The content of organic substances in the product, except micro-organisms, that are aerobically non-biodegradable (not readily biodegradable, aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the limits for the reference dosage shown in Table 3.

Table 3: Biodegradability thresholds of organic compounds for Ready-to-Use hard surface cleaning products

(source: European Commission 2017a)

Product type	aNBO (g/l of cleaning solution)	anNBO (g/l of cleaning solution)
All-purpose cleaners, RTU	3,00	55,00
All-purpose cleaners, undiluted	0,20	0,50
Kitchen cleaners, RTU	5,00	35,00
Kitchen cleaners, undiluted	0,20	0,50
Window cleaners, RTU	2,00	20,00
Window cleaners, undiluted	0,20	0,50
Sanitary cleaners, RTU	5,00	35,00
Sanitary cleaners, undiluted	0,20	0,50

Criterion 4. Excluded and restricted substances

The following substances shall not be included in the product formulation regardless of concentration: alkyl phenol ethoxylates and other alkyl phenol derivatives, formaldehyde and its releasers, glutaraldehyde, per fluorinated alkynoates, aromatic hydrocarbons[7] and halogenated hydrocarbons.

VOCs shall not be present above the limits specified in Table 4.

[7] For example toluene.

Furthermore, the product shall not contain ingoing substances at a concentration limit at or above 0,010 % weight by weight in the final product that meet the criteria for classification as toxic, hazardous to the aquatic environment, respiratory or skin sensitizers, carcinogenic, mutagenic or toxic for reproduction in accordance to the rules set out in the following sub-criteria which apply to the Hazard classification and risk phrases and to the list of Substances of Very High Concern. These will be analyzed further in section 4.4.

Table 4: Content limits of VOCs and SVOCs for the EU Ecolabelled hard surface cleaning (source: European Commission 2017a)

Product type	VOC limit
All-purpose cleaners, RTU	30 g/l of RTU product
All-purpose cleaners, undiluted	30 g/l of cleaning solution
Kitchen cleaners, RTU	60 g/l of RTU product
Kitchen cleaners, undiluted	60 g/l of cleaning solution
Window cleaners, RTU	100 g/l of RTU product
Window cleaners, undiluted	100 g/l of cleaning solution
Sanitary cleaners, RTU	60 g/l of RTU product
Sanitary cleaners, undiluted	60 g/l of cleaning solution

Criterion 8. Information appearing on the EU Ecolabel

The logo shall be visible and legible. The EU Ecolabel registration/licence number shall appear on the product and it shall be legible and clearly visible. The applicant may choose to include an optional text box on the label that contains the following text:

- Limited impact on the aquatic environment,
- Restricted amount of hazardous substances,
- Tested for cleaning performance.

4.3.2.2 EU Ecolabel product group “Detergents for Dishwashers”

The criteria for awarding the EU Ecolabel to “Detergents for Dishwashers” cover the following aspects (European Commission 2017b):

1. Dosage requirements
2. Toxicity to aquatic organisms

3. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic compounds
4. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
5. Excluded and restricted substances
    a. Specified excluded and restricted substances
    b. Hazardous substances
    c. Substances of very high concern (SVHCs)
    d. Fragrances
    e. Preservatives
    f. Colouring agents
    g. Enzymes
6. Packaging
    a. Weight/utility ratio (WUR)
    b. Design for recycling
7. Fitness for use
8. User information
    a. Dosing instructions
    b. Packaging disposal information
    c. Environmental information
9. Information appearing on the EU Ecolabel
    a. Limited impact on the aquatic environment
    b. Restricted amount of hazardous substances
    c. Tested for cleaning performance

As for the previous subgroup (hard surface cleaning products), out of these nine criteria above, the “Biodegradability”, “Excluded and restricted substances” and “Information appearing on the EU Ecolabel” criteria are more directly influenced by the use solvents in the manufacture of detergents for dishwashers.

Criterion 3. Biodegradability

Different thresholds to measure the biodegradability of hard surface cleaning products are given for the following sub-groups: surfactants and organic compounds.

All surfactants shall be readily degradable (aerobically). All surfactants classified as hazardous to the aquatic environment: Acute Category 1 (H400) or Chronic Category 3 (H412), in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council shall be in addition anaerobically biodegradable.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable, aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the limits for the reference dosage shown in Table 5.

Table 5: Biodegradability thresholds of organic compounds for dishwasher detergents (source: European Commission 2017b)

Product type	aNBO (g/wash)	anNBO (g/wash)
Dishwasher detergents	1,00	3,00
Rinse aids	0,15	0,50

Criteria 5 and 9. Excluded and restricted substances and information appearing on the EU Ecolabel

These criteria shall comply with the same requirements reported for the previous subgroup hard surface cleaning products (section 4.3.2.1).

4.3.2.3 EU Ecolabel product group "Industrial and Institutional Automatic Dishwasher Detergents"

The criteria for awarding the EU Ecolabel to "Industrial and Institutional Automatic Dishwasher Detergents" cover the following aspects (European Commission 2017c):

1. Toxicity to aquatic organisms
2. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic compounds
3. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
4. Excluded and restricted substances
    a. Specified excluded and restricted substances
    b. Hazardous substances
    c. Substances of very high concern (SVHCs)
    d. Fragrances
    e. Preservatives
    f. Colouring agents
    g. Enzymes
5. Packaging
    a. Packaging take-back systems
    b. Weight/utility ratio (WUR)
    c. Design for recycling
    d. Fitness for use
6. Automatic dosing systems
7. User information
    a. Dosing instructions
    b. Packaging disposal information
    c. Environmental information
8. Information appearing on the EU Ecolabel
    a. Limited impact on the aquatic environment
    b. Restricted amount of hazardous substances
    c. Tested for cleaning performance

Out of these eight criteria above, the “Biodegradability”, “Excluded and restricted substances” and “Information appearing on the EU Ecolabel” criteria are more directly influenced by the use of solvents in the manufacture of industrial dishwasher detergents.

Criterion 2. Biodegradability

Different thresholds to measure the biodegradability of hard surface cleaning products are given for the following sub-groups: surfactants and organic compounds.

All surfactants shall be readily degradable (aerobically). All surfactants classified as hazardous to the aquatic environment: Acute Category 1 (H400) or Chronic Category 3 (H412), in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council shall be in addition anaerobically biodegradable.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable, aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the limits for the reference dosage shown in Table 6.

Table 6: Biodegradability thresholds of organic compounds for industrial dishwasher detergents (source: European Commission 2017c)

aNBO (g/l of washing solution)

Product type / Water hardness	Soft < 1,5 mmol $CaCO_3$/l	Medium 1,5-2,5 mmol $CaCO_3$/l	Hard > 2,5 mmol $CaCO_3$/l
Pre-soaks	0,40	0,40	0,40
Dishwasher detergents/Multi-component system	0,40	0,40	0,40
Rinse aids	0,04	0,04	0,04

anNBO (g/l of washing solution)

Product type / Water hardness	Soft < 1,5 mmol $CaCO_3$/l	Medium 1,5-2,5 mmol $CaCO_3$/l	Hard > 2,5 mmol $CaCO_3$/l
Pre-soaks	0,40	0,40	0,40
Dishwasher detergents/Multi-component system	0,60	1,00	1,00
Rinse aids	0,04	0,04	0,04

Criteria 4 and 8. Excluded and restricted substances and information appearing on the EU Ecolabel

These criteria shall comply with the same requirements reported for the previous subgroups.

4.3.2.4 EU Ecolabel product group "Hand dishwashing detergents"

The criteria for awarding the EU Ecolabel to "Hand dishwashing detergents" cover the following aspects (European Commission 2017d):

1. Toxicity to aquatic organisms
2. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic compounds
3. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
4. Excluded and restricted substances
    a. Specified excluded and restricted substances
    b. Hazardous substances
    c. Substances of very high concern (SVHCs)
    d. Fragrances
    e. Preservatives
    f. Colouring agents
    g. Enzymes
    h. Corrosive properties
5. Packaging
    a. Weight/utility ratio (WUR)
    b. Design for recycling
6. Fitness for use
7. User information
    a. Dosing instructions
    b. Packaging disposal information
    c. Environmental information
8. Information appearing on the EU Ecolabel
    a. Limited impact on the aquatic environment
    b. Restricted amount of hazardous substances
    c. Tested for cleaning performance

As for the previous subgroups, out of these eight criteria above, the "Biodegradability", "Excluded and restricted substances" and "Information appearing on the EU Ecolabel" criteria are more directly influenced by the use solvents in the manufacture of detergents for dishwashers.

Criterion 2. Biodegradability

Different thresholds to measure the biodegradability of hard surface cleaning products are given for the following sub-groups: surfactants and organic compounds.

All surfactants shall be readily degradable (aerobically). All surfactants classified as hazardous to the aquatic environment: Acute Category 1 (H400) or Chronic Category 3 (H412), in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council shall be in addition anaerobically biodegradable.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable, aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the limits for the reference dosage shown in Table 7.

Table 7: Biodegradability thresholds of organic compounds for hand dishwasher detergents

(source: European Commission 2017d)

Product type	aNBO (g/l of washing water)	anNBO (g/l of washing water)
Hand dishwashing detergents	0,03	0,08

Criteria 4 and 8. Excluded and restricted substances and information appearing on the EU Ecolabel

These criteria shall comply with the same requirements reported for the previous subgroups.

4.3.2.5 EU Ecolabel product group "Laundry detergents"

The criteria for awarding the EU Ecolabel to Laundry detergents cover the following aspects (European Commission 2017e):

1. Dosage requirements
2. Toxicity to aquatic organisms
3. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic compounds
4. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
5. Excluded and restricted substances
    a. Specified excluded and restricted substances
    b. Hazardous substances
    c. Substances of very high concern (SVHCs)
    d. Fragrances
    e. Preservatives
    f. Colouring agents
    g. Enzymes
6. Packaging
    a. Weight/utility ratio (WUR)
    b. Design for recycling
7. Fitness for use
8. User information
    a. Dosing instructions
    b. Packaging disposal information
    c. Environmental information
9. Information appearing on the EU Ecolabel
    a. Limited impact on the aquatic environment
    b. Restricted amount of hazardous substances
    c. Tested for cleaning performance

As for the previous subgroups, out of these nine criteria above, the “Biodegradability”, “Excluded and restricted substances” and “Information appearing on the EU Ecolabel” criteria are more directly influenced by the use solvents in the manufacture of detergents for dishwashers.

Criterion 3. Biodegradability

Different thresholds to measure the biodegradability of hard surface cleaning products are given for the following sub-groups: surfactants and organic compounds.

All surfactants shall be readily degradable (aerobically). All surfactants classified as hazardous to the aquatic environment: Acute Category 1 (H400) or Chronic Category 3 (H412), in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council shall be in addition anaerobically biodegradable.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable, aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the limits for the reference dosage shown in Table 8.

Table 8: Biodegradability thresholds of organic compounds for laundry detergents

(source: European Commission 2017e)

aNBO

Product type	aNBO (g/kg of laundry) powder/tablets	aNBO (g/kg of laundry) liquid, capsules, gel
Heavy-duty laundry detergent, colour-safe detergent	1,00	0,45
Light-duty detergent	0,55	0,30
Stain remover (pre-treatment only)	0,10	0,10

anNBO

Product type	anNBO (g/kg of laundry) powder/tablets	anNBO (g/kg of laundry) liquid, capsules, gel
Heavy-duty laundry detergent, colour-safe detergent	1,10	0,55
Light-duty detergent	0,55	0,30
Stain remover (pre-treatment only)	0,10	0,10

Criteria 5 and 9. Excluded and restricted substances and information appearing on the EU Ecolabel

These criteria shall comply with the same requirements reported for the previous subgroups.

4.3.2.6 EU Ecolabel product group "Industrial and institutional laundry detergents"

The criteria for awarding the EU Ecolabel to Laundry "Industrial and institutional laundry detergents" cover the following aspects (European Commission 2017f):

1. Toxicity to aquatic organisms
2. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic compounds
3. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
4. Excluded and restricted substances
    a. Specified excluded and restricted substances
    b. Hazardous substances
    c. Substances of very high concern (SVHCs)
    d. Fragrances
    e. Preservatives
    f. Colouring agents
    g. Enzymes
    h. Corrosive properties
5. Packaging
    a. Packaging take-back systems
    b. Weight/utility ratio (WUR)
    c. Design for recycling
6. Fitness for use
7. Automatic dosing systems
8. User information
    a. Dosing instructions
    b. Packaging disposal information
    c. Environmental information
9. Information appearing on the EU Ecolabel
    a. Limited impact on the aquatic environment
    b. Restricted amount of hazardous substances
    c. Tested for cleaning performance

As for the previous subgroups, out of these nine criteria above, the "Biodegradability", "Excluded and restricted substances" and "Information appearing on the EU Ecolabel" criteria are more directly influenced by the use solvents in the manufacture of detergents for dishwashers.

Criterion 2. Biodegradability

Different thresholds to measure the biodegradability of hard surface cleaning products are given for the following sub-groups: surfactants and organic compounds.

All surfactants shall be readily degradable (aerobically). All surfactants classified as hazardous to the aquatic environment: Acute Category 1 (H400) or Chronic Category 3 (H412), in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council shall be in addition anaerobically biodegradable.

The content of organic substances in the product that are aerobically non-biodegradable (not readily biodegradable, aNBO) or anaerobically non-biodegradable (anNBO) shall not exceed the limits for the reference dosage shown in Table 9.

Table 9: Biodegradability thresholds of organic compounds for industrial and institutional laundry detergents

(source: European Commission 2017f)

aNBO (g/kg of laundry)

Soft water (< 1,5 mmol $CaCO_3$/l)			
Product type / Degree of soiling	Light	Medium	Heavy
Powder	0,70	1,10	1,40
Liquid	0,50	0,60	0,70
Multi-component system	1,25	1,75	2,50

Medium water (1,5-2,5 mmol $CaCO_3$/l)			
Product type / Degree of soiling	Light	Medium	Heavy
Powder	1,10	1,40	1,75
Liquid	0,60	0,70	0,90
Multi-component system	1,75	2,50	3,75

Hard water (> 2,5 mmol $CaCO_3$/l)			
Product type / Degree of soiling	Light	Medium	Heavy
Powder	1,40	1,75	2,20
Liquid	0,70	0,90	1,20
Multi-component system	2,50	3,75	4,80

anNBO (g/kg of laundry)

Soft water (< 1,5 mmol $CaCO_3$/l)			
Product type / Degree of soiling	Light	Medium	Heavy
Powder	0,70	1,10	1,40
Liquid	0,50	0,60	0,70
Multi-component system	1,25	1,75	2,50

Medium water (1,5-2,5 mmol $CaCO_3$/l)			
Product type / Degree of soiling	Light	Medium	Heavy
Powder	1,10	1,40	1,75
Liquid	0,60	0,70	0,90
Multi-component system	1,75	2,50	3,75

Hard water (> 2,5 mmol $CaCO_3$/l)			
Product type / Degree of soiling	Light	Medium	Heavy
Powder	1,40	1,75	2,20
Liquid	0,70	0,90	1,20
Multi-component system	2,50	3,75	4,80

Criteria 4 and 9. Excluded and restricted substances and information appearing on the EU Ecolabel

These criteria shall comply with the same requirements reported for the previous subgroups.

4.3.3 Targeted application: Inks

4.3.3.1 EU Ecolabel product group “Imaging equipment”

The criteria for awarding the EU Ecolabel to “Imaging equipment” cover the following aspects (European Commission 2013):

1. Availability of N-up printing
2. Duplex printing
3. Use of recycled paper
4. Energy efficiency
5. Restriction on indoor emissions
6. Noise emissions
7. Excluded or limited substances and mixtures
    a. Hazardous substances and mixtures
    b. Substances listed in accordance with Article 59(1) of Regulation (EC) No 1907/2006
8. Mercury in light sources
9. Design for disassembly
10. Design for recycling and/or reuse of toner and/or ink cartridges
11. Toner and/or ink cartridge take-back requirement
12. Substances in ink and toners

13. Packaging
14. Warranty, guarantee of repairs and supply of spare parts
15. User Information
    a. Environmental relevance of paper consumption
    b. Noise
    c. Ink and toner cartridges:
    d. A guide shall be provided with instructions on how to maximise the environmental performance of the particular imaging equipment
    e. Recycled paper
16. Information appearing on the EU Ecolabel
    a. Designed for efficient paper management
    b. High energy efficiency
    c. Minimised use of hazardous substances

Out of these 16 criteria above, the following three criteria “Restriction on indoor emissions”, “Excluded or limited substances and mixtures” and “Information appearing on the EU Ecolabel” are more directly influenced by the solvents used in the manufacture of imaging equipment:

Criterion 5. Restriction on indoor emissions

In the use phase the product shall not emit the air pollutants listed in, in amounts higher than the maximum emission rates, shown in the Table 10. All the maximum emission rates set out in Table 10 shall be measured in accordance with the requirements described in Blue Angel RAL UZ 171 of July 2012.

Table 10: Maximum emission rates for EU Ecolabel for “Imaging Equipment” (source: European Commission 2013)

Maximum emission rates for air pollutants

Maximum emission rate in mg/h			
		Monochrome printing	Colour Printing
Ready mode	TVOC (**)	1 (Desktop products) 2 (Floor-mounted equipment, Volume > 250 litres)	1 (Desktop products) 2 (Floor-mounted equipment, Volume > 250 litres)
Printing mode (sum of Ready + Printing mode)	TVOC (**)	10	18
	Benzene	< 0,05	< 0,05
	Styrene	1,0	1,8
	Not identified single VOC substances (**)	0,9	0,9
	Ozone (*)	1,5	3,0
	Dust (*)	4,0	4,0

(*) Only for electro-graphic (EP)-printing.
(**) The list of the ‘identified VOCs’ in the measuring method is provided in Blue Angel Ral UZ 171 of July 2012, Annex S-M Chapter 4.5.

Criterion 7. Excluded or limited substances and mixtures

The hazardous substance restriction and derogation list are important in all EU Ecolabel product categories and will be analyzed further in section 4.4.

Criterion 16. Information appearing on the EU Ecolabel

Optional label with text box shall contain the following text which may be influenced by the use of solvents in the manufacture of the product:

- Minimised use of hazardous substances

4.3.4 Targeted application: Personal care products

4.3.4.1 EU Ecolabel product group "Rinse-off cosmetics"

The criteria for awarding the EU Ecolabel to Laundry "Rinse-off cosmetics" cover the following aspects (European Commission 2014b):

1. Toxicity to aquatic organisms: Critical Dilution Volume (CDV)
2. Biodegradability
    a. Biodegradability of surfactants
    b. Biodegradability of organic ingoing substances
3. Excluded or restricted ingoing substances and mixtures
    a. Specified excluded and restricted substances
    b. Hazardous substances and mixtures
    c. Ingoing substances listed in accordance with Article 59(1) of Regulation (EC) No 1907/2006
    d. Fragrances
    e. Preservatives
    f. Colorants
4. Packaging
    a. Primary packaging
    b. Packaging Impact Ratio (PIR)
    c. Design of primary packaging
    d. Design for recycling of plastic packaging
5. Sustainable sourcing of palm oil, palm kernel oil and their derivatives
6. Fitness for use
7. Information appearing on the EU Ecolabel
    a. Reduced impact on aquatic ecosystems,
    b. Fulfils strict biodegradability requirements,
    c. Limits packaging waste.

Out of these seven criteria above, the following three criteria "Biodegradability", "Excluded or limited substances and mixtures" and "Information appearing on the EU Ecolabel" are more directly influenced by the solvents used in the manufacture of rinse-off cosmetics:

Criterion 2. Biodegradability

The content of all organic ingoing substances in the product that are aerobically non-biodegradable (not readily biodegradable) (aNBO) and anaerobically non-biodegradable (anNBO) shall not exceed the limits in Table 11.

Table 11: Biodegradability thresholds of organic compounds for EU Ecolabel for rinse-off cosmetics (source: European Commission 2014b)

aNBO and anNBO limits

Product	aNBO (mg/g AC)	anNBO (mg/g AC)
Shampoo, shower products and liquid soaps	25	25
Solid soaps	10	10
Hair conditioners	45	45
Shaving foams, shaving gels, shaving creams	70	40
Shaving solid soaps	10	10

Criterion 3. Excluded or limited substances and mixtures

The following substances shall not be included in the product formulation regardless of concentration: alkyl phenol ethoxylates and other alkyl phenol derivatives, nitrile-tri-acetate (NTA), butylated hydroxy toluene (BHT), formaldehyde and formaldehyde releasers.

Furthermore, the EU Ecolabel may not be awarded to any product that contains substances meeting the criteria for classification with the hazard statements and risk phrases specified in section 4.4 in accordance with Regulation (EC) No 1272/2008 of the European Parliament and of the Council or Council Directive 67/548/EC.

Criterion 7. Information appearing on the EU Ecolabel

The optional label with text box shall contain the following text which may be influenced by the use of solvents in the manufacture of rinse-off cosmetics:

- Reduced impact on aquatic ecosystems
- Fulfils strict biodegradability requirements

4.4 Restriction of hazardous substances and mixtures

The EU Ecolabel may not be awarded to any product that contains hazardous substances and mixtures in accordance with the rules set out in the following sub-criteria which apply to:

- Hazardous classifications and risk phrases
- Substances of Very High Concern
- Group-specific other listed substances

4.4.1 Hazard statements and Risk Phrases at EU Ecolabel

The most recent classification rules adopted by the Union shall take priority over the listed hazard classifications and risk phrases. In accordance with Article 15 of Regulation (EC) No 1272/2008 applicants of EU Ecolabel shall therefore ensure that classifications are based on the most recent rules on the classification, labelling and packaging of substances and mixtures and are required to calculate the hazard classification of the final product in order to demonstrate compliance.

Overall restrictions to hazard classification and risk phrases

The final product formulation, including all intentionally added ingredients present at a concentration of greater than 0,010%, shall not contain substances or mixtures classified as toxic, hazardous to the environment, respiratory or skin sensitizers, or carcinogenic, mutagenic or toxic for reproduction in accordance with Regulation (EC) No 1272/2008 or Council Directive 67/548/EC (1) and as interpreted according to the hazard statements and risk phrases listed in Table 12 of this criteria.

Table 12: EU Ecolabel restricted hazard classifications and risk phrases and their categorization (source: European Commission 2014, 2017a, b, c, d, e and f)

Restricted hazard classifications and their categorisation

Acute toxicity	
Categories 1 and 2	*Category 3*
H300 Fatal if swallowed (R28)	H301 Toxic if swallowed (R25)
H310 Fatal in contact with skin (R27)	H311 Toxic in contact with skin (R24)
H330 Fatal if inhaled (R23/26)	H331 Toxic if inhaled (R23)
H304 May be fatal if swallowed and enters airways (R65)	EUH070 Toxic by eye contact (R39/41)
Specific target organ toxicity	
Category 1	*Category 2*
H370 Causes damage to organs (R39/23, R39/24, R39/25, R39/26, R39/27, R39/28)	H371 May cause damage to organs (R68/20, R68/21, R68/22)
H372 Causes damage to organs through prolonged or repeated exposure (R48/25, R48/24,R48/23)	H373 May cause damage to organs through prolonged or repeated exposure (R48/20, R48/21,R48/22)
Respiratory and skin sensitisation	
Category 1A/1	*Category 1B*
H317 May cause allergic skin reaction (R43)	H317 May cause allergic skin reaction (R43)
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled (R42)	H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled (R42)
Carcinogenic, mutagenic or toxic for reproduction	
Categories 1A and 1B	*Category 2*
H340 May cause genetic defects (R46)	H341 Suspected of causing genetic defects (R68)
H350 May cause cancer (R45)	H351 Suspected of causing cancer (R40)
H350i May cause cancer by inhalation (R49)	
H360F May damage fertility (R60)	H361f Suspected of damaging fertility (R62)
H360D May damage the unborn child (R61)	H361d Suspected of damaging the unborn child (R63)
H360FD May damage fertility. May damage the unborn child (R60, R60/61)	H361fd Suspected of damaging fertility. Suspected of damaging the unborn child (R62/63)
H360Fd May damage fertility. Suspected of damaging the unborn child (R60/63)	H362 May cause harm to breast fed children (R64)
H360Df May damage the unborn child. Suspected of damaging fertility (R61/62)	
Hazardous to the aquatic environment	
Categories 1 and 2	*Categories 3 and 4*
H400 Very toxic to aquatic life (R50)	H412 Harmful to aquatic life with long-lasting effects (R52/53)
H410 Very toxic to aquatic life with long-lasting effects (R50/53)	H413 May cause long-lasting effects to aquatic life (R53)
H411 Toxic to aquatic life with long-lasting effects (R51/53)	
Hazardous to the ozone layer	
H420 Hazardous to the ozone layer (R59)	

CLP versus DSD equivalence

Equivalence between mixture classifications according to the Dangerous Substances Directive 67/548/EEC (referred to as DSD) and those made according to Regulation (EC) No 1272/2008 (the CLP Regulation) can be found in Table 13. The final product shall not be classified and labelled as being acutely toxic, a specific target organ toxicant, a respiratory or skin sensitizer, or carcinogenic, mutagenic or toxic for reproduction hazardous to the environment, in accordance with Regulation (EC) No 1272/2008 or Directive 67/548/EEC.

Table 13: CLP versus DSD equivalence for EU Ecolabel

(source: European Commission 2014, 2017a, b, c, d, e and f)

Final product classification: CLP versus DSD equivalence

CLP Mixture classification	DSD equivalent
Acutely toxic	T or T+
Specific target organ toxicant	T, T+ or Xn
A respiratory or skin sensitiser	—
A carcinogen, mutagen or reproductive toxicant	Carcinogen, Mutagen or Reproductive toxicant categories 1-3
Hazardous to the environment	N (excluding R53 and R52/53)

4.4.2 Restrictions that apply to substances of Very High Concern

In accordance with Article 6(7) of Regulation (EC) No 66/2010 the final product and any ingredients or raw materials, shall not, unless specifically derogated, contain substances that:

- Meet the criteria in Article 57 of the REACH Regulation.

- Have been identified according to the procedure described in Article 59(1) of the REACH Regulation which establishes the Candidate List for Substances of Very High Concern.

No derogation shall be given concerning substances that meet one or both of these conditions, and which are present in a product at concentrations higher than 0.10% (weight by weight).

5 Conclusions

- Hazard communication and EU ecolabelling possibilities are two completely different aspects from a regulatory point of view.
- EN 16766/2017 on bio-based solvents does not provide a lot of binding or helpful information for ecolabelling of bio-based solvents. The definition of what a bio-based solvent is, could be useful – but for ecolabelling, the properties of a solvent are much more decisive than what it is made from.
- The most relevant aspect for any labelling activity provided by EN 16766/2017 is the section on determining the bio-based content. In order to be classified as a bio-based solvent, the bio-based carbon content of the material needs to be at least 25%.
- The EU Ecolabel is end-product specific and there are no EU Ecolabel criteria specifically for solvents as usually consumers do not purchase solvents directly. Instead, they are either used as process agent or as part of a formulation of which the end-product consists.

- End-products, that are already represented in product catalogues of the EU Ecolabel criteria and for which bio-based solvents could potentially be used in their production, were identified. The following existing application groups were identified as relevant:
    - Paints & Coatings
    - Cleaning products
    - Inks
    - Personal care products
- The relevance of environmental criteria differs widely depending on the typical use of a product, its potential loss in the environment, its contact to humans, its end-of-life options.
- Out of the many different EU Ecolabel criteria for different end-product groups the “Biodegradability”, “Excluded and restricted substances” and “Information appearing on the EU Ecolabel” are the criteria that are directly influenced by the use of solvents in the manufacture of the corresponding end-products.
- Content limits of VOCs and SVOCs are reported in two EU Ecolabel criteria catalogues, namely of the “paints and varnishes” and “imaging equipment” (Inks).
- Content limits of all organic ingoing substances, including solvents, in the product that are aerobically non-biodegradable (not readily biodegradable) (aNBO) and anaerobically non-biodegradable (anNBO) are reported for the specific end-applications.
- As any chemical, the substance(s) composing the bio-based solvent shall be fully in compliance with REACH regulation (EC 2006), especially for their registration and classification, and with GHS/CLP regulation for the labelling. In addition, a bio-based solvent shall comply with any other EU regulations related to chemicals. (CEN 2015)
- The information appearing on the EU Ecolabel of different end-groups give possibilities for the bio-based solvents for the further recognition of their properties like low emission values, biodegradability and low toxicity. The regulation of the EU Ecolabel allows statements like:
    - Limited impact on the aquatic environment
    - Restricted amount of hazardous substances
    - Reduced content of volatile organic compounds (VOCs): x g/l

Ecolabelling is application-specific, so the learnings from this report can only be preliminary. They can be used to further select the many solvents being screened in the project; more detailed analysis can only be made when the products, their properties and the targeted end-applications are known.

6 Appendices

6.1 Definitions

Substance: means a chemical element and its compounds in the natural state or obtained by any manufacturing process, including any additive necessary to preserve its stability and any impurity deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition

Mixture: means a mixture or solution composed of two or more substances.

Intermediate: means a substance that is manufactured for and consumed in or used for chemical processing in order to be transformed into another substance.

VOCs: The European Union defines a VOC as "any organic compound having an initial boiling point less than or equal to 250 °C (482 °F) measured at a standard atmospheric pressure of 101.3 kPa." The VOC Solvents Emissions Directive is the main policy instrument for the reduction of industrial emissions of volatile organic compounds (VOCs) in the European Union.

SVOCs: Semi-volatile organic compounds (SVOCs) are a subgroup of VOCs that tend to have a higher molecular weight and higher boiling point temperature. SVOCs are of concern because of their abundance in the indoor environment and their potential for negative health effects on humans.

Biodegradability: The capacity of a material to decompose over time as a result of biological activity, especially to be broken down by microorganisms. Biodegradability is a very broad term and does not automatically mean that a product will degrade in any environment. It is dependent on factors such as temperature, time and the presence of bacteria and fungi in the specific environment.

6.2 List of Standards and Norms

Directive 2004/42/CE of the European Parliament and of the Council of 21 April 2004 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products and amending Directive 1999/13/EC (OJ L 143, 30.4.2004, p. 87).

EN 16640, Bio-based products - Bio-based carbon content - Determination of the bio-based carbon content using the radiocarbon method.

EN 16751, Bio-based products - Sustainability criteria.

EN 16766/2017, Bio-based solvents - Requirements and test methods; German version.

EN 16785-1, Bio-based products - Bio-based content - Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis.

EN 16848, Bio-based products - Requirements for Business to Business communication of characteristics using a Data Sheet.

EN 16935, Bio-based products - Requirements for Business-to-Consumer communication and claims.

ISO 11890-2:2013. Paints and varnishes -- Determination of volatile organic compound (VOC) content -- Part 2: Gas-chromatographic method

ISO 14024:1999: Environmental labels and declarations – Type I environmental labelling – Principles and procedures (ISO 1999)

ISO 17895:2005: Paints and varnishes -- Determination of the volatile organic compound content of low-VOC emulsion paints (in-can VOC)

prEN 16785-2:2016, Bio-based products - Bio-based content - Part 2: Determination of the bio-based content using the material balance method.

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EU Ecolabel Helpdesk 2017: EU Ecolabel Logo guidelines: http://ec.europa.eu/environment/ecolabel/documents/logo_guidelines.pdf (last accessed 2018-04-25).

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