



The Invisible Danger: **Hidden Polymers in Cosmetic Products**

CodeCheck Report UK

Microplastics & Non-Biodegradable, Liquid Polymers
Environmental and Health Impacts



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CodeCheck's app is the leading shopping guide for health and sustainability in German-speaking countries and the UK. The database contains several million products. When users scan the barcode of foods and cosmetics, the database explains what the ingredients do. For almost ten years, CodeCheck has been helping conscious consumers make better purchasing decisions.

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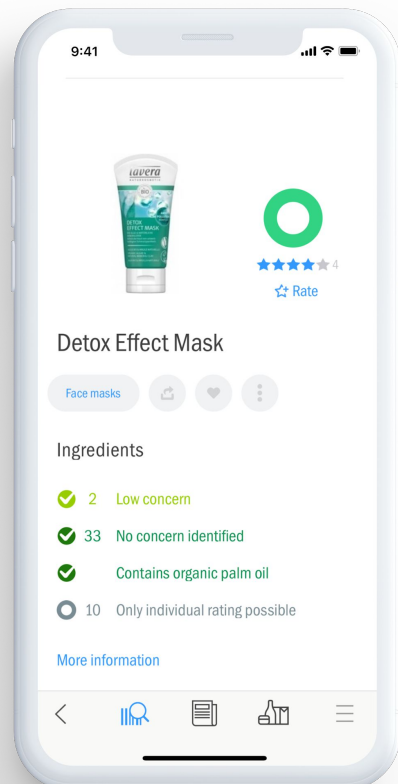
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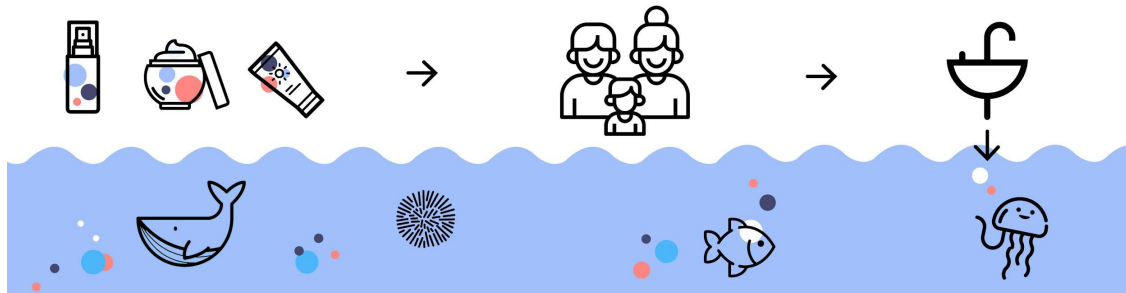
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1. Introduction

The endless range of cosmetics on the shelves of shops is irresistible. A quarter of the women in Western industrialised nations use up to 15 different cosmetic products every day.¹ In Germany alone, around **1,000 tons of polymers in the form of solid microplastic particles and almost 50 times more liquid polymers are released each year from the contents of our cosmetics and detergents into the wastewater and soil.**² This may have devastating consequences for the environment and, in the long term, also for our health. On a global average, a human being absorbs up to five grams of plastic per week, which is roughly the weight of a credit card.³



One problem is that sewage treatment plants cannot completely filter the dissolved and liquid synthetic polymers and solid microplastic particles. And even if these polymers and microplastics were filtered, they would still be applied to our fields via sewage sludge, which is often used as fertiliser or end up in open landfills. This is how our soils and waters are continuously polluted.^{4,5} Due to their poor biodegradability, synthetic polymers and solid microplastic particles remain in the environment for many decades and bind to toxins and environmental pollutants. Thus, billions of small plastic particles and liquid polymers and their associated toxins continuously enter our food cycle. Currently, each consumer ingests about 100 solid plastic particles per day.⁶ The uptake of liquid polymers has not yet been quantified.

It would be easy to prevent microplastics and poorly degradable, liquid polymers contained in cosmetics from entering our food and water cycles. Countries such as Great Britain,⁷ the USA,⁸ Canada⁹ and New Zealand¹⁰ have already banned the use of plastic microbeads (such as "polyethylene") in rinse-off products (such as soaps and peelings). However, the use of microplastics in leave-on products (such as face creams, make-up and sunscreens) is still permitted. Non-biodegradable liquid polymers, which are used in large quantities in cosmetics as opacifiers, film formers, emulsifiers and surfactants, to name a few functions,² have not even been included in the discussion yet.

While those substances remain under the radar in the media, they are finally starting to receive attention in politics. In October 2019, a proposal was submitted by the Ministry for the Environment of the German federal state of Hesse, to restrict the use of liquid polymers in cosmetics and cleaning agents. Quote: *"...the Federal Council notes with concern that polymers, even in liquid or dissolved form and irrespective of their size, can be difficult to degrade, bioaccumulate or have ecotoxic potential, thus posing a considerable risk to humans and the environment"*.¹¹ The European Chemicals Agency (ECHA) is currently working on a proposal to restrict the use of intentionally added microplastics and has claimed to extend the focus to leave-on cosmetics and detergents. It remains unknown whether the measure would apply in the UK after Brexit.

2. The Most Important Facts I

84%

of the respondents consider it very important that cosmetic products do not contain any microplastics



Microplastic-bomb lipstick:
Every third product is affected

29%

of all cosmetic products contain hidden polymers that are of concern



Our second skin: Every third face cream contains acrylate polymers

99%

of interviewed CodeCheck users would like to see a general ban on non-biodegradable substances in cosmetics

A total of 50,737 cosmetic products were analysed for 159 not readily biodegradable, synthetic polymers in 34 cosmetic product categories in the UK.

The CodeCheck user survey was carried out via the CodeCheck app in the period from 09 Dec 2019 to 10 Dec 2019 with 699 voluntary participants from Germany, Austria and Switzerland.

3. The Most Important Facts II

All plastics are polymers – but not all polymers are plastics

What are microplastics?

The term microplastics or microbeads covers all solid and insoluble synthetic polymers that are smaller than five millimetres in length, width and diameter. In general, a distinction is made between primary and secondary microplastics. The latter occurs when larger plastic parts, such as plastic bags, decompose. Primary microplastics, on the other hand, are produced industrially and usually in the form of fine plastic granules, particles or beads. The microscopic plastic particles can also be found in various cosmetics, peelings, shower gels and shampoos, as well as in lipsticks and makeup. In the past, the standard classifications of plastic particles and liquid polymers of concern under the term 'microplastics' led to a generalisation that was not plausible from a scientific point of view. As a result, many companies focused on removing only particulate, solid microplastic particles, especially polyethylene, from their products. But the tiny plastic particles are hidden behind many names in cosmetics, as our list of microplastics shows. In the meanwhile, microplastics have been found in seafood, honey, sugar, salt, alcohol, mineral and tap water and also in human stools.^{12, 13} Recently researchers found that the London air is especially polluted with microplastics: More particles are raining down on its citizens than in any other city in the world.¹⁴

What are poorly degradable liquid polymers?

The cosmetics industry often uses water-soluble synthetic polymers for a variety of functions in hair-care and skincare products and sunscreens. Unlike microplastics, these substances have no peeling properties, but rather serve as consistency enhancers, opacifiers and fillers. However, these polymers degrade with similar difficulty in the environment. In particular, acrylate-based polymers pose a severe problem because of the quantities used. Their effects on the environment are expected to be similar to those of microplastics. Various synthetic non-biodegradable polymers have already been found in the gills of fish. In addition, such high-molecular charged polymers may form insoluble complexes with other toxic compounds. When they enter our rivers and seas, they can form films and attract environmental pollutants, which they then carry with them. The long-term effects on our health and environment remain unclear as only a few research groups have begun to study these components. However, because the polymer structures are diverse, many research groups will be needed before the full extent of their effects is understood.

Microplastics and liquid or dissolved synthetic polymers thus differ in their physical properties and role in cosmetic products. However, their impact on the environment and health poses a similar risk.

*For reasons of simplification, the term 'liquid polymers' used in this study represents the entire group of non-solid, persistent, synthetic polymers, independent of their physical state, such as liquid, waxy or hydrogel-forming.

4. The CodeCheck List: Microplastics and other poorly biodegradable polymers

Here is the list of the most frequently used ingredients in cosmetics. This list was derived from analysing microbeads and poorly biodegradable liquid polymers in the products in CodeCheck's database.

INCI poorly biodegradable, liquid polymers

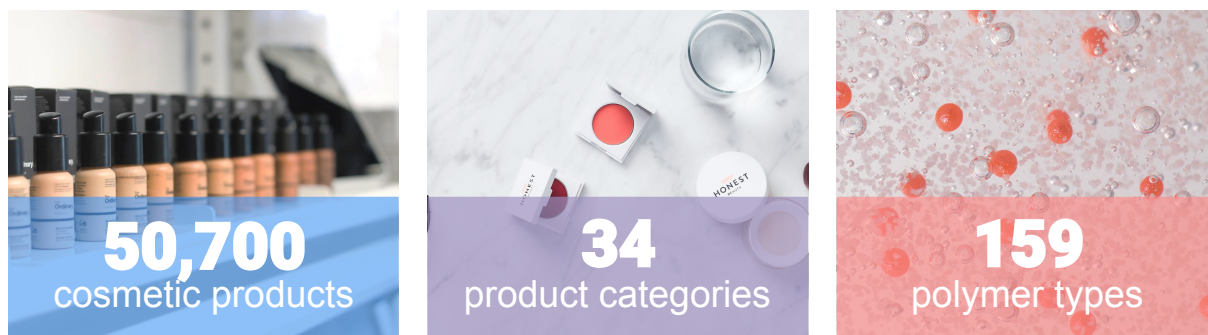
Acrylates/C10-30 alkyl acrylate crosspolymer	Cyclopentasiloxane
Acrylates copolymer	Polyquaternium-7
Carbomer	Sodium polyacrylate
Cyclohexasiloxane+143*

INCI microplastics

	Poly(methyl methacrylate) (PMMA)
Nylon-12	Polypropylene (PP)
Nylon-6	Polystyrene (PS)
Polyethylene (PE)	Polyurethane (PU)
Polyethylene terephthalate (PET)	Polytetrafluoroethylene (PTFE)

The assessment of degradability is based on information in the safety data sheets of the raw materials and other openly available sources.

5. Results



An alarming 29 percent and thus every third cosmetic article contains substances of concern that pose risks for both the environment and our health. Although these are declared and have permitted usage limits in specific products,¹³ it is often difficult for consumers to understand the information on the packaging. Especially for women, plastic toxins pose a health risk. Due to the histological composition of women's body tissue and certain product usage habits, women are, for example, particularly exposed to the possible negative influences of endocrine disruptors in microplastics.^{1, 16} In this study, we present the most common polymeric ingredients and product groups that pose potential risks to the body and environment.

The present report, generated by CodeCheck, which represents the most extensive product database in German-speaking countries, shows that the use of microplastics and poorly degradable, liquid polymers urgently needs to be restricted. In addition, the assumption that leave-on products do not end up in wastewater is not defensible. Global and public laws should strictly regulate the use of solid microplastics and poorly biodegradable synthetic polymers in cosmetics and detergents. This would help to prevent the increasing contamination of our world from solid plastics and liquid polymers and thereby would contribute towards protecting our health.

The present analysis shows that a ban, limited to specific products and polymer types, would cover only a fraction of the problem. In the long term, the introduction of persistent polymers into our environment through cosmetic products must be drastically and urgently reduced in order to minimise the possible health risks to humans.

A total of 50,737 cosmetic products were analysed for 159 poorly biodegradable, synthetic polymers in 34 product categories in the UK. A close look was taken at the nine known solid microplastic ingredients. In addition, we assessed seven particularly worrisome liquid polymer candidates out of the 150 most frequently used poorly biodegradable, liquid polymers in cosmetic products. These seven acrylate-based polymers in "leave-on" and "rinse-off" products are the focus of this report.

Results – Microplastics

Despite the UK's ban on microplastics in rinse-off products, hidden microplastic bombs still exist in our regular care routines. They are found in products ranging from lipsticks and rouge to foundation and eye shadows. Many leave-on products still contain solid microplastic particles and are used daily and generously on the faces of millions of consumers.

One substance stands out as particularly concerning in these categories – polyethylene (PE). Since 36 percent of all tested lip care products contain microplastics, it is fair to assume that lipstick users regularly and unconsciously "eat" polyethylene (PE). Nylon-12 and polyethylene terephthalat (PET) are also popular ingredients in decorative cosmetics. They make eyelashes look fuller, help foundations stay on the skin up to 24 hours and make lipsticks kiss-proof. The question remains: at what cost to our health?

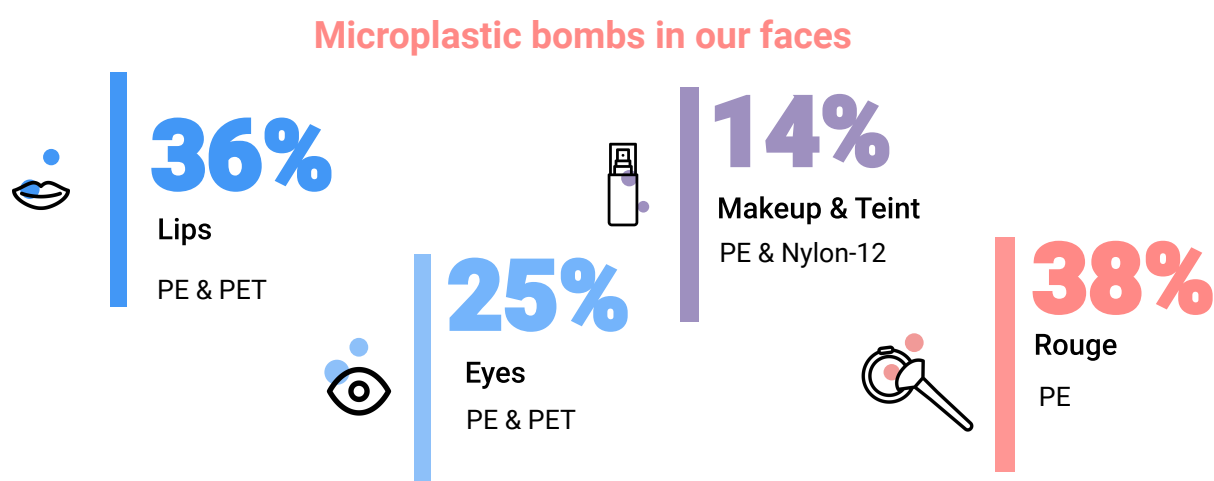


Figure 1: Percentage of products containing microplastics per category.

Many believe that as long as we use make-up remover pads or wipes to dispose of affected cosmetic products in the household waste, the microplastics in these leave-on products do not pose an environmental problem. The ingredients are not discharged directly into the wastewater but instead are sent to landfill or incinerated with the regular waste.

And yet, those products do pose a problem. When we shower and bath, we use washable and reusable makeup remover pads or soap for cleansing. Large quantities of microplastics contained in the leave-on products can be flushed directly into the wastewater by using these "zero waste" tissues. It is even more alarming that microplastics contain and may release substances such as plasticisers, which are suspected of being endocrine disruptors.^{1, 15} Even if they end up in regular waste, those substances remain an environmental concern. Friends of the Earth England, Wales and Northern Ireland, campaigner Julian Kirby states: "landfills risk leaking pollution to the surrounding environment and 'energy-from-waste' incinerators destroy recyclable materials whilst pumping climate-wrecking greenhouse gas and other emissions into the atmosphere."

Results – Liquid Polymers

Liquid polymers are everywhere, from sun protection products to nail polishes and all kinds of hair styling products, and yet, they are unattended by the public or regulatory bodies. They are used as thickeners and fillers in styling products and for leaving a good feeling on skin and hair. Every second product in these categories contains at least one of these environmentally concerning ingredients.

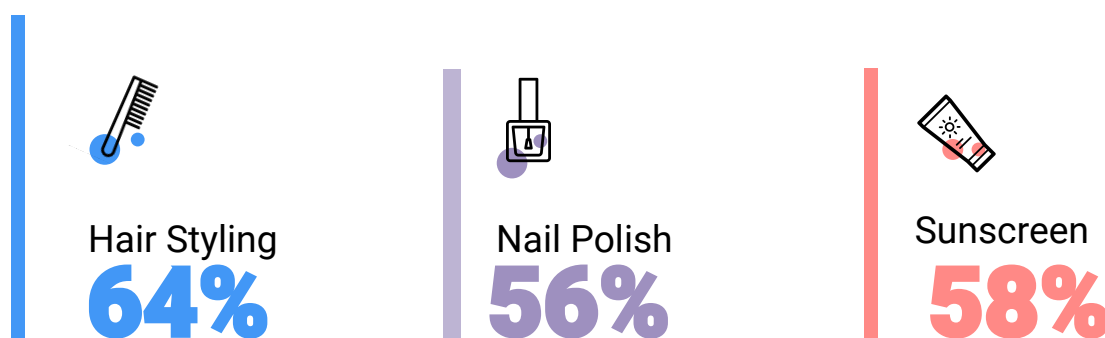


Figure 2: Percentage of products containing critical liquid polymers per category.

The fact is that during our daily care routines, we expose ourselves to a multitude of different liquid polymers. We literally wrap ourselves in liquid polymers. For example, acrylates and silicones form a film that remains on skin and hair, making skin and hair soft to touch, and mimicking long-lasting smoothness. The ingredients that do not stay on the body, however, flow directly into the wastewater. Almost half (45%) of the shower gels examined are affected. Face masks, skincare products and shampoos are also part of this "polymer trend".

Our second skin: liquid polymers

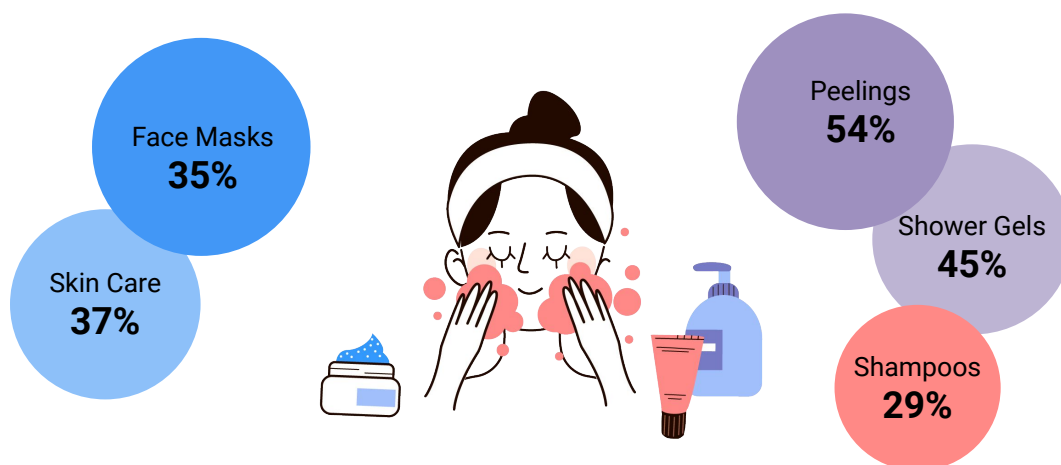


Figure 3: Percentage of products containing liquid polymers of concern per category.

Results – Liquid Polymers

A detailed analysis shows that mainly different acrylate compounds and silicones (siloxanes) are commonly used in cosmetic products. The Top-3 list of poorly biodegradable, liquid polymers in cosmetics is led by carbomer, a polyacrylic acid. As much as 24 percent of the products tested contain this liquid polymer. Cyclopentasiloxane, which is the second most frequently used ingredient, follows with 19 percent. Siloxanes are monomeric building blocks of silicones and can also exist in cyclic form. Acrylates copolymer is the third most common liquid polymer and is found in 16 percent of the cosmetic products studied.

Top 3 liquid polymers in cosmetics

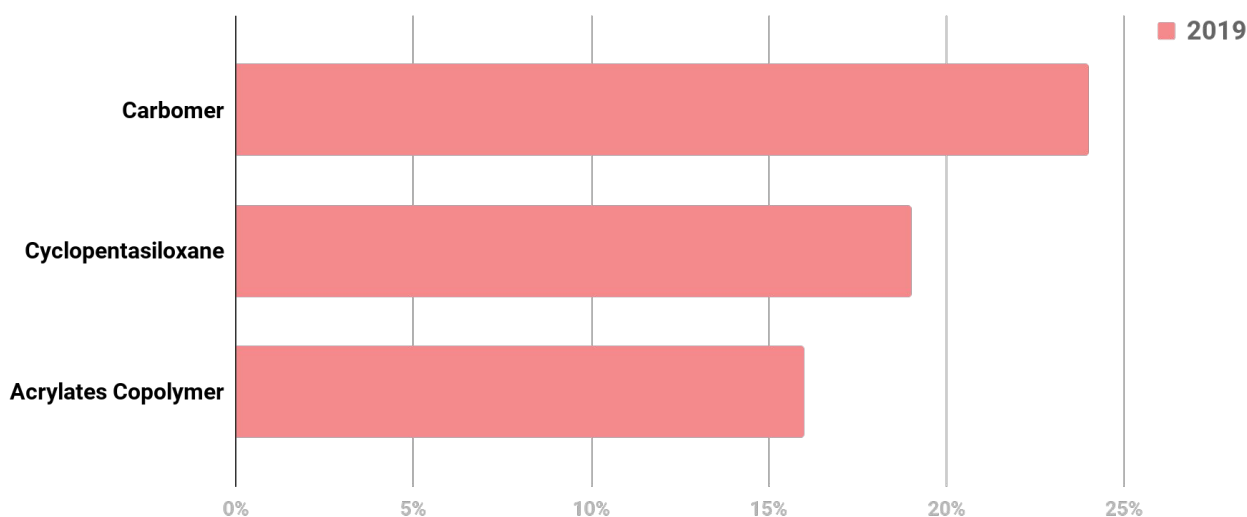


Figure 4: Distribution of the Top 3 liquid polymers in products containing critical liquid polymers.

What are acrylate polymers and cross- or copolymers?

Acrylates are synthetic polymers made of acrylic acid. Additional units – for example methacrylic acid or one of its simple esters – form copolymers. If these are also structurally crosslinked, so-called crosspolymers are formed.

Despite their solubility in water, acrylate compounds are considered non-biodegradable or poorly biodegradable (even if non-acrylic parts of the copolymers can be degraded). Furthermore, similar to microplastics, these liquid polymers can attract environmental pollutants, facilitating the transport of pollutants into organisms – with unknown negative consequences.

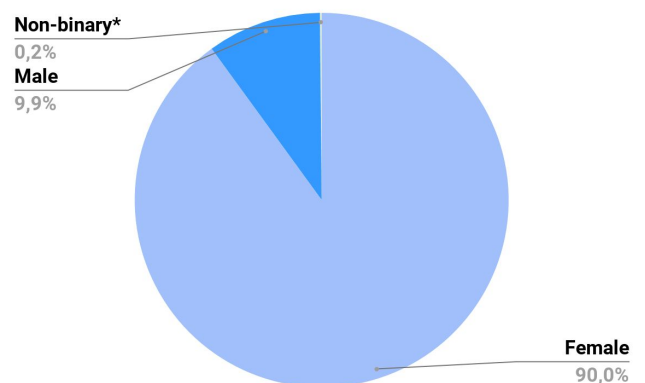
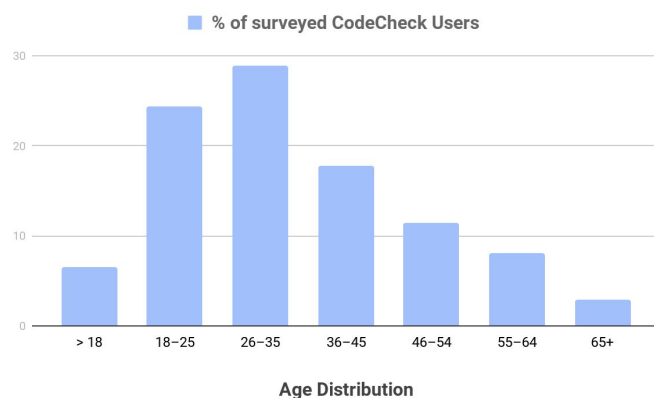
6. CodeCheck Survey on Polymers

84% of the CodeCheck users in this survey consider it **very important** that cosmetic products do **not contain microplastics**.

51% of respondents would like **more information** on the difference between solid and liquid polymers. As many as 19% **do not know the difference**.

75% of the users consider it **very important** that cosmetic products **do not contain any other poorly biodegradable polymers**, for example, in liquid form.

99% of the CodeCheck users surveyed would **like to see a general ban on poorly biodegradable substances** in cosmetics.



The CodeCheck user survey was carried out via the CodeCheck app between 09 Dec 2019 and 10 Dec 2019 with 699 voluntary respondents from Germany, Austria and Switzerland. Participants: 90% female, 9.9% male, 0.2% non-binary*.

"non-binary*" includes transgender, agender, gender-fluid and people who don't want to disclose their gender identity.

7. Go Forward Recommendations

Regulatory

- **Ban the use of solid microplastics in cosmetics, specifically leave-on products**
 - Alternatives: Beeswax, rice bran wax, jojoba wax, starch, tapioca and carnauba, marine algae, silica, clay and other natural substances
- **Strongly reduce the use of poorly biodegradable acrylic polymers in all cosmetics and detergents** and switch to biodegradable alternatives. Introduce relevant legal regulations and transitional periods for manufacturers
 - Adaptation of product formulations for particularly critical substances and switch to more degradable alternatives or non-polymeric substances
- **Detailed ingredient declaration** that reflects both the physical and chemical state of the ingredient; for example, Carbomer = Polyacrylate (dissolved/hydrogel), Styrene-Acrylates Copolymer (micro/nano)
- **Amendment of the EU Regulation on cosmetic products** to include provisions on the use, declaration and separate labelling of poorly biodegradable or persistent polymers

Consumer

- Avoid cosmetic products and detergents with intentionally added microplastics
- Choose products without added acrylic polymers or at least significantly reduce the use thereof
- Eliminate products containing polymers that are difficult to degrade and may end up in our environment
- Give feedback to manufacturers

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