Think Globally, Buy Locally – New Approaches to Professional Cleaning and Care

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On May 22nd and 23rd, 2023, stakeholders from the cleaning and hygiene industries gathered in Constance for the annual conference of the SEPAWA Professional Cleaning & Care Specialist Group.

This conference is aimed at manufacturers and users of professional products and has been providing information on current developments in this field for over fifteen years. The conference was moderated by **Tobias Potstada** and covered three thematic areas.

Due to the disrupted supply chains caused by the COVID-19 pandemic, two presentations focused on supply security. One presentation highlighted the issue from the perspective of an association **(Mr. Entner, Presentation 1)**, and the other from the perspective of a distributor **(Mr. Heimbach, Presentation 2)**.

Environmental protection has a strong influence on formulations in the field of cleaning and care due to various existing or anticipated regulations. The topic of microplastic avoidance has been a concern in the industry for some time and will continue to be so, as the filtration of fibrous microplastics in washing machines will be mandatory in France from 2025. Three presentations showcased the range of challenges in this regard. These included an examination of legislative aspects within the framework of ECHA regulations **(Mr. Entner, Presentation 4)**, a presentation of findings on the formation and prevention of microplastics during washing **(Brandt, Presentation 3)**, and an exploration of the handling of microplastics in floor care by a polymer manufacturer **(Ms. Mannheim and Mr. Bach, Presentation 5)**. Thus, there is a need for biodegradable components in floor care products, such as polymers based on PU **(Mr. Bernhard Sölle – Presentation 6)**, wood-derived glycols **(Mr. John, Presentation 7)**, or natural waxes **(Dr. Krendlinger, Presentation 8)**.

A practical perspective rounded out the program. One presentation provided an update on the current state of solar cleaning from a manufacturer of solar cleaning systems **(Mr. Kneiber, Presentation 9)**, while another took a closer look at questionable cleaning methods from the perspective of a cleaning product manufacturer **(Ms. Nerowski, Presentation 10)**.

As usual, on the first day's evening, attendees had the opportunity to exchange information and industry news on the lakeside terrace. The next conference is expected to take place in May or June 2024 in Constance.

Presentation 01: Raw Material Supply in Uncertain Times (Marcello Entner, Austrian Federal Economic Chamber / Association of the Chemical Industry of Austria (FCIO))

In his presentation, Mr. Marcello Entner from the Association of the Chemical Industry of Austria (FCIO) described the economic situation of the European chemical industry. Based on current data, he referred to the positive development of sales in recent years, particularly since 2021. However, this trend in sales figures is primarily attributed to inflation, as the production volumes have not increased to the same extent.

One of the main drivers of price increases mentioned by Mr. Entner is the rising energy prices, which have currently stabilized at a high level after a significant increase. For example, this trend in energy costs led to a 17% increase in manufacturer prices for soaps and detergents in the EU compared to the previous year. Consequently, this will result in a competitive disadvantage for Europe.

The chemical industry is also concerned about the shortage of skilled workers. 72% of the surveyed companies stated that they are heavily affected by the shortage of skilled workers, which has a significant impact on business operations and expansion efforts. The prevailing inflation also drives up labor costs and exacerbates the situation further.

Despite the significant economic challenges, Mr. Entner concluded his presentation with a cautiously positive outlook, partly because the sentiment in the chemical sector is gradually improving.

Presentation 02: Supply Security and Supply Chain Issues from the Distributor's Perspective (Daniel Heimbach, Julius Hoesch GmbH & Co. KG)

The past few years have certainly not been easy for producers of cleaning and care products in terms of product availability, marked by volatility and fluctuations. However, this challenging time has brought about significant changes not only for customers but also for raw material distributors. Mr. Daniel Heimbach, Head of Sales & Procurement at Julius Hoesch, explained in his presentation how the supplier of industrial and specialty chemicals has dealt with these challenges. The three phases of the supply chain – procurement, production, and distribution – have faced unprecedented problems within a short period of time:

Due to the pandemic, demand plummeted within a few weeks, and even in recovering markets, supply chains remained disrupted. This was further compounded by long-standing trade disputes between the US and China, the Ukraine conflict, and individual events such as the Ever Given container ship incident. At the same time, new regulatory requirements such as the Supply Chain Due Diligence Act came into effect. These challenges were further compounded by a shortage of skilled workers in the logistics sector.

To better mitigate these events, which are beyond the distributor's control, and to prevent supply shortages in the future, various strategies have been defined. These include diversifying suppliers, strengthening the sourcing strategy in Europe, and establishing transparent supply chains. Additionally, inventory management is being optimized.

To reduce risks in the long run, a sustainable multi-supplier strategy is being pursued. Moreover, awareness of the relationship between price and performance must be established, allowing for a confident stance against the "cheap is good" logistics and procurement mentality.

Presentation 03: New Insights into Sources, Sinks, and Solutions for Fibrous Microplastics (Stefan Brandt, University of Applied Sciences Niederrhein, Krefeld)

At the beginning of the presentation, Mr. Brandt explained the definition and differences between specifically fibrous microplastics from textiles and microplastics in general. Microplastics are defined as particles with a diameter of less than 5 mm. In contrast, fibrous microplastics are usually only a few micrometers thick, which allows them to easily reach wastewater treatment plants. However, the microplastics retained there are not disposed of through incineration but are instead, to a significant extent, spread as fertilizer on fields through sewage sludge, thus remaining in the environment. In Germany, approximately 80 g of fiber abrasion from synthetic textile washing is released per person annually. According to an estimate from 2017, fibrous microplastics from synthetic textiles account for 35% of the microplastics in the world's oceans. This high contamination is caused by the large proportion of polyester fibers in textiles, accounting for about 50% **(Figure 1)**.

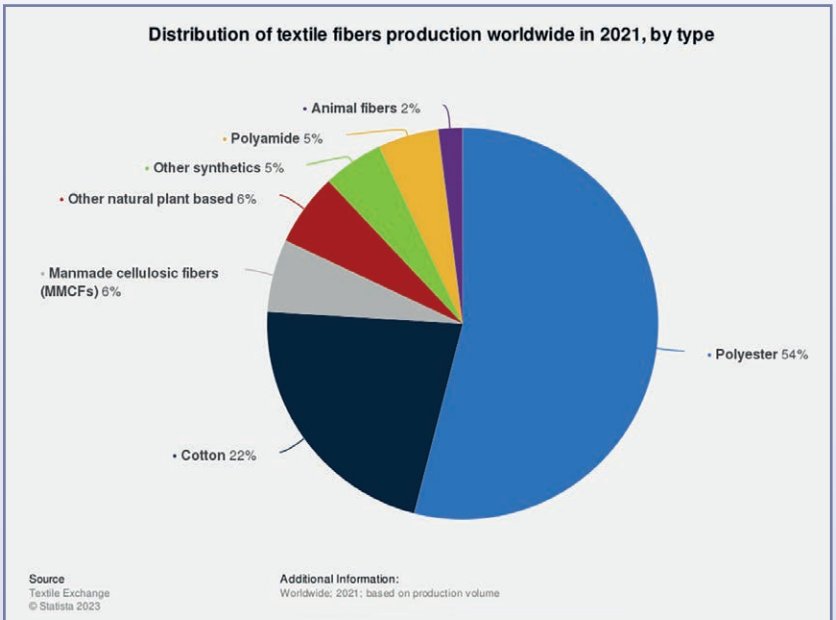


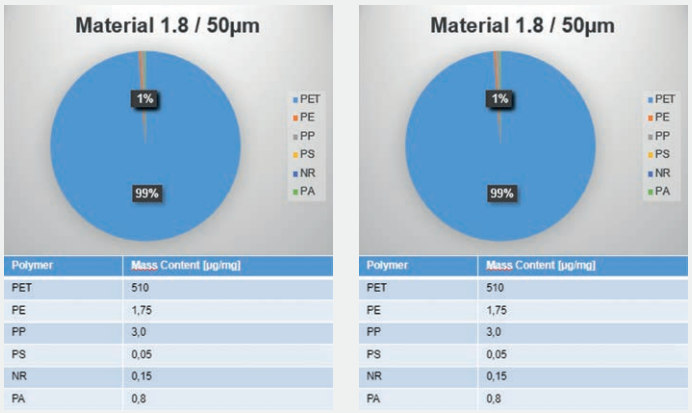
Fig. 1 The global distribution of fiber types in fiber production in 2021 shows that polyester dominates the world fiber market with 54%. *Source: Statista based on data from Textile Exchange.*

These fibers are mainly used in outdoor clothing, which has a high growth rate, as well as in bulky knits (fleece®).

The TextilMission project was launched in 2017, involving various partners (University of Applied Sciences Niederrhein, Technical University of Dresden, WWF, Henkel, Miele, BSI, adidas, VAUDE, and POLARTEC). Through interdisciplinary collaboration, analyses were conducted, and solutions for reducing fibrous microplastics were identified.

To determine the impact of domestic laundry on microplastics, washing tests were carried out under various conditions. Small washing loads of selected top-selling outdoor and sports apparel were washed with liquid detergent in a household front-loading washing machine using the Easy Care 40°C program. Subsequently, the wastewater from the washing machines was filtered sequentially through different steel filters (1.5 mm, 0.5 mm, 0.15 mm, 50 µm, and 5 µm). The amount of retained microplastics was determined gravimetrically. The quantification of the found polymers was performed in the laboratory using TED-GC/MS. At the filter

sizes of 50 µm and 5 µm, 99% of the captured samples were quantified as PET originating from the textiles. The other polymers likely originated from contamination with other types of microplastics found in households and laboratories **(Figure 2)**.



Polymer	Mass Content [µg/mg]
PET	510
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PS	0,05
NR	0,15
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Fig. 2 Quantification of polymers retained by various filters with mesh sizes of 50 µm and 5 µm. The respective proportions were determined by the laboratory method TED-GC/MS by the Federal Institute for Materials Testing.

An important finding was that a significant amount of fibrous microplastics is released, particularly during the first and second washes. When the microplastic quantities from the first 10 washing cycles are added together, approximately 50% of the total amount is released during the first wash **(Figure 3)**.

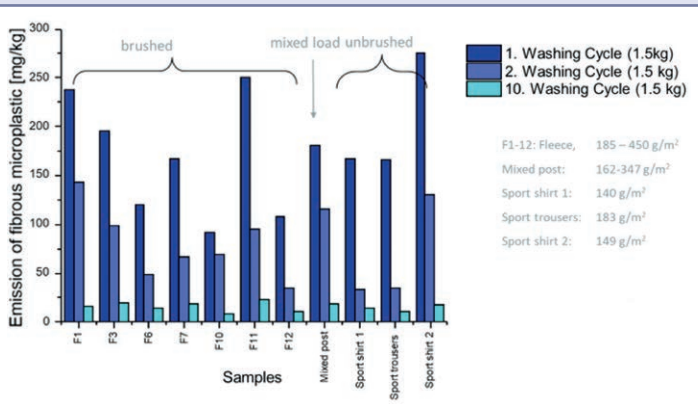

Fig. 3 The release of fibrous microplastics during the first wash accounts for 40-60% of the sum of the first ten washes.

Based on these results, Mr. Brandt, on behalf of the TextilMission project, recommended avoiding "fast fashion" and opting for high-quality fibers or clothing. The more frequently the fiber is washed, the lower the loss of fibrous microplastics. Additionally, the release can be reduced through higher load quantities and optimized utilization of washing machine capacity.

According to the EU Textile Strategy, various measures are aimed at avoiding or reducing microplastics throughout the product life cycle, including mandatory requirements for product design, controlled manufacturing processes, promotion of innovative materials, optimized washing machine filters and detergents, as well as setting microplastic limits. Mr. Brandt sees the enzymatic degradation of PET fragments in wastewater treatment plants and the development of new materials for innovative fiber types that possess better biodegradability as perspectives for addressing the issue.

Presentation 04: Microplastic Restriction Sales according to ECHA (Marcello Entner, Austrian Federal Economic Chamber / Association of the Chemical Industry Austria (FCIO))

Mr. Marcello Entner summarized the planned microplastic restrictions of the EU regulation, which will come into effect in the third quarter of this year, in another presentation. He first addressed the definition of microplastics or "Synthetic Polymer Microparticles" (SPM). SPM particles are defined as particles containing an encapsulation or solid polymer content of ≥ 1% (w/w). Such particles with a diameter of ≤ 5 mm or fibers with a length of ≤ 15 mm and a diameter of ≤ 3 mm fall under the restrictions of the forthcoming regulation.

Products that add SPM to achieve certain properties at more than 0.1 weight percent are affected by the restriction. However, if the release of SPM into the environment can be prevented by the chemical or physical properties of the product in its end use or if emissions are already avoided by other regulatory measures, there are exceptions to the prohibition of placing on the market (§ 4 and 5).

This point was highly debated among the participants during the event on both days. For example, is the application of floor care products and subsequent removal of the coating with cleaning agents considered an introduction into the environment or not? The fact is that floor polish products are explicitly listed in the regulation. Clarification on this point will likely have to await accompanying guidance documents. The exceptions for which the regulation does not apply include:

- Natural polymers
- Polymers that do not contain carbon
- Water-soluble polymers (solubility ≥ 2 g/L)
- (Biologically) degradable polymers

After the regulation comes into effect, authorities can request mandatory information on polymer identity. This request must be responded to within a feedback period of 7 days. The requested detailed information may include names (IUPAC), CAS, EC number, molecular weight (range), analytical data, associated methods, and information on the function of the polymer. If the information is not yet available, there is a

30-day feedback period for the supplier. Transition provisions apply to various product categories, with the following deadlines listed below:

- Rinse-off cosmetics (4 years)
- Detergents, waxes, polishes like floor polish (5 years)
- Encapsulated fragrances (6 years)
- Leave-on cosmetics (6 years)
- Makeup, lip, and nail products (12 years)

Furthermore, according to the regulation, there is an obligation to provide information on SPM/microplastics in the product on labels, packaging, package inserts, and safety data sheets starting from the second year after the regulation comes into effect. Digital tools such as QR codes are only permitted as complementary means.

In conclusion, Mr. Entner provided an outlook on forthcoming regulatory measures regarding SPM that will impact the industry in the future, such as regulations on dishwasher and laundry detergent capsules.

Presentation 05: Microplastic – A Challenge in Floor Care from a Polymer Manufacturer's Point of View (Christelle Mannheim & Armin Bach, Zschimmer & Schwarz Group)

After the legal classification, the challenges faced by floor care products with microplastic-containing formulations were presented. The entry of microplastics through cleaning and care products is very low, but there is a clear need for action. Every measure counts, and everyone must take responsibility. For example, it was pointed out that the use of cleaning agents in the North East Atlantic region leads to an annual entry of 100,000 kg of microplastics into the marine environment. The most radical step would be to completely eliminate the use of floor care products. However, it is also argued that the use of these products can help reduce environmental impact by increasing the lifespan of floor coverings and reducing cleaning efforts. In addition, the ingredients are only partially affected by microplastic restrictions since, for example, the micro-particles contained in floor coatings form a closed layer during film formation and are therefore no longer subject to the restrictions. However, it is expected that regulations will become stricter in the long term, so proactive planning should be considered. Another problem is that conventional ingredients of floor care products, such as polymers (acrylates) and waxes, often contain polyethylene (PE), both of which are poorly biodegradable.

The company calls for new global standards, increased investments in research for sustainable and biodegradable substitutes, and more green innovations. They aim to lead by example.

Presentation 06: Biodegradable Polymers for PU-based Floor Care Products (Bernhard Sölle, Polymer Competence Center Leoben GmbH (PCCL))

To address the challenges arising from the SPM restrictions in the field of floor care, Mr. Bernhard Sölle reported on initial research results from his dissertation on biodegradable PU-based polymers for floor care products, supported by the Austrian Research Promotion Agency. The project aimed to find substitution options for the predominantly used acrylates in the field of floor care, which are non-biodegradable or have low biodegradability.

Therefore, Mr. Sölle primarily synthesized polymers with "labile" groups, such as ester groups, to enhance biodegradability. However, pure polyesters proved to be too "soft" or not sufficiently resistant for use in heavily stressed floor care coatings. Consequently, he focused on the synthesis of polyurethanes in the further course of the research project. By using different polyester diols in the synthesis, it is possible to adjust various polymer properties, such as biodegradability and hardness/resistance.

After a brief overview of step-growth reactions such as polycondensation and polyaddition, Mr. Sölle detailed the polymer syntheses conducted in his work and the possibilities to influence the desired properties accordingly.

Initial formulations of floor care coatings showed promising results but exhibited lower resistance and poorer soil repellency compared to standard coatings upon closer examination. However, external tests of biodegradability according to OECD 302B already showed biodegradabilities of up to 30% for the polymer prototypes.

As another highlight of the project, Mr. Sölle introduced covalently bound fluorescent markers (naphthalimide derivatives) into the polymer structure during the synthesis to enable the detection of SPM (microplastic particles) in wastewater, sludge, etc., for better tracking of the fate of SPM in the environment.

Presentation 07: Circular Economy: Bioglycols from Wood (Holger John, UPM Biochemicals, Helsinki)

In his presentation, Mr. Holger John from UPM Biochemicals in Helsinki reported on the development and production of glycols from renewable raw materials. Ethyleneglycol and propyleneglycol can be produced from wood as the base material. Initial samples have already been made available and tested. The CO_2 footprint has been determined and certified by DEKRA. FSC-certified beech wood is used for production, which is harvested within a radius of 150-600 km around the Leuna production site.

The share of beech trees in German forests is 16% (2021), and it is projected to increase to 21% by 2050 through the cultivation of mixed wood. Wood is a renewable and climate-neutral resource. Sustainable forest management and forestry practices are essential to achieve global CO_2 sequestration goals. This involves controlled harvesting and replanting, as young trees can absorb more CO_2, creating a renewable cycle.

The hardwood from the tree trunk is used in the furniture industry, but a large proportion of the remaining tree components are currently only used for energy generation. The plan is to produce bioglycols from this combustion wood and the ongoing thinning wood.

Mr. John highlighted the following advantages: Bioglycols are 100% bio-based and can have a better carbon footprint and CO_2 impact compared to fossil fuels. The beech wood is sourced and distributed regionally and is vegan. Bioglycols can also replace conventional glycols as a raw material for PET production, enabling a bio-based content of up to 30%.

Presentation 08: Natural and Biodegradable Waxes for Use in Microplastic-Free Floor Care Products (Dr. Ernst Krendlinger, EPW GmbH)

Dr. Krendlinger, former Head of Development at Clariant, Lubrizol, and Deurex, as well as a recipient of the European Inventor Award, illustrated the possibilities of using natural waxes in polymer coatings, both theoretically and with practical examples.

Due to the upcoming restrictions on the intentional use of microplastics, traditional fossil-based PE and PP waxes in floor care products are facing limitations. One solution is to look to nature, as natural waxes are not covered by the planned ECHA regulation. In addition to the well-known but too soft for floor coatings beeswax, the properties of the much harder and already industrially used Brazilian carnauba wax were discussed. The lesser-known but still relevant candelilla and sunflower waxes, with a melting point of around 70°C, were also examined practically with provided samples.

A waste product of sugar production is sugarcane wax, which is present in the sugarcane itself at only 0.1%, but can be found in the bagasse (filter cake) at 8-10%. This bagasse, which has been deposited in landfills in the main cultivation areas for decades, can now be exploited through landfill mining. With a high melting point and low acid value, the properties relevant to floor care products align with the new rising star: rice (bran) wax. This wax exhibits properties that can compete with the synthetic hydrocarbon waxes used so far.

Even more exotic waxes were mentioned to illustrate that waxes can be found in unusual places, such as the wax properties of earwax and the particularly hard wax from scale insects used in shellac production.

Presentation 09: Practical Insights from PV Cleaning (Josha Kneiber, TG hyLIFT GmbH)

Germany's ambitions regarding the expansion of photovoltaic (PV) systems are evident with the Renewable Energy Sources Act, which came into effect in 2023. According to this act, the currently installed PV capacity is set to increase by over 330% by 2030. The necessity and benefits of sustainable energy should be generally known. In his presentation, Josha Keiber, Managing Director of TG hyLIFT GmbH, discussed the importance of PV system cleaning and the associated challenges.

The type and intensity of dirt accumulation vary depending on the region, type of installation, location, season, and weather conditions. However, it is clear that higher dirt accumulation leads to greater loss of energy yield. In Germany, not cleaning the PV panels can result in a loss of around 10%, while in "dusty weather conditions without rain," this figure can quickly exceed 20%. Therefore, cleaning is necessary. The use of unsuitable techniques and methods, such as using a freely moving robot on a steep surface and/or using the wrong cleaning chemicals, can lead to the robot sliding off the roof, making the investment in cleaning far from profitable. Similarly, treating a concrete plant's PV system with water to remove cement dust would be counterproductive. Too abrasive bristles could damage anti-reflective coatings, reducing the system's energy yield despite cleaning. The use of certain chemicals requires the capture of wash water, making the cleaning of large systems economically unfeasible.
In summary, it is important to differentiate that not every cleaning method is suitable for every PV system. While simple handheld brushes may be suitable for smaller, easily accessible systems, it is recommended to invest in expensive specialized equipment or hire specialized service providers for other systems.

Presentation 10: Critical Examination of Questionable Cleaning Methods (Bianca Nerowski, TANA Chemie GmbH)

In the last presentation, Bianca Nerowski discussed the issues with various cleaning methods. She started with a brief summary of the definition of dirt (misplaced matter) and cleaning (removal of dirt). Then, Ms. Nerowski presented three cleaning methods that are often marketed as supposed solutions for private and building cleaners: UV-C light, ozone, and dry steam.

The DNA-damaging effect of UV-C light (wavelength of 200 to 280 nm) has been known for decades and is used, for example, for surface disinfection in hospitals. However, criticisms of this method include non-compliance with disinfection times, inadequate safety labeling that prohibits entering the treated areas, and the lack of effectiveness on shaded surfaces.

Dry steam refers to water vapor heated to 150 °C, where, unlike conventional (wet) steam, there is no liquid phase present. This medium can be used in appropriate cleaning devices to cause adhering dirt on surfaces to simply peel off through rapid heating. It is often claimed that 99.9% of germs on the surface are killed. However, this advertising claim is criticized because a germ reduction of a factor of 10^5 ("99.999%") is usually required to speak of disinfection. Nevertheless, slogans such as "No more health-endangering chemical disinfectants: Steam works faster than disinfectants!" are used in advertising. Ms. Nerowski emphasized that contrary to these claims, this method is also ineffective against house dust mites and therefore does not provide relief for allergy sufferers.

Finally, ozone (O3) is discussed as a problem-solving method. Due to its strong oxidative properties, ozone decomposes odor molecules and kills microorganisms, making it suitable for disinfection and odor elimination. However, the use of ozonated water in washing machines and dishwashers is criticized because the ozone molecule is unstable. It decomposes in distilled water after about 30 minutes and in the presence of dirt, it only takes a few seconds. Thus, there is not enough time for a disinfecting effect. Ozone spray bottles are often marketed as cleaning agents for quick and comprehensive "hygienization," although the precise meaning of this term remains open to interpretation for the recipient.

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