FACTSHEET ON THE USE OF PALM (KERNEL) OILS IN DETERGENTS, CLEANING AND MAINTENANCE PRODUCTS IN GERMANY

Some of the figures and data in this factsheet are estimates. They rely, inter alia, on surveys among market players. Wordings like “circa” or “around” are not used. The form of expression “palm (kernel) oil” means that both palm oil and palm (kernel) oil are referred to.

Summary

In terms of volume, surfactants were the largest group of ingredients in detergents, cleaning and maintenance products for private households in Germany in the year 2015 (184,000 tonnes). They are obtained from both renewable and petrochemical raw materials. Palm kernel oil and coconut oil are the main renewable inputs. . In 2015 the share of palm kernel oil in the manufacture of detergents, cleaning and maintenance products for private households in Germany amounted to 46,400 tonnes.

As a matter of principle, renewables are not per se more sustainable than petrochemical raw materials. The factsheet takes a differentiated approach to the cultivation and production conditions of oil palms and oils obtained from them and also addresses several sustainability standards.

INTRODUCTION

A wide range of ingredients with specific functions and properties are available for the manufacture of strongly performing detergents, cleaning and maintenance products. The entire value chain needs to be considered in order to continually improve the sustainability profile of these products. The value chain comprises the ingredients as such as well as raw materials from which the ingredients are produced.

In 2015 the total input volume of the major ingredients or groups of ingredients for detergents, cleaning and maintenance products in Germany was 530,000 tonnes.[1,2] With 184,000 tonnes, surfactants – i.e. surface-active substances – are the most important group in terms of volume.

In 2008 FORUM WASCHEN[3] decided to look more closely in the topic of renewable raw materials and, more specifically, to examine the use of palm kernel and coconut oils as raw materials for surfactant production and to elaborate factsheets.

[1] This figure refers to input quantities without water.

[2] IKW survey on the input volumes of major ingredients in detergents, cleaning and maintenance products in the year 2015 (see p. 12 of the IKW report on sustainability of the sector in Germany IKW-Bericht Nachhaltigkeit in der WPR-Branche in Deutschland 2015-2016: www.ikw.org/fileadmin/content/downloads/Haushaltspflege/HP_Nachhaltigkeitsbericht__15_16.pdf;; accessed in July 2017)

[3] Actors‘ workshop of the dialogue platform FORUM WASCHEN in Würzburg on 24/25 September 2008.

This paper is a fully revised version of the factsheet on the use of palm kernel oil in detergents, cleaning and maintenance products of 2010. Furthermore, a factsheet on the use of coconut oil in detergents, cleaning and maintenance products can be accessed on the website www.forum-waschen.de.

SURFACTANTS AND THEIR RAW MATERIAL BASE

Surfactants [blend word formed from **surf**(ace) **act**(ive) **a**(ge)**nt**] are compounds whose molecules contain a hydrophilic (polar) part and a hydrophobic (non-polar) part. They reduce the surface tension of a liquid or the interfacial tension between two phases.

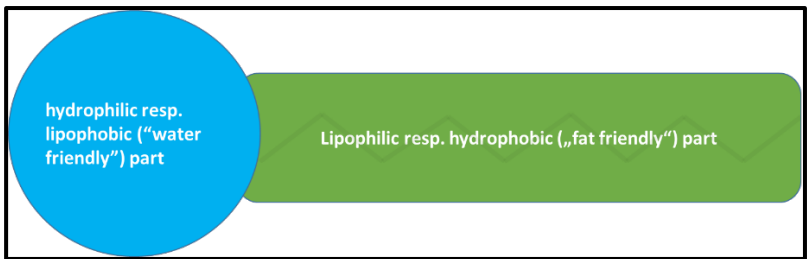

Figure 1: Schematic structure of surfactants including hydrophilic head (blue) and lipophilic rest.[4]

The differences between the various surfactants are negligible in the hydrophobic ("fat friendly") part of the molecule, while they are marked in the hydrophilic ("water friendly") part.

Anionic residues (negatively charged), non-ionic (uncharged), cationic (positively charged) or amphoteric residues (each with one negatively and one positively charged functional group) are used for the hydrophilic part of the molecule.

The hydrophobic part of the molecule is invariably a carbon residue that can be obtained from renewable (plant, animal) or fossil (petrochemical) raw materials.

Regarding the raw material sources, surfactants can be divided into three categories:

1. Surfactants obtained exclusively[5] from **renewable raw materials**[6]. But from aspects of cost and performance, these surfactants currently have a rather minor role in the manufacture of detergents, cleaning and maintenance products where volumes are concerned.
2. Surfactants obtained exclusively from **petrochemical raw materials.**
3. Surfactants that contain constituents based on both **renewable and petrochemical raw materials**.

[4] Publication – A brief introduction to the world of surfactants: Die fleißigen Verbindungen - Eine kurze Einführung in die Welt der Tenside, TEGEWA, Frankfurt am Main, 2014: http://www.tegewa.de/uploads/media/Tensid_Broschuere_2014_deutsch.pdf

[5] Not taking into account the inorganic constituents.

[6] Renewable raw materials for surfactant production can be: palm kernel oil, palm oil or coconut oil as well as other vegetable oils, animal fats but also sugar.

Based on the total volume of 184,000 tonnes of surfactants[2] that were used in 2015 in Germany for the manufacture of detergents, cleaning and maintenance products for private households, the following input volumes are estimated for the individual categories[7]:

Category 1: 13,000 tonnes of surfactants (based exclusively on **renewable raw materials**)
Category 2: 92,000 tonnes of surfactants (based exclusively on **petrochemical raw materials**)
Category 3: 79,000 tonnes of surfactants (based on **renewable and petrochemical raw materials**)

Among the renewables used in surfactant production, mainly oils and fats[8] are economically important.[9] Particularly palm kernel oil and coconut oil are technically relevant as raw materials because of their high share of fatty acids in the medium carbon chain length (C_{12-14})[10], with palm kernel oil having the greater economic importance.[11] Palm oil is chemically different from palm kernel oil; it has only a very minor role in surfactant production. Also oils from local crops (e.g. sunflowers or rapeseed) are chemically different from palm kernel oil, but basically they are suitable for surfactant production. However, formulating detergents and cleaning products with such surfactants requires sophisticated technical efforts.

OILS FROM THE OIL PALM

OBTAINING OILS AND THEIR ECONOMIC IMPORTANCE

Oil palms provide not only palm kernel oil (yield: 10 percent)[12] but mostly palm oil (yield: 90 percent)[12]. The latter is obtained from pulp; it is the most important vegetable oil[8] in terms of globally produced volumes. Palm oil is used preferably for food purposes, with its use for energy (inter alia, as biodiesel) having increased considerably in the past years.[13] Palm oil is used in special fields of the food industry, but mainly as a raw material in chemistry (inter alia, for surfactant production)[14].
Out of the 123,000 tonnes of palm kernel oil consumed in 2015 in Germany, 78,000 tonnes were used for surfactant and soap production[15] and further 16,000 tonnes for the production

[7] J. Tropsch, Europe's bio-based initiative: standardization in the surfactants industry, 4. ICIS European Surfactants Conference, Berlin, 2015.
[8] Oils and fats consist of one glycerin molecule and three fatty acid residues. However, only the fatty acid residues can be considered for surfactant production.
[9] Surfactants obtained from renewables are also used by way of biotechnological methods, but these are not included in this examination.
[10] Oils with such fatty acids are frequently called *laurics*. Their main constituents are lauric acid (dodecanoic acid) and myristic acid (tetradecanoic acid).
[11] Further details on the use of palm kernel oil and coconut oil as materials and its impacts: A. Üllenberg et al., Nachwachsende Rohstoffe für die stoffliche Nutzung – Auswirkungen für Entwicklungs- und Schwellenländer, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, Eschborn, 2011: http://star-www.giz.de/fetch/34Q00i3XO0001jgtGg/giz2011-0449de-nachwachsende-rohstoffe.pdf (accessed in July 2017)
[12] The shares of palm oil yield (90 percent) and palm kernel oil yield (10 percent) were determined through the ratio of volumes produced globally in 2015 (palm oil: 63 million tonnes; palm kernel oil 7 million tonnes).
[13] Renewable Energy Progress Report, Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 2017.
[14] In this connection, surfactants are also called derivatives or secondary products.
[15] Mixtures in water of soluble alkaline salts of higher fatty acids (C_{20}-C_{22}) are called soap. The soaps obtained from a saponification reaction are the simplest form of surfactants.

of other chemical products (e.g. candles). 29,000 tonnes of palm kernel oil were processed in the food sector.[16]

Out of the 78,000 tonnes of palm kernel oil used in surfactant production, 46,400 tonnes were used in the detergents, cleaning and maintenance products sector for private consumers and 15,400 tonnes in the cosmetics sector. The remaining 16,200 tonnes were used to produce detergents and cleaning products for professional and industrial applications and for soaps[15] or syndets[17]. Palm oil has a very minor role in the production of surfactants for detergents, cleaning and maintenance products (1,200 tonnes).[18,19]

Based on the total tonnage of surfactants of 184,000 tonnes and the share of renewables in the hydrophobic part of the molecule, an alternative estimate is in the same order of magnitude regarding the volumes of input vegetable oil.[5,20]

For the reporting year 2014, the Food and Agricultural Organization of the United Nations (FAO) determined for oil palms a global total of over 18 million hectares of agricultural land. Thus, the areas under cultivation have more than tripled since 1990.[21] Other sources estimate agricultural areas of 14 million hectares for 2014. This would correspond to 5.5 percent of the global areas used for oil crop cultivation.[22]

For the year 2015, the globally produced volumes are estimated to amount to 63 million tonnes for palm oil and 7 million tonnes for palm kernel oil. The most important producer countries are Indonesia and Malaysia, with shares in global palm oil production of 53 percent and 32 percent, respectively. Thailand ranks third with a share of just 2.9 percent.[23] While cultivation areas are growing only slowly in Southeast Asia, palm oil cultivation is expanding in West Africa and also in South America.

The main reasons for the strong expansion of the palm oil industry are the manifold possibilities for using palm oil and the low production costs. For example, in their main

[16] Final report on the palm oil market in Germany in 2015, chart 40: Der Palmölmarkt in Deutschland im Jahr 2015 Endbericht, Meo Carbon Solutions Team, Köln, 7. September 2016, Folie 40: http://www.forumpalmoel.org/imglib/downloads/20160927_Palmoel-in-Deutschland_Endbericht.pdf (accessed in July 2017)

[17] Syndets are synthetic, wash-active substances intended to replace soaps.

[18] Final report on the palm oil market in Germany in 2015, chart 93: Der Palmölmarkt in Deutschland im Jahr 2015 Endbericht, Meo Carbon Solutions Team, Köln, 7. September 2016, Folie 93: http://www.forumpalmoel.org/imglib/downloads/20160927_Palmoel-in-Deutschland_Endbericht.pdf (accessed in July 2017)

[19] Final report on the palm oil market in Germany in 2015, chart 91: Der Palmölmarkt in Deutschland im Jahr 2015 Endbericht, Meo Carbon Solutions Team, Köln, 7. September 2016, Folie 91: http://www.forumpalmoel.org/imglib/downloads/20160927_Palmoel-in-Deutschland_Endbericht.pdf (accessed in July 2017)

[20] The total of 40 percent of input volume of category 3 surfactants (40% share of renewable raw materials x 79,000 tonnes = 31,600 tonnes) and the input volume of category 1 surfactants (13,000 tonnes) results, rounded up, in a tonnage of 45,000 tonnes of renewable raw materials for the year 2015.

[21] FAO (Food and Agricultural Organization), 2017: FAOSTAT, production, crops, Rome: FAO (accessed in July 2017)

[22] http://www.palmoilresearch.org/statistics.html (accessed in July 2017)

[23] Oil World 2016, www.ovid-verband.de/unsere-branche/daten-und-grafiken/pflanzenoel (accessed in July 2017)

cultivation areas, oil palms can be harvested throughout the year in tropical regions. This results in high yields per area compared to other oil fruits.

Oil crop	Yield per area [tonnes per hectare]
Oil palm	3.3 (palm oil)
	0.37 (palm kernel oil)*
Rapeseed[24]	1.4 (in Germany)
Sunflower	0.7 (sunflower oil)
Coconut palm	0.7 (coconut oil)
Soya	0.4 (soya oil)

Table 1: Oil crops and average yield per area in tonnes of oil per hectare/cultivation area[25] *(*the yield per area for palm kernel oil results indirectly from the volume of palm kernel oil that can be obtained from the palm fruit.*[12]*)*

Because of the higher yield per area of oil palms, the volumes of palm (kernel) oil produced clearly increase more strongly than those of other oil crops (e.g. coconut oil).

The yield of 3.3 tonnes of palm oil per hectare is an average that also includes, in particular, the large number of small farms. Small farmers typically have much lower yields.[26] Today, well-managed plantations already achieve yields of 5.7 tonnes per hectare of cultivation land.[27] In optimal cultivation conditions, top yields of up to 8 tonnes per hectare of cultivation land are possible.[28]

THE VALUE CHAIN FOR SURFACTANTS BASED ON PALM (KERNEL) OIL

In order to avoid quality losses, the oil palm fruits ("fresh fruit bunches"), from which palm oil is obtained, need to be processed fast. Therefore, the oil mills are usually in the direct vicinity of the cultivation areas. By contrast, palm kernels can be stored over long periods of time and transported without any loss in quality. Compared to the extraction of palm oil, obtaining palm kernel oil requires greater technical efforts and more energy. At the next stages, palm kernel oil is processed into large numbers of various derivatives, mainly surfactants (see fig. 2).

[24] Agriculture and forestry, fishery, Destatis (German Federal Statistical Office), Wiesbaden, August/September 2016.
[25] Calculations for a more palm oil-free world: Auf der Ölspur – Berechnungen zu einer palmölfreieren Welt, WWF Deutschland, Berlin, 2016: https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Studie_Auf_der_OElspur.pdf
[26] RSPO IMPACT REPORT 2016, p. 41 et. seq.
[27] Martin Bek-Nielsen (United Plantations), personal communication.
[28] From food to fuel / Developments and forecasts for a contentious plantation product: F. Adams, Palmöl, Vom Nahrungsmittel zum Treibstoff. Entwicklungen und Prognosen für ein umstrittenes Plantagenprodukt, Stuttgart, Brot für die Welt, 2011.

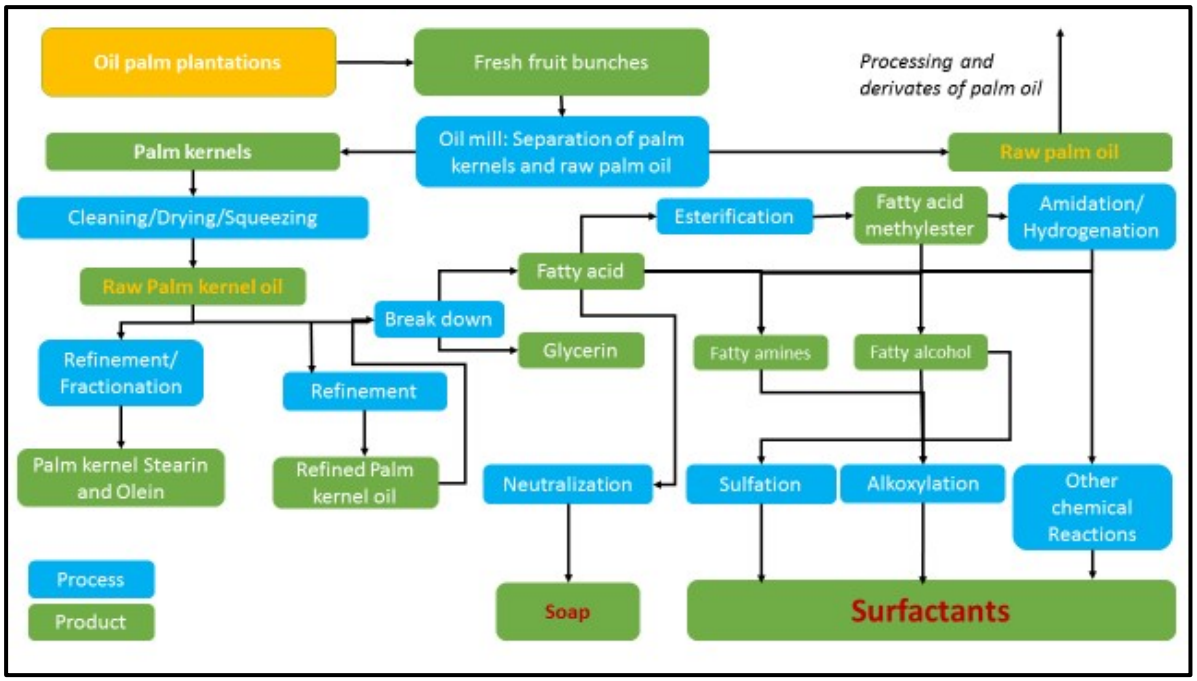

Figure 2: Exemplary processing and value chain of palm kernel oil and the corresponding derivatives.

SUSTAINABILITY ASPECTS

The use of renewables can be an alternative to the use of fossil, non-renewable resources.[29] In principle, renewables are not per se more sustainable than petrochemical raw materials. Here, the conditions for obtaining and producing the respective raw materials are decisive.

Assessing the cultivation of oil palms from a sustainability perspective depends on the ecological, economic and social conditions.

Ecological aspects:

- Biodiversity
- Protection of land areas with high carbon sequestration like forests, peat moors and wetlands
- Quality of water and air
- Fertility of soils

Socio-economic and socio-cultural aspects:

- Living conditions and land rights of the local population (indigenous population and small farmers)
- Living and working conditions of plantation workers (inter alia, pay that secures a livelihood)

In the expansion of cultivation areas for oil palms, primary forests or other areas with high carbon sequestration are still being converted into plantations. This frequently destroys the means of existence of population groups whose livelihood strongly depends on traditional land use. Moreover, forest clearance comes with a loss of valuable eco-systems and

[29] H. van Zutphen, Comparative LCA Analysis of Different Edible Oils and Fats. Vortrag (verschriftlicht) auf der Tagung "International Palm Oil Sustainability Conference", 13.-15. April 2008, Sutera Harbour Resort, Kota Kinabalu, Malaysia.

biodiversity and results in the release of large amounts of carbon dioxide (CO_2; the major greenhouse gas in terms of volume). A topical study shows that land use changes in the oil palm industry have the strongest effect on greenhouse gas emissions, beside the treatment of waste water from the oil mills and the squeezed "fresh fruit bunches".[30]

As late as in the 1990s the rededication of existing plantations of other tropical crops, e.g. rubber plantations, was of great importance. Today, it is the development of fallow land that has a regional potential for expanding the cultivation areas.[31] But in many cases, the complex and barely documented property situation renders such rededication difficult. Furthermore, these areas are often in a wild state so that agricultural use requires a major input effort.

In addition the pressure to expand oil palm plantations to valuable natural areas can be reduced by sustainably increasing the yield of existing cultivation areas or by a more efficient or sparing use of the products obtained from them. This presupposes improved cultivation and harvesting techniques, sound agricultural advice and training for producers. The topical study shows that dynamics have slowed down in the expansion of cultivation areas for oil palms in Indonesia and Malaysia.[32]

CERTIFICATION SYSTEMS AS A SOLUTION FOR A MORE SUSTAINABLE PALM OIL INDUSTRY

The certification of products and production methods offers certain chances for steering the production of (agricultural and forestry) goods onto a track that is more compatible socially and environmentally, but there are clear limitations to this approach. For certification to unfold its positive effect, firstly, the criteria must have an adequate content and, secondly, such standards need to be checked reliably.[33]

There are various certification systems with fundamental differences in their scope, structure, intentions and accreditation procedures. Certification of palm oil is possible, inter alia, by the Roundtable on Sustainable Palm Oil (RSPO), the International Sustainability & Carbon Certification (ISCC EU) and the Roundtable on Sustainable Biomaterials (RSB). Every system has its own strengths and weaknesses. However, a fundamental problem is the non-existent or very weakly developed monitoring and assessment scheme for covering the effects of certification.[34]

On the international market, ISCC EU is the most widely used standard for certifications according to the Renewable Energy Directive (2009/28/EC).

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[30] J. Shah, E. Aslan, J. Cirucci, J. O'Brien, D. Moss, Comparison of Oleo- vs. Petro-Sourcing of Fatty Alcohols via Craddle-to-Gate Life Cycle assessment, J Surfactant Detergent, 2016, 19, p. 1333-1351.

[31] T. Fairhurst, D. McLaughlin, Sustainable Oil Palm Development on Degraded Land in Kalimantan, WWF, Januar 2009.

[32] OECD FAO (2016), OECD-FAO Agricultural Outlook 2016-2025, OECD Publishing, Paris.

[33] Sustainable and resource-friendly use of global land areas and biomass / German Environment Agency: Globale Landflächen und Biomasse – nachhaltig und ressourcenschonend nutzen, Umweltbundesamt, page 84.

[34] A comparative analysis of certification systems for biomass for biofuels production: Der Nachhaltigkeit auf der Spur. Vergleichende Analyse von Zertifizierungssystemen für Biomasse zur Herstellung von Biokraftstoffen, WWF Deutschland 2013.

In terms of volume, the RSPO standard is the most important system in Germany for a certification of sustainable palm kernel oil.[35] As the first organisation, RSPO defined a standard that also includes the derivatives (e.g. surfactants)[14] in the certification. At present, 21 percent of the globally available palm (kernel) oil are certified according to RSPO standard.[36]

The RSPO was established in 2004. The RSPO membership consists of operators of oil palm plantations, palm (kernel) oil traders, delegates from the processing industry and consumer goods manufacturers, banks, and environmental/nature conservation and social organisations. In 2007, the RSPO adopted a certification scheme for the sustainable production and trade of oil from oil palms (palm oil and palm kernel oil).[37]

Manufacturers of detergents, cleaning and maintenance products can directly or indirectly support the sustainable production of palm (kernel) oil at various certification levels. "RSPO Credits / Book & Claim" is the lowest level of certification[38], because for this only volume equivalents of RSPO-certified palm (kernel) oil need to be produced that subsequently go onto the world market (see annex 2: RSPO certification level "RSPO Credits / Book & Claim").[39]

Since 2013 several surfactant producers are offering RSPO-certified surfactants based on mass-balanced and segregated sustainable palm (kernel) oil; this is the next highest certification level from "Book & Claim".[40] For mass-balanced palm (kernel) oil (RSPO certification level "Mass Balance"), certified palm (kernel) oil can be mixed with conventional palm (kernel) oil throughout the supply chain, with the share of sustainable palm (kernel) oil being documented. Therefore, a surfactant of certification level "Mass Balance" does not necessarily need to be produced from certified palm (kernel) oil. This RSPO certification level only confirms that the surfactant producer purchased an equivalent amount of certified palm (kernel) oil (see annex 2: RSPO certification level "Mass Balance"). A surfactant of RSPO certification level "Segregated" consists of palm (kernel) oil from various certified plantations (see annex 2: RSPO certification level "Segregated"). Palm (kernel) oil from this certification level is physically kept apart from non-certified palm (kernel) oil throughout the supply chain.

At the RSPO certification level "Identity Preserved" the origin of the palm (kernel) oil can be traced back to the individual certified plantation. However, for reasons of logistics this level has no role in the surfactant industry (see annex 2: RSPO certification level "Identify Preserved").

From the viewpoint of some interest groups, the progress achieved is still unsatisfactory. For example, the fact that the clearing of primary forests for setting up oil palm plantations cannot be excluded under RSPO criteria is also criticised.[34]

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[35] Final report on the palm oil market in Germany in 2015, chart 56: Der Palmölmarkt in Deutschland im Jahr 2015 Endbericht, Meo Carbon Solutions Team, Köln, 7. September 2016, Folie 56: http://www.forumpalmoel.org/imglib/downloads/20160927_Palmoel-in-Deutschland_Endbericht.pdf (accessed in July 2017)

[36] Annual production capacity for Certified Sustainable Palm Oil and Certified Sustainable Palm Kernel Production: http://www.rspo.org/about/impacts (accessed in July 2017)

[37] www.rspo.org (accessed in July 2017)

[38] „Level" is also known as „trade model" or „trade option".

[39] RSPO Supply Chain Systems Overview, RSPO Factsheets: www.rspo.org/certification/supply-chains (accessed in July 2017)

[40] Statement by the association TEGEWA, June 2016.

Initiatives like e.g. the “Palm Oil Innovation Group (POIG)”[41] or the “Forum Nachhaltiges Palmöl [FONAP][42] drive forward the discussion about sustainability criteria in the palm oil industry. In an indirect manner, this makes action necessary for the existing standards e.g. of the RSPO. Here, it is worth noting that the RSPO regularly (in five-year intervals) reviews the principles and criteria that form the basis for certification and is introducing an improved standard with RSPO Next (http://www.rspo.org/certification/rspo-next). At present, the focus is on topics like traceability up until the oil mill, requirements for protecting and preserving forests and peat moors, and involving the local population in decision processes.[43]

With the growing use of products based on renewables in the detergents, cleaning and maintenance products industry, the role of consumers increasingly gains importance. Consumer involvement through responsible and transparent communication can contribute to establishing existing standards in the market and, subsequently, to their further improvement. Consumers need to be enabled to make active buying decisions in favour of improved standards.

[41] http://poig.org (accessed in July 2017)
[42] http://www.forumpalmoel.org/de/fonap.html (accessed in July 2017)
[43] RSPO NEXT-Initiative: http://www.rspo.org/certification/rspo-next (accessed in July 2017)

ANNEXES

Annex 1: Facts, compact

	Reference region	Reporting year	Tonnage
Consumption of ingredients – detergents, cleaning and maintenance products for private households, excluding water	Germany	2015	530,000 t
Consumption of surfactants, general	Germany	2015	184,000 t
Consumption of palm kernel oil for surfactant production for detergents, cleaning and maintenance products for private households	Germany	2015	46,400 t
Consumption of palm oil for surfactant production for detergents, cleaning and maintenance products for private households	Germany	2015	1,200 t
Consumption of palm kernel oil, total	Germany	2015	123,000 t
Consumption of palm oil, total	Germany	2015	1,000,000 t[36]
Production of palm kernel oil	global	2015	7,000,000 t (thereof 21% RSPO certified)[36]
Production of palm oil	global	2015	63,000,000 t (thereof 21% RSPO certified)[36]

Annex 2: Description of RSPO certification levels[38]

Certification level[18]	Content	Certification System
1. Identity Preserved[44]	The origin of the certified palm (kernel) oil can be traced back to the individual oil palm plantation (level: plantation).	Certified throughout the value chain
2. Segregated	Certified palm (kernel) oil from various plantations, which is physically kept apart from non-certified palm (kernel) oil throughout the supply chain (level: oil mill).	Certified throughout the value chain
3. Mass Balance	The amount of certified palm (kernel) oil is documented, with certified and non-certified palm (kernel) oil being mixed (level: storage tank).	Certified throughout the value chain
4. RSPO Credits / Book & Claim	Certified palm (kernel) oil reaches the world market. Corresponding amounts are traded in the form of "credits" or certificates.	Companies at the end of the value chain can additionally buy "credits" or certificates, reflecting the amount of palm (kernel) oil used in the surfactants.

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FORUM WASCHEN is a dialogue platform of actors committed to sustainability in the fields of laundry, dishwashing and cleaning in households. It consists of experts from public authorities, federal ministries, research institutes, trade union, manufacturers of detergents, cleaning products and household appliances, churches and environmental and consumer organizations.

[44] For reasons of logistics this level has no role in the surfactant industry.