PLASTIC SOUP FOUNDATION

BEAT THE MICRO BEAD

PLASTIC
THE HIDDEN BEAUTY INGREDIENT

An analysis of the use of microplastics in personal care products and the upcoming legislation covering intentionally added microplastics

About THE PLASTIC SOUP FOUNDATION

DISLAIMER

The information in this report has been obtained in good faith from sources that are believed to be reliable. We accumulated the product level data via the Beat the Microbead app users. We requested input on this data, the perspective and policy on microplastics from the brand owners involved. The text of this report is composed with utmost care and reflects the interpretation and opinion of Plastic Soup Foundation on the date of publication of this report. However, Plastic Soup Foundation cannot exclude and cannot be held liable whatsoever for any inaccuracies or incompleteness of the data or this report.

The Plastic Soup Foundation was founded in February 2011. Our goal is to make the general public and other stakeholders familiar with the phenomenon of "plastic soup" and to stop it at its source. As long as the supply of plastic to our rivers, seas and oceans is not stopped, it's like trying to empty the ocean with a thimble.
We are a single-issue organisation, focused entirely on plastics. With a committed and passionate team of about thirty people, we do our utmost to achieve our goal: no plastic in our water or our bodies!

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Published in: April 2022

Supported by:

SURFRIDER FOUNDATION EUROPE · RETHINK PLASTIC · EEB European Environmental Bureau · OCEAN NOW! · FAUNA & FLORA INTERNATIONAL · #breakfreefromplastic

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LIST OF ABBREVIATIONS

ADHD: Attention Deficit Hyperactivity Disorder
BTMB: Beat the Microbead
CMR: Carcinogenic, mutagenic or toxic for reproduction
ECHA: European Chemicals Agency
EC: European Commission
EU: European Union
H&S: Head & Shoulders
PBT: Persistence, Bioaccumulation, Toxicity
PET: Polyethylene Terephthalate
P&G: Procter & Gamble
PMMA: Poly(methyl methacrylate)
PP: Polypropylene
RAC: Risk Assessment Committee
REACH: Registration, Evaluation, Authorisation and Restriction of Chemicals
TAUW: Technisch Adviesbureau van de Unie van Waterschapsbonden
UNEP: United Nations Environmental Program
WSPs: Water-Soluble Polymers

GLOSSARY

Bioavailability: The extent to which a substance is absorbed by a living organism. Small plastic particles such as microplastics and nanoplastics can enter bodies via ingestion and inhalation. They are so small that they can cross biological barriers in the gut and lungs, reaching the blood stream and consequently other organs.

Chemical toxicity: The degree to which a chemical substance can cause adverse health and environmental effects. Chemicals are added to plastics to give them certain characteristics, for example flexibility, durability, or colour. Some plastic additives have been associated with serious health problems such as hormone-related cancers, infertility, and neurodevelopmental disorders such as ADHD and autism.

Leave-on cosmetics: Leave-on products intended to stay in prolonged contact with the skin, hair, or mucous membranes. These include body creams, sunscreens, hair sprays, make-up, et cetera.

Microbeads: Microbeads are tiny plastic particles that are intentionally added to personal care products. They are commonly used in exfoliating products and toothpaste. The microbeads that the industry refers to are mainly made of Polyethylene (PE) and Polymethyl Methacrylate (PMMA). Microbeads are also considered to be microplastics.

Microplastics: The term 'microplastic' is not consistently defined but is typically considered and not limited to refer to small solid particles made of a synthetic polymer. They are associated with long-term persistence in the environment if released, as they are very resistant to biodegradation. In cosmetics, 'microplastic' refers to all types of plastic particles intentionally added to personal care & cosmetic products. This definition continues to evolve in accordance with ongoing relevant scientific research.

Nanoplastics: The exact cut-off between a microplastic and nanoplastic is a subject of ongoing debate. In this report we define nanoplastics as 0.1 micrometre (which equals 100 nanometres) or less in size. These particles tend to be smaller than or close to the size of viruses. Engineered nanoplastics are deliberately manufactured plastics for use in various products. Secondary nanoplastics are generated as a result of the fragmentation of larger plastics.

Particle toxicity: The degree to which a particle can cause adverse health effects. A well-known example of particle toxicity is the air pollutant black carbon. Black carbon can lead to various lung conditions including cancer.

Persistency: Persistent substances remain in the environment for a long time, as they are resistant to biodegradation. Persistency is a cause of concern as environmental concentrations will inevitably increase with the continuous release of a persistent substance. With increasing environmental concentrations, the probability of adverse effects will increase as well. Once adverse effects are observed, reversing contamination could take centuries, or even longer.

Planetary boundaries: Planetary boundaries are thresholds within which humanity can survive, develop, and thrive for generations to come. It is a concept highlighting human-caused disturbances of Earth system processes. There are nine boundaries created for a safe operating limit for survival. They include climate change, biodiversity, and deforestation.

Polymer: A polymer is a natural or synthetic substance consisting of very large molecules, called macromolecules, composed of many repeating subunits (monomers). Plastic is an example of a synthetic polymer. Polysaccharides are an example of a natural polymer, imagine your pasta, cereals, or bread!

Rinse-off cosmetics: Rinse-off products are intended to be washed off after application on the skin and hair. These include shower gels, face washes and shampoos.

EXECUTIVE *summary*

Each year about 3800 tonnes of microplastics are released into the environment through the use of everyday cosmetics and care products in Europe. This is an estimation the European Chemicals Agency (ECHA) made after the European Commission (EC) requested them to submit a proposal for restricting intentionally added microplastics in certain products. The European Union (EU) wants to restrict intentionally added microplastics in products such as cosmetics that pose a potential risk to the environment and to human health.This restriction is on the horizon and is expected to be adopted the end of 2022.

A central focus of ECHA's restriction proposal for the EC is to establish a definition of microplastics. Unfortunately, ECHA's proposed definition of microplastics is limited and has various loopholes, corresponding with industry lobbying positions. The current proposed definition excludes nanoplastics, water-soluble, liquid, and biodegradable polymers. Therefore, we believe that ECHA's figures (of microplastics released into the environment every year through cosmetics) have been thoroughly underestimated. Moreover, if a synthetic polymer has been exempted from the proposed restriction on microplastics, it doesn't mean that it has been proven to be safe. We want to take this report as an opportunity to present a science-based review explaining why these exempted polymers could potentially also cause adverse environmental and human health impacts.

With so many synthetic polymers exempted, the aim of the proposed restriction legislation would be undermined. We want to stress the need for adopting the precautionary principle for all synthetic polymer groups when developing new regulatory measures. The unjustified delays because of the transition periods granted to the cosmetics industry could potentially allow pollution to continue for up to 8 years. What's more, an inadequate piece of legislation gives the cosmetics industry the opportunity to work around restrictions and continue their reliance on synthetic polymers. By overlooking these consequential drawbacks, the European Commission might also be undermining its own goal to make businesses accountable for their green claims.

To highlight this strong dependency of the cosmetics industry on plastic ingredients, we looked into the 10 most popular consumer brands of the 4 biggest cosmetic producers in Europe. The brands are L'Oréal Paris, Elvive/Elseve, Garnier, Nivea, Gillette, Oral-B, Head & Shoulders, Dove, Rexona, and Axe. We examined their product level information via citizen science efforts from the Beat the Microbead app users. We also evaluated public commitments made by the brands and their producers, as well as their policies on tackling the microplastic menace. Furthermore, we reached out to the producers of these brands to gain information on any future plans on removing plastics from inside their products.
This report provides a comprehensive analysis of the proposed definition of microplastics and its shortcomings. In particular, we demonstrate that if this definition is adopted as proposed by ECHA, it will have regrettable consequences. From the responses that we received from the 4 cosmetic producers, we observed that they hide behind ECHA's proposed definition to keep using microplastics that are derogated. Consequently, the measures that these producers take to tackle the microplastics in their products do not go far enough, which will result in continuous releases of synthetic polymers from their products. We believe not only that the cosmetics industry could take advantage of this situation by using deceiving green claims, but also that consumers would find it even harder to make conscious decisions in choosing microplastic-free products.

With this report we aim to invite the EC and the EU member states to close the loopholes and take the opportunity to deal with all intentionally added microplastics once and for all. We want to urge the cosmetics industry to look beyond the proposed definition by ECHA, to ensure the environmental and human health safety of the products they bring on the market. We want to encourage consumers to demand transparency from brands and accountability for the ingredients these brands put into our personal care and cosmetic products.

KEY findings

9 out of 10 products contain microplastics

From the 10 popular brands registered in our database whose products we analysed (7.704 in total), we found that 9 out of 10 products contain microplastics according to our traffic light system to categorise products (see chapter 3). More precisely, microplastics accounted for 87% of the products. Our personal care and cosmetic products are riddled with plastic ingredients.

The exemptions are undermining the purpose

The stakes are high for an EU-wide initiative to take essential measures that will control a large amount of unnecessary microplastics. The proposed definition of microplastics under ECHA's restriction proposal contains a number of derogations. With their current restriction proposal, ECHA aims to address the environmental and human health risks posed by microplastics. By exempting engineered nanoplastics, water-soluble, liquid and biodegradable polymers in their proposal, we argue that ECHA undermines the purpose of its own proposal.

Why scientists are worried about the exemptions

- **Water-soluble polymers (WSPs), liquid & semi-solid polymers:**
  WSPs are presumed to be present in the environment based on their production volumes and high potential for environmental discharge. Their distribution, concentrations, and impact are unfortunately still highly unclear. Moreover, little is known about the degradation products of many WSPs, and their persistency and toxicity. In addition, the use of liquid, semi-solid and water-soluble plastics in cosmetic products greatly exceeds that of solid plastics. A commonly used liquid polymer in cosmetics (dimethicone) has been identified as a potential risk to the environment. This illustrates that these polymers should not be presumed benign.

- **Engineered nanoplastics:**
  Nanoplastics can easily cross biological barriers and exert toxic effects, even more so than microplastics.

- **Biodegradable polymers:**
  Real-world conditions are poorly reflected in current standardised tests to assess the biodegradation of biodegradable polymers. Consequently, biodegradable plastics can still persist in the environment. Additionally, various concerns about their toxicity exist.

Only 1 out of 10 brands mention microplastics*

- **Looking closer at sustainability plans** and the public commitments of the popular consumer brands, as well as their response to our letter (see Annex III), it became evident that not enough is being done to address the microplastics pollution caused by the personal care and cosmetic products of these brands.

- **Only 1 (Nivea) out of 10 brands** made a direct mention of the term 'microplastics' in their public plans. At the parent company level, only Beiersdorf and Unilever (2 out of 4) have public plans on tackling microplastics. Their understanding of microplastics is limited to solid, insoluble particles of plastic smaller than 5mm.*

- **There is a clear need for more sincere actions** to fight microplastic pollution arising from the content of these products. The cosmetics industry is already defending their use of WSPs, liquid and biodegradable polymers with the current restriction proposal by ECHA. They argue that the synthetic polymers in their products are not microplastics according to the definition in ECHA's proposal and hence do not pose a threat to the environment.

*Redaction 05/2022: As a result of reassessment of the table on page 34, we came to a conclusion that only 1 out 10 brands (Nivea) mention the word microplastics in their public sustainaility plans. For detailed explanation, please see page 58.

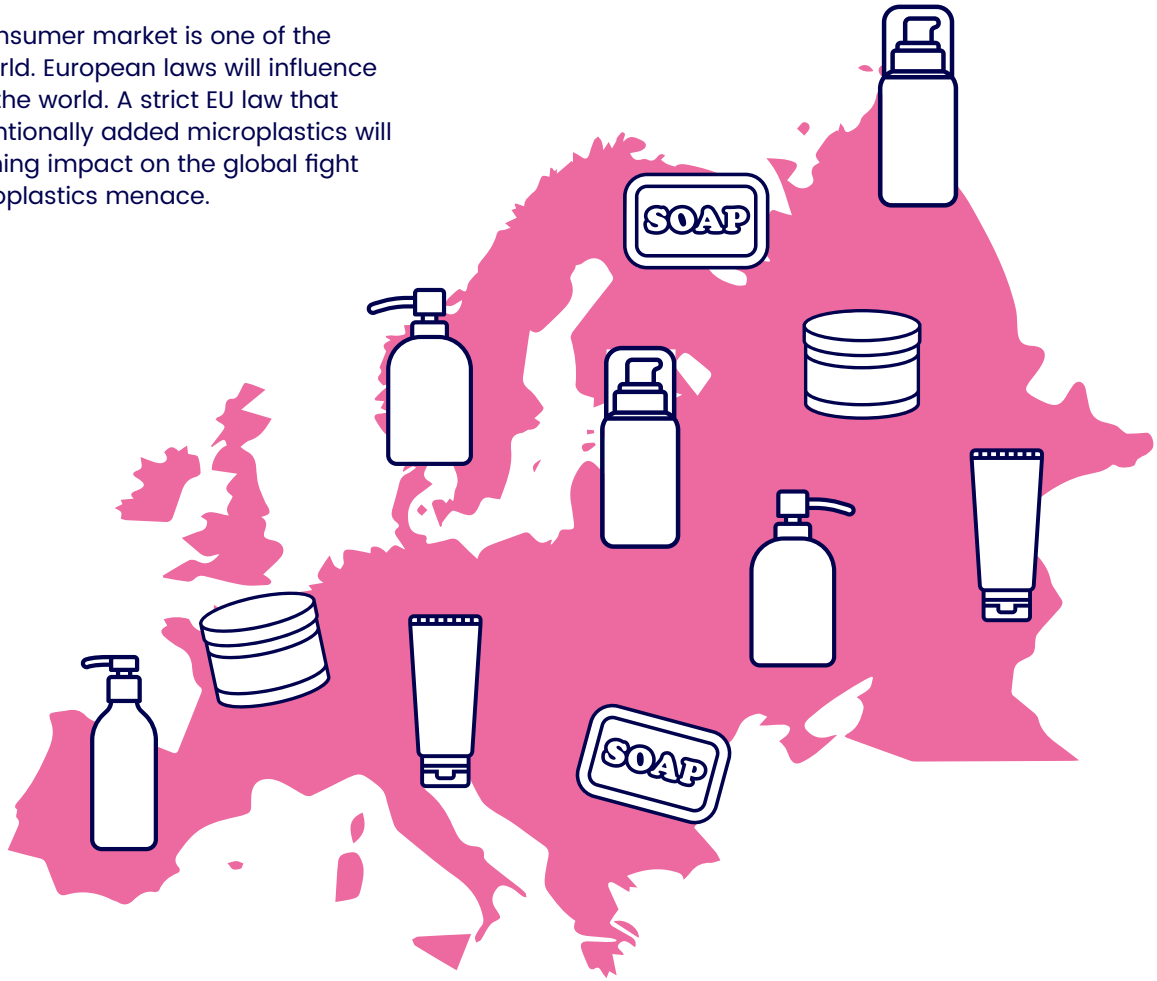
Plenty of opportunities for greenwashing

By adhering to ECHA's current proposal, which excludes engineered nanoplastics and soluble, liquid, and biodegradable polymers, the cosmetics industry would still be able to use plastics in nano, soluble, liquid, semi-solid and biodegradable form. However, the environmental safety of these ingredients cannot be guaranteed, and any green claims may therefore be false. If the upcoming legislation adopts the definition and derogations proposed by ECHA, it may enable the cosmetics industry to make misleading claims and advertisements, such as 'microplastic-free' and 'biodegradable ingredients'. It will leave more room for greenwashing to be rampant, which would leave consumers even more confused.

A future-proof legislation is key

With so many unknowns and potential risks for environmental and human health, we call upon the European Commission to adopt the precautionary principle and include engineered nanoplastics, water-soluble, liquid, semi-solid and biodegradable polymers in their restriction proposal. The coming years will be crucial for creating a future-proof restriction on microplastics that potentially pose a risk to the environment and to human health.

The European consumer market is one of the biggest in the world. European laws will influence markets around the world. A strict EU law that regulates *all* intentionally added microplastics will have a far-reaching impact on the global fight against the microplastics menace.



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Context: THE OMNIPRESENCE OF MICROPLASTICS

Plastic pollution is ubiquitous and far-reaching. Plastics are found in the water we drink, the food we eat, and the air we breathe. There's no corner of our planet left untouched by microplastic pollution. Plastics have infiltrated our food chain at all levels. This should not come as a surprise considering we live in a highly plasticised world. From everyday products such as food packaging and textiles to building materials and industrial machinery, every industry uses plastic as a common ingredient.

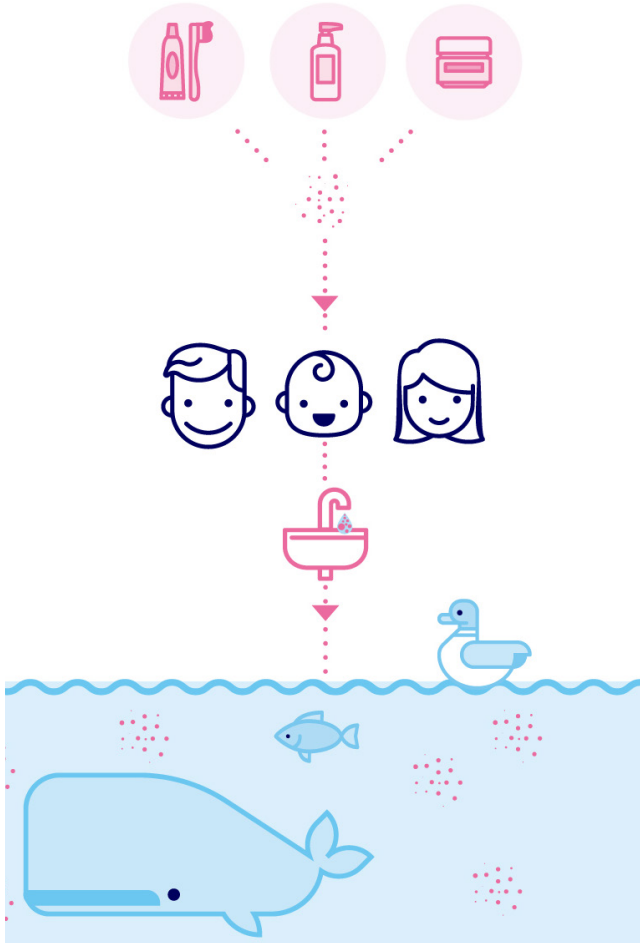
Microplastics are an (un)intended product of our plastic world. The term 'microplastic' is not defined consistently but only loosely as a plastic particle smaller than 5 mm. These particles are associated with long-term persistence in the environment, as they are very resistant to biodegradation. Microplastics can be generated through the fragmentation of bigger plastic waste that ended up in the oceans and other ecosystems. These small pieces of plastics are often also referred to as secondary microplastics because they were not intended to end up as microplastics. They are the result of the disintegration of plastic products that broke down into ever smaller plastic pieces.

The other type of microplastics – the primary or engineered microplastics – are deliberately manufactured plastic particles which are added to a wide variety of products, for example cosmetics, paint, pharmaceuticals and agricultural products such as fertilisers. In Europe, each year around 42,000 tonnes of this irreversible pollution end up in the environment when products containing microplastics are used.[1]

Microplastics have been found at the highest point on Earth, in the Himalayas, and at the lowest points of our planet, such as the Mariana Trench. Microplastics have been found in all kinds of water bodies on our planet. Once they end up in the environment, microplastics are almost impossible to remove. In this sense, we are causing irreversible pollution via our seemingly harmless everyday products.

The reasons for concern

In some cases, plastic can constitute up to 90% of the ingredients added to a cosmetic product.[2] Once used, these microplastics, hardly visible to the naked eye, flow straight from the bathroom drain into the sewer system. Wastewater treatment plants are not capable of filtering them out completely; that is how microplastics from cosmetics contribute to the 'Plastic Soup' in our oceans. The microplastics removed in wastewater treatment plants are also trapped in the sludge[3], which is then applied to our agricultural soil as fertiliser. Consequently, our soil is also contaminated by microplastics.



PLASTICS MAY AFFECT *our health*

- **Once ingested or inhaled,** microplastics can enter our bodies. Recently, ground-breaking research showed that plastic is present in human blood. Once in our blood, these plastics can travel to other parts of our bodies. Our immune system will react to these plastic trespassers, yet it is not equipped to deal with non-biodegradable objects. The immune system may continue attacking these plastic particles, which may in turn lead to inflammation. Chronic inflammation is associated with numerous health conditions such as auto-immune diseases and cancer.

- **Plastic products contain chemical additives,** and these can leach into our bodies. A number of these chemicals have been associated with serious health problems such as hormone-related cancers, infertility, and neurodevelopmental disorders such as ADHD and autism.

- **Plastics in the environment** attract micro-organisms, such as harmful bacteria (pathogens). If microplastics containing these pathogens enter our body, they may increase the risk of infection.

Box 1.1

After ending up in the environment, these microplastic ingredients attract and absorb contaminants as if they were little magnets and sponges. The particles become polluted and are eaten by organisms; the ingested microplastics can then be passed along the food chain. Since humans are ultimately at the top of this chain, we also ingest microplastics and the chemicals added to these plastics.

Using a variety of cosmetics and care products is, amongst others, one of the prominent ways our bodies are exposed to microplastics. Over recent years the scientific community has expressed concerns about the human health hazards of microplastics. Plastics may affect our health in different ways (See box 1.1).

Our dependence on plastics in its multiple shapes and forms is not only a threat to our environment but it may also have an impact on our health.[4] Plastic pollution is not just an environmental crisis but also a human health issue.

Making the invisible visible

We started campaigning against microbeads in 2012, highlighting the 5 kinds of microbeads made of Polyethylene, PET, PMMA, PP & nylon. These spherical shaped beads were used in rinse-off products such as toothpaste and scrubs for exfoliation purposes. Since then, the Beat the Microbead (BTMB) campaign has successfully raised awareness about microbeads as well as other plastic ingredients. We accomplished this by accumulating information on these ingredients, and reaching out on a large scale to brands, governments, and people.

One of the earliest accomplishments of the BTMB campaign was to get multinational company Unilever to promise in December 2012 to phase out microbeads from their entire product range. In 2013, this commitment was also adopted by the biggest personal care & cosmetics brands in the world such as L'Oréal, Colgate-Palmolive, Beiersdorf, Procter & Gamble, and Johnson & Johnson. This move resulted in the removal of microbeads from all rinse-off products under the European Union Ecolabel.

Since the beginning of our campaign, 15 countries have taken steps to ban microbeads. Our continuous campaigning put this topic on the map and made the issue of microplastics in cosmetics a global concern. We may have been victorious in the battle, but the war is yet to be won. Microbeads in cosmetics were just the tip of the iceberg. Thanks to studies that followed, we now know that there are hundreds of other plastic ingredients widely used in cosmetics and personal care products.

The European Commission shares these concerns and has started looking into restricting these intentionally added microplastics inside our care products. But restricting these plastic ingredients won't be an easy task.

Europe's restriction on intentionally added microplastics

In 2018, the EU's 'plastics strategy' was published. In its strategy, the EU recognises the serious negative effects plastics can have on the environment and human health. Therefore, the EU is taking measures to tackle plastic pollution and marine litter. A central focus in the plastics strategy is to restrict "intentionally added microplastics that pose a risk to the environment and/or to human health". The EU aims to restrict the use of microplastics that are intentionally added to products such as cosmetics, detergents, paint, and pesticides.

Although this restriction would be the first of its kind and will initiate similar conversations worldwide, it might not be free of limitations. We are worried that not all synthetic polymers will be included in this upcoming restriction on 'intentionally added microplastics'. Decisions at this stage are crucial in determining whether Europe's future will be truly microplastic-free or not. Such loopholes can jeopardise the integrity of the effectiveness of this restriction.

Aims of this report

With this report we aim to explain the potential shortcomings of the upcoming European legislation on 'intentionally added microplastics'. The purpose of this legislation is to protect environmental and human health from microplastic pollution. Some types of microplastics might be exempted and we will present a science based review explaining why these exemptions could also have adverse environmental and human health impacts. Exempting these microplastics would be underming the purpose of the upcoming legislation. We will stress the need for including a broader definition of microplastics that is not limited to solid particles (see chapter 2). As the EU is already working with a 'no data, no market' approach when it comes to chemicals, the precautionary principle should work in our favour where there is not enough information available on these substances (see chapter 2).

With this report we also want to seize the opportunity to warn about how an inadequate piece of legislation will enable the cosmetics industry to use green claims such as 'microplastic-free' or 'biodegradable ingredients' on their products. However, the environmental safety of these ingredients cannot be guaranteed, and these claims may therefore be false. Hence, the upcoming legislation may enable the cosmetics industry to make misleading claims and advertisements.

Lastly, we want to push the industry to take greater responsibility for the substances they bring to our markets and our everyday products. We want to plead with regulators to not miss this golden opportunity to deal with all intentionally added microplastics once and for all and to come up with a future-proof policy that leads the way for the rest of the world to follow. We want to ask consumers to demand transparency from brands, choose zero plastic in their care and cosmetic products and make their voices heard in demanding a truly microplastic-free future.

Microplastics
THROUGH THE EYES OF POLITICS AND SCIENCE

The EU decision-makers are at a crucial crossroad. The decisions made at this point will either ensure a future-proof policy on intentionally added microplastics, or it will create a backlog of problems that will have to be addressed in the future. It all started in 2018 when the EU's 'plastic strategy' was published. In this strategy, the EU recognises the serious negative effects plastics can have on the environment and human health. Therefore, the EU is taking measures to tackle plastic pollution and marine litter.

In 2019, the European Commission (EC or Commission) published the European Green Deal. This is a set of policy initiatives with the aim of making the European Union climate neutral in 2050. It also introduces new legislation on the circular economy, building renovation, biodiversity, farming, and innovation. The Green Deal follows up on the EU's 2018 plastic strategy and proposes measures to encourage Europe to adopt a sustainable approach to plastics. This will lead to rules and targets for different areas, including single-use plastics, plastic packaging, microplastics, and biobased, biodegradable, and compostable plastics.

Already in 2017, the European Commission requested the European Chemicals Agency (ECHA) to formulate a proposal for a restriction on 'intentionally added microplastics' in products such as cosmetics, detergents, and agricultural products such as cosmetics, detergents, and agricultural products[5]. ECHA presented their final opinion to the EC in February 2021[6], together with the opinions of its scientific committees[7].

The scientific data gathered by ECHA is loud and clear: microplastics pose a serious risk to the environment, a source that is undeniably out of control[8]. ECHA wants to prevent 500,000 tonnes of microplastics that would be released to the EU environment (and to our food and water) over a 20-year period[9]. The European Commission will come up with a proposal for legislation to achieve this goal. It is for the Commission to determine the extent to which the final text will follow ECHA's proposal. Once they have presented their proposal, the EU Member States will vote on it after which the European Parliament and Council will have a three months scrutiny period to review it, before eventual final adoption.

It's all in the definition of microplastics

The EU is truly leading the way by investigating a legislation to restrict intentionally added microplastics. This restriction will be the first of its kind in the entire world. However, in line with industry lobbying positions, ECHA's proposed definition of microplastics is limited with various loopholes. This is evident in the discussions and decisions

made around the central topic of this upcoming legislation: defining microplastics.

Defining microplastics is the most important aspect of such an undertaking as it could ensure the reduction of microplastics leaking into our environment considerably. The current proposed definition is a good start, but it is still far from complete. ECHA suggested to define microplastics as[10] (See box 2.1):

MICROPLASTIC
proposed definition

'microplastic' means particles containing solid polymer, to which additives or other substances may have been added, and where ≥ 1% w/w of particles have (i) all dimensions 0.1 µm ≤ x ≤ 5 mm, or (ii), a length of 0.3 µm ≤ x ≤ 15 mm and length to diameter ratio of >3.

Box 2.1

There are multiple problems here: not all synthetic polymers have been included in this proposed definition. For instance, all solid plastics smaller than 0.1 µm are outside of the scope. That means these plastics would still be allowed in our care products. All water-soluble, semi-solid and liquid polymers are also excluded from this definition, focusing only on synthetic polymers in solid form. Additionally, 'biodegradable' plastics escape this restriction proposal as these have also been derogated from the proposal. The Plastic Soup Foundation considers ECHA's definition of microplastics too limited, as environmental and human health concerns also exist for the derogated groups. We also argue that an inadequate piece of legislation gives ample room for the cosmetics industry to work around the restriction and continue their reliance on synthetic polymers (see Chapter 4).

The cosmetics industry uses 8,700 tonnes of microplastics every year, and according to ECHA an estimated 3,800 tonnes find their way into the environment annually. Considering that many synthetic polymers escape the scope of the proposed restriction, we believe that these figures are much higher than ECHA estimates. Additionally, long transitional periods are introduced that will delay the entry of the ban into force. The cosmetics industry would get four years to remove microplastics from 'rinse-off' products and six years to remove them from 'leave-on' products.

The current derogations and long transitional periods in the proposal will considerably undermine the capacity of the restriction to achieve its objective. On top of this, microplastic pollution will continue for almost another decade. Such long transitional periods to adapt to the law would mean allowing tonnes of microplastics to enter the environment. A number of other organisations in Europe share our concerns. Together, we drafted a position paper that outlines these points at length.[11]

These long periods for adaptation are even more worrying when the Commission itself is delaying delivering a proposal. The Commission should have delivered a proposal in May 2021 (in accordance with the legal deadline set in REACH, Art. 133(4)). Yet, no proposal has been put forward. Because of unclear reasons, the process is delayed. The adoption of this restriction is now foreseen by the end of 2022.[12]

ClientEarth and the European Environmental Bureau (EEB) have calculated that a yearlong delay could see levels of around 42,360 tonnes of additional microplastics emitted into the environment through cosmetics, detergents, paints, and fertilisers. This is equivalent to 1.6 billion plastic bottles. Since 2017,

when the Commission first asked ECHA to come up with a proposal for a restriction, 169,441 tonnes of microplastics (or 6.4 billion plastic bottles) are estimated to have already been released into the environment.[13]

The longer it takes the EC to submit its proposal, the more microplastics will end up in the environment. Therefore, the restriction process must no longer be delayed.

Science-based red flags

Synthetic polymers are the main constituent of plastics, resins, coatings, and paints. They are also used in cosmetics, personal care products and a variety of other products. We and our environment are widely exposed to these polymers on a daily basis. Over the years scientific research has pointed out the various environmental and human health hazards of plastics. Nevertheless, synthetic polymers have so far been exempted from registration under the European chemical regulation REACH.[14] Under the REACH regulation, the 'no data, no market' principle is at play. Meaning, the REACH regulation holds the industry accountable for managing the risks from chemicals and providing safety information on the substances.[15] Producers and importers are required to gather information on the properties of their chemical substances, which will allow their safe handling. Thus, the precautionary principle underpins REACH.

Similar concerns exist for microplastics as those of persistent, bioaccumulative and toxic (PBT) chemicals. Therefore, an EU-wide restriction on microplastics is justified. Unfortunately, by exempting so many synthetic polymers in the restriction, many synthetic polymers with PBT concerns will continue to be used in cosmetic products. In the following sections we will address these concerns for engineered nanoplastics (< 0.1 µm), water-soluble, liquid, and semi-solid polymers and biodegradable polymers.

Water-soluble, liquid, and semi-solid polymers

Water-soluble polymers

Synthetic water-soluble polymers (WSPs) are plastics that 'dissolve, disperse or swell in water'. Useful properties in many applications, these plastics are therefore used in paints, building materials, personal care products and agricultural products, among other things. Many of these uses however enable direct or indirect discharge into the environment. Annual production volumes of WSPs are estimated in the millions of tons range in Europe alone, and this combination results in a high potential for the presence of WSPs in the environment. When present in sufficiently high concentrations, WSPs could cause long-lasting changes to natural ecological processes.[16]
Some WSPs are very slowly degraded in the environment and can therefore persist for a long time. Other WSPs are more prone to degradation and degrade into various transformation products, which can be persistent and toxic. Polyacrylamide (PAM) is a prominent example of this as the monomer acrylamide is a known neurotoxin and potential carcinogen. Moreover, transformation products of WSPs have the potential to cross biological cell membranes. The extent to which WSPs and degradation products are present or accumulating in drinking water, surface water, sediments or soil is not investigated due to lacking analytical tools; therefore, despite the increasing exposure to WSPs, the environmental and health risks resulting from them remain highly uncertain.[17] [18]

Liquid and semi-solid polymers

Some synthetic polymers are used in a liquid, or semi-solid phase, when being applied in products. Depending on their molecular structure, these polymers can be water soluble or form insoluble droplets. The phase of a polymer depends not only on the monomers that make up the (co)polymer but also on properties like chain length, degree of crosslinking and molecular weight. In addition, the ratio of different monomers in copolymer material can also determine the phase of the polymer[19].

German figures illustrate that the use of liquid and semi-solid polymers in cosmetic products greatly exceeds the use of solid polymers. Every year 23,700 tonnes of soluble, semi-solid and liquid polymers enter the wastewater system due to the use of cosmetic products, compared to 922 tonnes of solid synthetic polymers (<5 mm)[20]. From this we can conclude that a large proportion of plastic emissions from personal care products will not be prevented with the upcoming legislation on intentionally added microplastics.

Dimethicone, a silicone-based substance, is an example of a liquid polymer commonly used in personal care products. Concerningly, dimethicone meets the persistent criteria as described in REACH legislation, has been identified as a CMR (carcinogenic/mutagenic/reprotoxic) substance and exhibits endocrine disrupting properties[21]. The use of CMR substances is prohibited under the EU cosmetics regulation, yet some exceptions to this rule exist. For example, some silicone-based CMR substances are permitted at concentrations equal to or less than 0.1% by weight. Moreover, in some applications including personal care products, dimethicone has been identified as a potential risk to the environment[22 23]. This example illustrates that liquid or semi-solid polymers can be hazardous and should therefore not be presumed to be benign.

Engineered nanoplastics

Though the exact cut-off between a microplastic and nanoplastic is a subject of ongoing debate, nanoplastics are often defined as 100 nanometres or less in size. These particles tend to be smaller than or close to the size of viruses. Engineered nanoplastics are deliberately manufactured plastics and their use can facilitate direct or indirect discharge into the environment. Apart from this, environmental pollution by nanoplastics takes place due to the fragmentation of larger plastics, resulting in secondary nanoplastics. Substantial knowledge gaps still exist regarding the presence of nanoplastics in the environment, as analytical tools to detect these particles are still in the development phase.

The environmental and human health hazards of (engineered and secondary) nanoplastics are threefold, and all are related to their small size. First, due to their large surface-volume ratio, they can easily absorb contaminants present in the environment. Moreover, plastics themselves contain a complex mixture of chemicals. When plastics are ingested or inhaled, these chemicals and contaminants can migrate from the plastic into exposed tissue. The role of (engineered and secondary) nanoplastics in mediating chemical effects is however still unclear. Secondly, nanoplastics can cross biological barriers present

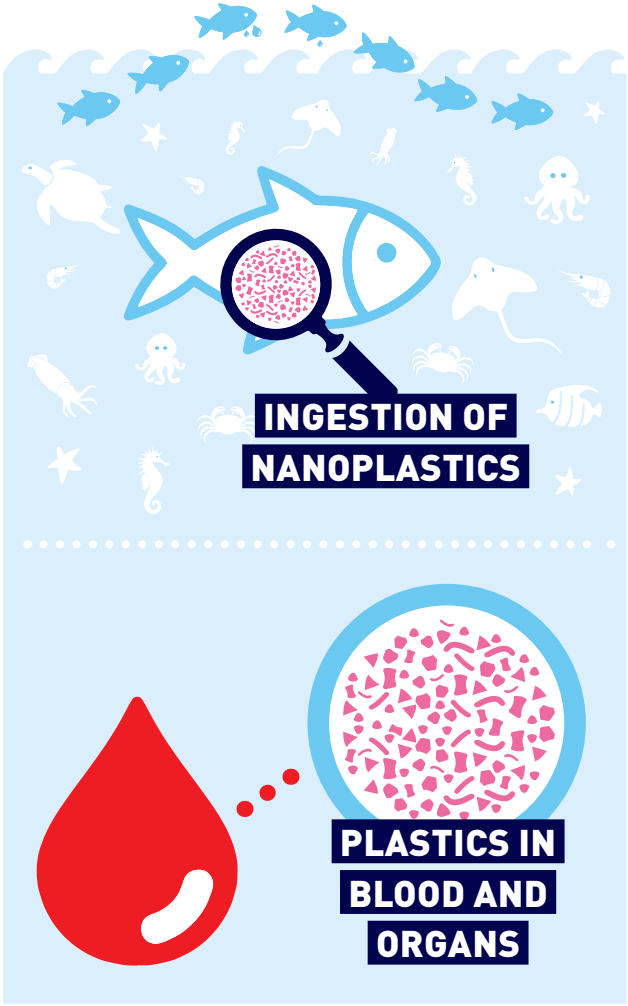


Figure 2.1

in the gut, lung, placenta and brain, even more so than larger plastic particles. Consequently, nanoplastics are able to reach the blood, reach organs and even the foetus[24] (See figure 2.1). To what extent nanoplastics accumulate in bodies or are excreted remains to be investigated.
Thirdly, once in our body, the particle can exert toxic effects (particle toxicity – see glossary). A more well-known example of particle toxicity is black carbon, where exposure to the particle has been linked to the development of lung diseases including cancer. Particle toxicity has also been demonstrated for plastics and includes immunotoxic effects, inflammation, DNA damage and cellular damage, among other things[25] (See figure 2.2). Many features of plastics such as size, shape and chemical make-up ultimately determine the extent of particle toxicity. Nanoplastics are potentially more toxic than larger particles as it has been suggested that toxicity increases with decreasing particle size[26 27].

Biodegradable Polymers

A relatively new group of polymers are biodegradable polymers, and they can be made from renewable feedstocks (biobased) or fossil fuels. Biodegradable plastics are designed for conversion into CO2, methane, biomass and mineral salts by microorganisms, a process called mineralisation (See figure 2.3). The speed and

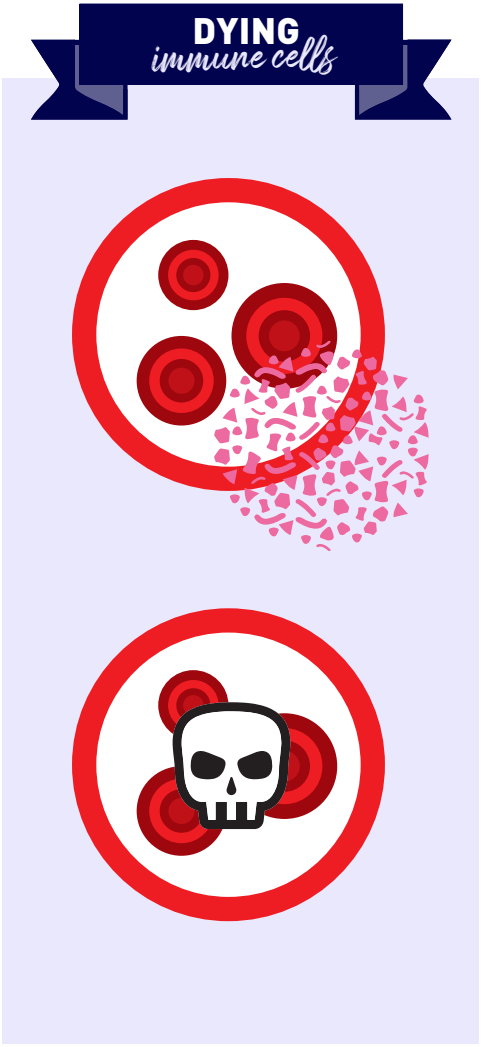


Figure 2.2

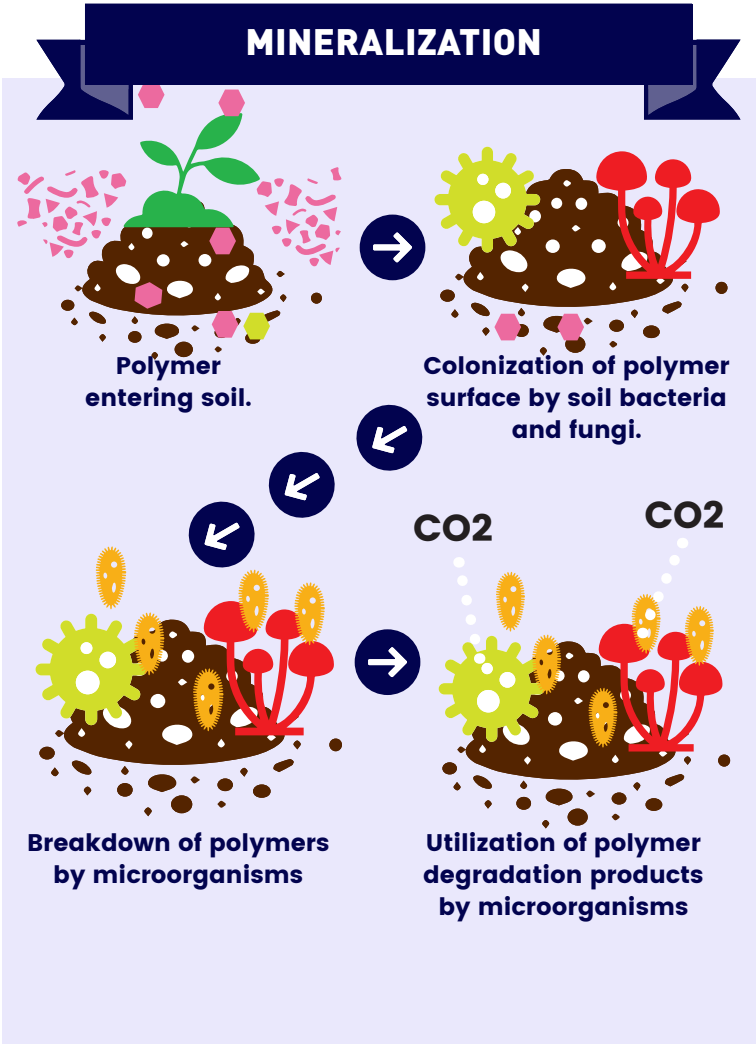


Figure 2.3

degree of biodegradation in the environment, however, is largely dependent on the prevailing conditions (e.g. temperature, humidity) and fragments of the biodegradable polymer may remain in certain environments over long time scales.

Biodegradable plastics should not be confused with biobased plastics or compostable plastics. Biobased plastics are derived from biological raw materials (for example starch) and can but do not necessarily have biodegradable properties. Compostable polymers require very specific conditions present in industrial composting facilities for their degradation. Though developed as an 'environmentally friendly' alternative to conventional plastics, various questions regarding the persistency and toxicity of biodegradable polymers remain.

Different standardized laboratory tests are used to assess the biodegradation of plastics, for example in water, aquatic sediments, or soil. Depending on the plastic application, different tests have been approved by the European Chemicals Agency, making use of standards developed by the Organisation for Economic Co-operation and Development (OECD) or the International Organisation for Standardization (ISO). It is important to note that many of these tests have been developed for chemicals, and not specifically to assess the biodegradation of plastics. For engineered microplastics used in cosmetic products, most approved tests use average temperatures of at least 20 °C and oxygen-rich conditions. While these experimental conditions may be useful for determining the maximum degree of biodegradability, they poorly reflect relevant environmental conditions such as colder climates and low oxygen availability. In those conditions, microbial activity may be much lower and hence, also biodegradation rates are lower[28]. Consequently, biodegradable plastics may still persist in the environment. It has therefore been argued that current standardised tests are not rigorous enough and that degradation under actual field conditions should be studied in order to calibrate the standards[29]. Concerns also exist with regards to the presence of hazardous chemicals, as chemicals contained in biodegradable plastics can have similar toxicity as conventional plastics[30]. Chemicals and micro-sized particles of biodegradable materials have also been shown to adversely affect marine and freshwater organisms, crop growth, as well as soil quality and bacteria amongst others.

No Data, No Market

With their restriction proposal, ECHA aims to address the environmental and human health

risks posed by microplastics. By including only solid, non-biodegradable plastics between 5 mm and 0.1 µm, we believe that ECHA is undermining the purpose of this restriction. As outlined above, the presence of WSPs in the environment is to be expected based on their production volumes and high potential of environmental discharge.

Their distribution, concentrations, and impact are unfortunately still highly unclear. Moreover, little is known about the transformation products of many WSPs, and their persistency and toxicity. Regarding liquid and semi-solid polymers, the example of dimethicone illustrated that these polymers can be of environmental concern. Engineered nanoplastics, such as those applied in personal care products can cross biological barriers and exert toxic effects. ECHA justifies the lower limit of 0.1 µm by arguing that a lower size limit (of 1 nm) cannot be enforced. However, an interdisciplinary group of scientists recently argued that this claim is invalid and that "intentionally added plastic particles in the nano range (< 0.1 µm) could be reintroduced into the restriction proposal[31]. With respect to biodegradable polymers, real-world conditions are poorly reflected in current standardised biodegradation tests and various concerns about their toxicity exist.[32]

Clearly, there are still too many unknowns for these synthetic polymer groups in order to assess their risk. Not all polymers within these groups may be harmful to environmental and human health, but some likely will be. Future research and hazard assessments will hopefully provide new insights and identify sub-groups requiring strong regulation. Until that time we call upon policy-makers to adopt the precautionary principle for all synthetic polymers and consider their hazards when developing new regulatory measures. In the case of ECHA's restriction proposal, exemption of the above-mentioned groups is particularly unjustified for applications for which ample non-synthetic polymer alternatives already exist (for example personal care products). Additionally, regulations can be introduced that will require more short-term and long-term hazard toxicity testing before authorizing synthetic polymers to be placed on the market at certain volumes. One avenue for this would be to include the registration of polymers under REACH. The first steps towards registering polymers under REACH have been made by the European Commission. The criteria to identify polymers requiring registration (PRR) have however been highly criticised by members of the scientific community as at this stage 94% of polymers would be exempted from registration[33]. If polymers would require registration under REACH, the 'no data, no market principle would apply to these substances, which would fill many relevant knowledge gaps presented here. Furthermore, it would require manufacturers and producers to take responsibility for all ingredients used in their products.

TEN BRANDS UNDER *the microscope*

Hundreds if not thousands of synthetic polymers are used in our cosmetics and care products. While the extent of these ingredients is known, the environmental impact is difficult to grasp. Research by UNEP[34], TAUW[35], and the restriction proposal by ECHA[36] does help a little in placing some of these synthetic polymers on our map. This information can be quite daunting, which is why we, as the Plastic Soup Foundation, created a traffic light system to categorize products: Red, Orange & Green (See box 3.1).

We collected product information through the citizen science efforts from Beat the Microbead app users (see Annex II for detailed methodology). By collecting data and categorising them with this traffic light system, we were able to look at ingredient level information of all the products registered in our database. Since 2020, we have been able to investigate different product categories and have discovered how many products under these product types contain microplastics.

For instance, in 2020, because of the Covid-19 pandemic, the use and sales of hand sanitisers skyrocketed. Out of 138 registered sanitisers and hand gels, 82 contained microplastic ingredients, 5 had sceptical microplastics and 28 disinfectants had both microplastics and sceptical microplastics.

GUIDE TO MICROPLASTICS

RED

Products in this colour category contain microplastics. Our list of microplastics is derived from the research conducted by UNEP, TAUW, and ECHA. We consider these reports to be the best-substantiated overview currently available on the different microplastics potentially present in cosmetics and personal care products. This list contains over 500 synthetic polymers.

ORANGE

Products in this colour category contain what we call 'sceptical' microplastics. By 'sceptical microplastic' ingredients we mean synthetic polymers without sufficient information concerning their risks. These include, but are not limited to, Polyquaternium, Polysorbate, PEGs, and PPGs. We will keep adding suspicious substances to this list and remove the ones that proved not to pose a risk to the environment and/or human health.

GREEN

Products in this category do not contain any known microplastics or 'sceptical' microplastics from the red and orange categories.

Box 3.1

That's about 80% of hand sanitisers and gels with plastic ingredients inside them. There's hardly any popular consumer brand with an entire range of products using plastic-free ingredients.

A deep dive into Europe's popular consumer brands

To get a more specific picture of the wide use of microplastics, we have dived into the 10 most popular consumer brands of the 4 biggest cosmetic producers in Europe. For this purpose, we largely based our choice of targeted companies and brands on the report: *'Leading 20 health and beauty brands ranked by consumer reach points in Europe in 2020'*, by the Statista Research Department[37]. Our focus in choosing these producers and brands is based on the fact that they are the biggest players in the market with popular brands. They are by no means the worst performers in the market. In order to obtain the product level information, we looked into the Beat the Microbead app database. This data is collected through the citizen science efforts of the app users.

Since we are committed to holding ourselves to the same high standards of transparency we demand of others, our thought process on which cosmetics companies and brands should be included in this report is explained in Annex II.

After determining the producers and brands to engage with, we looked at how many of the registered products from these companies in our database had either red, orange or both ingredients from our traffic light system to categorize products in our database. We also looked for the most common microplastics ingredients in these products.

Despite the increasing popularity of the BTMB app we are still far from having a complete overview of the cosmetics and personal care industry. Inevitably certain limitations apply to our dataset. Our methodology, data collection method and its limitations can be found in Annex II. Furthermore, we analysed the information available on these 10 brands' websites, public policies and sustainability plans.

To get further clarifications, insights on their plans and to verify whether the product formulae have been changed, we sent a letter to the producers of all the brands mentioned above (see Annex IV). We did that so we could update our dataset based on their response and find out how committed they are to tackling microplastic pollution.

Where do these brands stand?

Considering the recent developments in the conversation around (micro)plastic pollution, businesses cannot avoid addressing this issue anymore. Businesses must take responsibility for the impact their products have on the planet. The question is how sincerely big businesses want to tackle this issue. The summaries of our findings are laid out in the following sections.

TAKING THE ABOVE INTO ACCOUNT, WE ENDED UP FOCUSING ON THE FOLLOWING COMPANIES AND BRANDS:

L'ORÉAL GROUPE
- L'Oreal Paris
- Elvive/Elseve
- Garnier

Beiersdorf
- Nivea

P&G
- Gillette
- Oral-B
- Head & Shoulders

Unilever
- Dove
- Rexona
- Axe

L'ORÉAL:

Plan for the future

The L'Oréal Group does recognise the problem of plastic pollution. In their sustainability plan *L'Oréal For the Future,* they go as far as calling it "one of today's most pressing environmental issues".[38] They do recognise the need for bettering their packaging by claiming that "by 2030, 100% of their packaging will be from recycled or biobased plastic, and by 2025 all plastic packaging will be refillable, reusable, recyclable or compostable"[39].

However, there is no direct mention of microplastics in their sustainability plans. Instead, they say they will re-evaluate all their formulae by 2030 to guarantee respectfulness to all aquatic ecosystems both continental and coastal, but nowhere in their booklet or on their website do they explain what they mean by "respectful". Another goal is to have 95% of their ingredients biobased by that same date. What this means in terms of their use of plastic ingredients is not specified enough as biobased ingredients do not automatically mean they are environmentally friendly and shouldn't be confused with biodegradable ingredients.

L'ORÉAL PARIS:

'Because Our Planet is Worth It'

L'Oréal Paris' plan *'Because Our Planet is Worth It'* closely follows its producer's plan. By 2030 they will use 20% less material to package the same number of products. They also want to use 100% recycled plastic and optimise the recyclability of packaging. For instance, in the future they will sell their shampoo and conditioner in aluminium packaging that consumers can send back for refilling.

However, these plans make no mention of microplastics or their view on the use of microplastic ingredients. They seem to be focusing their efforts on plastic packaging and carbon emissions, but they stop short of really making their formulae sustainable or respectful to the environment. When we asked them about their plans to tackle microplastics, L'Oréal Group responded:

"• We reformulated all our rinse-off products that are directly eliminated in water, such as shower gels or shampoos. Since 2020 they are all microplastic-free.
• L'Oréal started working on reformulating its rinse-off products in 2014. All plastic microbeads were eliminated from exfoliating products as of January 2017.

L'ORÉAL PARIS

77% of the **1.003 L'Oréal Paris products** registered in BTMB contain red microplastics.

90% of the **1.003 L'Oréal Paris products** registered in BTMB contain orange microplastics.

Only **4%** of the **1.003 L'Oréal Paris products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 5 **most used red ingredients in the L'Oréal Paris products** registered in BTMB are: Dimethicone (376), Carbomer (191), Acrylates Copolymer (60), Nylon-12 (60), and Polyquaternium-7 (51).
- The top 5 **most used orange ingredients in the L'Oréal Paris products** registered in BTMB are: PEG-100 Stearate (148), Amodimethicone (120), Ammonium Polyacryloydimethyl Taurate (87), Ceteth-2 (87), and Trideceth-6 (86).

Figure 3.1

- The gradual replacement of microplastics in other products is underway.
- At the European level, with the cosmetics industry and within our trade association, we are in dialogue with the authorities on the definition of microplastic, how restrictions are implemented according to product categories and the timing".

It seems they refer to the limited definition of microplastics proposed by ECHA. Based on this premise we find it worrying that they consider the rinse-off products as microplastic-free. As we demonstrated in the previous chapter, there is still no guarantee if the synthetic polymers that fall outside of this definition are safe for the environment. Our data shows that there are still many questionable plastic ingredients in their cosmetics, including shower gels and shampoos. Because we consider all synthetic polymers in order to assess whether a product is microplastic-free or not, our data shows that many L'Oréal products contain plastic ingredients (See figure 3.1).

OF THE SUB-CATEGORIES FACIAL CARE AND HAIR PRODUCTS OF L'ORÉAL PARIS, 3 OUT OF 4 PRODUCTS IN OUR DATABASE CONTAIN RED INGREDIENTS.

ELVIVE/ELSEVE:
Take on sustainability

On the L'Oréal Paris' website, Elvive is described as "flying the flag of L'Oréal Paris' ambitions toward sustainability," claiming that Elvive is making great strides to minimise its footprint and thus proving that "planet-friendly credentials and innovative products are not mutually exclusive."[40]

On their website L'Oréal Group presents their no-rinse hair products like the Elvive Dream Lengths line as part of their "green innovations". However, in our database we see that many of these products still contain plastic ingredients: of the 15 products 11 are red & orange, 3 are orange and only one (the dry shampoo) is green (See figure 3.2). The Dream Lengths range is being presented as eco-friendly while it is full of plastic ingredients. On the L'Oréal website they mention the Elvive Full Resist Power Mask released in 2019 as over 97% biodegradable ingredients[41]. According to our database, this product is also microplastic-free.

Elvive has two strategies which focus on packaging and formulae. As of 2020, 100% of the bottles are made of recycled plastic and they will be 100% recyclable in the future – they claim. Regarding the formula: their sustainability plan makes the first indirect mention of microplastics in the L'Oréal Group[42]. The L'Oréal Paris USA website states:

ELVIVE/ELSEVE

53% of the **374 Elvive/Elseve products** registered in BTMB contain red microplastics.

83% of the **374 Elvive/Elseve products** registered in BTMB contain orange microplastics.

Only **7%** of the **374 Elvive/Elseve products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 5 **most used red ingredients in the Elvive/Elseve products** registered in BTMB are: Carbomer (146), Dimethicone (127), Polyquaternium-7 (29), Polyquaternium-6 (7), and Acrylates/C10-30 Alkyl Acrylate Crosspolymer (4).
- The top 5 **most used orange ingredients in the Elvive/Elseve products** registered in BTMB are: Amodimethicone (187), Trideceth-6 (118), PPG-5-Ceteth-20 (59), Ceteth-2 (56), and Trideceth-10 (43).

Figure 3.2

"The latest generation co-emulsion technology means that the thinnest coating of microdroplets is used to wrap the fibers. This means that not only is less silicon used, but the biodegradability of the formula is increased without having to reinvent it".

It is hopeful the brand is at least brave enough to mention the use of silicones and their work on reducing the amount they use, but we would like to see them address their use of plastic ingredients more transparently. At the moment, to us it still looks like a greenwashing effort of what our database shows is an extensive use of microplastics in their formulae.

GARNIER:

Ideas on how to protect the ocean

Garnier recognises the fight against plastic pollution as one of the pillars of their sustainability plan. They also talk about their desire for greener and cleaner formulae, claiming that their new shampoos and hair care formulae were on average 91% biodegradable in 2019.

In 2025, they want 75% of their ingredients to be biobased. It is important to emphasise here again that biobased ingredients are not automatically environmentally friendly and their biodegradability is not a given fact. Only 23% of Garnier products in our database were free of microplastics (See figure 3.3). Considering this low percentage of green products, we encourage them to do more to become entirely microplastic-free.

OF THE SUB-CATEGORIES HAIR AND FACIAL CARE PRODUCTS OF GARNIER, 1 OUT OF 3 PRODUCTS IN OUR DATABASE CONTAINS RED INGREDIENTS.

In their sustainability plan called *'Green Beauty Initiative'*, they address the need for "more actions to fight plastic pollution". In this section they talk about their dedication to fight plastic pollution in the environment, specifically plastic in the ocean. Garnier states that "It poses a threat to the functioning of marine ecosystems, and micro-plastic particles floating in the ocean are toxic for all living beings."[44]

Even after acknowledging the above, they do not make any mention in their sustainability plans of the microplastic particles or the non-sustainable nature of the ingredients they use in their beauty products. Instead, most attention goes towards the plastics in packaging. They make different claims about packaging their products without virgin plastic and promise that all packaging will be 100%

GARNIER

48% of the **1.454 Garnier products** registered in BTMB contain red microplastics.

67% of the **1.454 Garnier products** registered in BTMB contain orange microplastics.

Only **23%** of the **1.454 Garnier products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 5 **most used red ingredients in the Garnier products** registered in BTMB are: Dimethicone (295), Carbomer (282), Acrylates/C10-30 Alkyl Acrylate Crosspolymer (138), Styrene/Acrylates Copolymer (62), and Poly C10-30 Alkyl Acrylate (47).
- The top 5 **most used orange ingredients in the Garnier products** registered in BTMB are: PEG-100 Stearate (187), Amodimethicone (184), PPG-5-Ceteth-20 (157), Ceteth-2 (150), and Trideceth-6 (146).

Figure 3.3

recyclable, degradable or reusable by 2025. Garnier presents itself as a green brand that will make green beauty accessible to all. By driving attention to how they are revolutionising their packaging and their efforts to stop plastics from flowing into the ocean where it breaks down into microplastic particles, they are not addressing how the plastic ingredients within their products might be adding to the plastic problem they are working on to resolve.

The missing link

The L'Oréal group and its brands seem to fall short in their thinking that sustainable beauty stops at sustainable packaging, fair-trade natural ingredients, and carbon neutral sites (100% renewable energy). In response to our letter, L'Oréal said they have "been committed for several years to reducing the use of plastic microbeads and microplastics in its products", while there are no clear public commitments and plans to address microplastics under their larger sustainability plans or under the sustainability of the plans of the brands we assessed above.

Microplastics seem to be the missing link between the public commitments and the ambitions of the L'Oréal group in addressing the plastic pollution problem. We encourage them to take a step further to create truly revolutionary new formulae for their brands and products that do not directly pollute our environment with microplastics.

BEIERSDORF:

"Care beyond Skin'

Beiersdorf is a company that seems to understand the importance and significance of the plastic pollution crisis. It has committed to reducing the use of fossil-based virgin plastic by 50% and using 30% recycled plastic in its packaging. Furthermore, it wants 100% of its packaging to be refillable, reusable or recyclable by 2025.

More importantly, Beiersdorf did not shy away from addressing the microplastics issue. It even went as far as claiming that Nivea would become 100% microplastic-free by the end of 2021 and Eucerin would follow by the end of 2023.[45] This looks extremely promising. We inquired Beiersdorf to get an update on this and if they were indeed able to achieve this goal. They responded by saying "We reached another important milestone in 2019: ever since, all Beiersdorf rinse-off products such as shampoos and shower gels have been free of microplastics. With regard to our "leave-on" products, which are not rinsed off after application, we are also working intensively to replace the few remaining microplastic-based raw materials used. We are making very good progress with these formula changes. In 2021, we were able to achieve our next major goal with NIVEA: Since then, NIVEA products no longer contain any microplastics worldwide."

Although Beiersdorf has been very active in addressing the issue of microplastics in their products, unfortunately, it sticks to the limited UNEP definition of microplastics. In their response to our letter, they say:

"Public debate around the topic of microplastics is very controversial and extremely complex, as there is no internationally binding definition for the term "microplastics". At Beiersdorf, we understand microplastics to be solid, water-insoluble plastic particles that are five-millimeters or smaller and not biodegradable. In doing so, we rely on the substantiated definition of the UNEP, the United Nations Environment Programme, thereby adhering to broadly shared scientific opinion."

Beiersdorf also claims that they will only use biodegradable polymers in all their European formulations by 2025. In their response, they mentioned that "As part of our sustainability agenda, it is our ambition to continuously expand the use of exclusively biodegradable polymers in all our brands' global product formulas." Upon asking for further clarification on this Beiersdorf stated that:

"By gradually eliminating non-biodegradable polymers, we pursue the goal of reducing harmful effects on the environment. We evaluate all raw materials regarding their biodegradability. For this assessment, we apply Annex XIII of the REACH regulation and the corresponding guidelines on information requirements, which also contain the criteria for persistence. These criteria describe the non-biodegradable properties of a molecule over a specific period. The Annex and the guidelines on information requirements are used to identify polymers that are not biodegradable, and our ambition is to avoid these in all our brands' global product formulas. To achieve this, we are not only replacing these ingredients directly, we also develop completely new polymer technologies. To rule out persistency, we are using the established OECD screening tests. As these screening tests (e.g. OECD 301, 302, 310) were not originally developed for polymers we take additional information into account wherever possible. This can include test methods e.g. ISO 14851 and ISO 14852 which have been developed to give indication for biodegradability of polymers and plastics. The above-mentioned test methods mainly target aquatic compartments."

The OECD methods Beiersdorf refers to are some of the approved biodegradability tests by ECHA. These tests were indeed not developed to assess the biodegradability of polymers yet were originally developed to assess the biodegradability of chemicals. The ISO tests are designed for assessing the biodegradability of plastics, however, in chapter 2 as well as in Annex IV we explain that both the OECD and ISO biodegradability tests insufficiently represent real-world conditions. Biodegradation rates of biodegradable microplastics are expected to be lower in the environment compared to the rates observed in these approved tests. Therefore, biodegradable microplastics may still persist in the environment. Furthermore, Beiersdorf mentions that they want to "develop completely new polymer technologies", it is unclear whether these will biodegrade in real-world conditions and would be rigorously tested on persistence, bioaccumulation and toxicity.

The next step for Beiersdorf in their path towards sustainable cosmetics is for them to update their definition of microplastics and therewith their formulae so that they can become a 100% plastic-free brand.

NIVEA:
Plan to phase out microplastics

One Skin. One Planet. One Care is the name of Nivea's sustainability program, which is in line with the sustainability plan of their producer. Like

NIVEA

62% of the **2.789 Nivea products** registered in BTMB contain red microplastics.

70% of the **2.789 Nivea products** registered in BTMB contain orange microplastics.

Only **10%** of the **2.789 Nivea products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 5 **most used red ingredients in the Nivea products** registered in BTMB are: Dimethicone (867), Carbomer (476), Acrylates /C10-30 Alkyl Acrylate Crosspolymer (280), Polyquaternium-7 (205), and Sodium Acrylates /C10-30 Alkyl Acrylate Crosspolymer (176).
- The top 5 **most used orange ingredients in the Nivea products** registered in BTMB are: PEG-40 Hydrogenated Castor Oil (655), PEG-200 Hydrogenated Glyceryl Palmate (371), PEG-7 Glyceryl Cocoate (298), Sodium Carbomer (245), and VP/Hexadecene Copolymer (235).

Figure 3.4

their parent company Beiersdorf, Nivea commits to reducing their use of fossil-based virgin plastic by 50% and to using 30% recycled plastic in their packaging, in addition to making 100% of its products refillable, reusable or recyclable by 2025.[46] As mentioned above, Nivea was supposed to be free of microplastics as of 2021, and thus they take the topic head-on, unlike other brands do.

ONLY 1 OUT OF 10 NIVEA DEODORANT PRODUCTS IN OUR DATABASE IS GREEN, ACCORDING TO OUR PRODUCT CATEGORISATION.

Nivea has a whole page of their website dedicated to the topic of microplastics.[47] However, like their producer, they adhere to the UNEP definition which we believe is very limited (see Chapter 2). They mention that they started phasing out microbeads of polyethylene in 2013 and succeeded by 100% in 2015. The next step was to steer clear from 'opacifiers' in rinse-off products, used for the colour and look of their products. They claim that since then, these shower gels, shampoos, and facial cleaning formulae are 100% microplastic-free.

However, our understanding of microplastic-free differs from Nivea's. This difference of opinion becomes even more apparent when looking at our database and ingredients lists. We believe that their definition of microplastics is not extensive enough (See chapter 2). Considering that Nivea has the most advanced plans yet to remove microplastics, still only 10% of Nivea products in our database are free of plastic ingredients according to our traffic light system to categorise cosmetic products (See figure 3.4).

Nivea's Naturally Good product line is free of microplastics according to our understanding, with all 49 entries in our database being green. This is a great example of Beiersdorf and Nivea's wish to create a range of cosmetics that is free of microplastics as we define them.

Nivea once again followed its producers' ambition of using biodegradable polymers either in liquid or in gel form. The physical state of these biodegradable polymers falls outside of the microplastics definition followed by Nivea. The brand thinks it is on the right path, and it certainly has made an important step. However, in our view, if Nivea truly wants to lead the way for green cosmetics and care products, they should reconsider their view on the definition of microplastics.

PROCTER & GAMBLE: "It's our home"

When it comes to plastic packaging, Procter & Gamble (P&G) is not falling behind its competition. In their sustainability program called *It's Our Home*, they state that by 2030 they aim to reduce virgin petroleum plastic in packaging by 50%. By that same deadline, they want all the packaging to be either recyclable or reusable. They aim to make their packages lighter, so they use fewer resources and at the same time start experimenting with refilling stations for shampoos from some of their brands. They also focus on several partnerships and programs which address the problem of plastic waste. What these partnerships and programs are meant to do is not clear.[48]

Unfortunately, this is where their concrete plans to tackle plastic pollution ends. The word microplastics is nowhere to be seen in their plans or on their website. P&G does mention green chemistry in their sustainability plans; claiming they found a way to turn lactic acid into biobased acrylic acid. It's not entirely clear what this means for their formulae, but they seem to claim that they have discovered a way to make polymers out of renewable crops. There's no clear mention of either a reduction in their use of plastic ingredients or a shift to more biodegradable ingredients.

While they do not address microplastic pollution in their sustainability plans, P&G told us in their response to our inquiry:

"P&G adheres to the microplastics definition and scope of materials ECHA has outlined in their dossier, and we will comply with the resulting regulation in the EU."

Meaning that for now, they will not address the plastic ingredients left out of the limited scope of ECHA's proposed definition. When we let P&G know that we do not agree with ECHA's proposed definition of microplastics, they responded stating:

"We respectfully disagree with you on the scope of ECHA's microplastic restriction. The extent and scope of the restriction is the result of an in-depth science-based review process over several years under REACH, including broad stakeholder engagement through a workshop and a six-month consultation process that also included NGOs. The scope of the resulting restriction is broad with ECHA describing it as "the most comprehensive restriction initiative in the world for reducing emissions from intentional uses of microplastics". From a science standpoint, all microplastics (solids) are polymers, but not all polymers are microplastics, with only the latter to be regulated by the microplastics restriction. We are supportive of a review of the human and environmental safety aspects of other, non-microplastic polymers (including liquid or water-soluble polymers) under REACH via an in-depth scientific, multi-stakeholder process."

Indeed, ECHA's decision to restrict the use of intentionally added microplastics has been a great step forward in addressing microplastic pollution. However, we disagree that this is a comprehensive restriction as many synthetic polymers, with unknown hazards (and in some cases known hazards), have been exempted in ECHA's proposal (see chapter 2). Even though NGOs were part of the stakeholder group, our viewpoint on this matter is not adopted in ECHA's restriction proposal. Many European NGOs have expressed this disagreement in form of a position paper.[49] We agree that 'not all polymers are microplastics'. The word polymer is however somewhat confusing as it can also refer to natural polymers (see glossary). Any synthetic polymer, ranging from liquid to semi-solid to solid polymers of various sizes can be considered plastics. By including solid synthetic polymers in the restriction proposal only, and excluding non-solid synthetic polymers, ECHA is clearly overlooking many sources of plastic pollution. This position is shared by an interdisciplinary group of scientists, expressing the need to reintroduce intentionally added plastic particles in the nano range (1-100 nm) in the restriction proposal[50].

It is great that P&G is supportive of reviewing the human and environmental safety of synthetic polymers such as liquid and water-soluble polymers under REACH. We are also glad about the decision of the European Commission to finally start the registration of polymers under REACH. We believe all synthetic polymers should undergo short-term and long-term hazard assessment before they can be authorized to be placed on the market at certain volumes. However, the criteria to identify synthetic polymers requiring registration (PRR) have been found very limited[51].

In their first response to our letter, they continue to say that "P&G is actively working to identify ingredients with an improved environmental footprint by considering 360° scientific life cycle assessments (LCA). These assessments are end-to-end including sourcing, manufacturing and environmental fate of ingredients." It is essential that these assessments and methodologies are thorough in mapping out the environmental impact of the plastic ingredients they continue to use in their products. We encourage P&G to be more transparent about these plans publicly and make this information easily accessible for consumers on their platforms.

GILLETTE:
Plan to become transparent

Most of Gillette's sustainability plan 'Bringing out the best in the world around us' seems to focus on their razors and their durability/sustainability. They do, however, mention that they also want 100% of its packaging to be recyclable by 2030[52].

Microplastics aren't mentioned anywhere in this plan, whereas our numbers suggest there is a lot of work to be done there, as only 6% of their products in our database we consider to be microplastic-free (See figure 3.5).

In the area of their formulae, Gillette states they want to "continue producing consumer tested, quality assured products that are endorsed by dermatologists and scientific organisations" as well as introduce a 'Smart Label' that promotes ingredient transparency. They are working to include the ingredient lists of their products on their websites in the interest of transparency. Nothing more is said about their ingredients and plans to tackle microplastics in their products. The use of microplastics by Gillette is substantial and deserves a place in their sustainability plans.

In its letter, P&G asserts that "several P&G products have been reformulated" and currently "no Gillette

GILLETTE

39% of the **115 Gillette products** registered in BTMB contain red microplastics.

90% of the **115 Gillette products** registered in BTMB contain orange microplastics.

Only **6%** of the **115 Gillette products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 3 **most used red ingredients in the Gillette products** registered in BTMB are: Dimethicone (21), Glyceryl Acrylate/Acrylic Acid Copolymer (12), Acrylates/C10-30 Alkyl Acrylate Crosspolymer (7).
- Top 5 **most used orange ingredients in the Gillette products** registered in BTMB are: PEG-90M (45), PEG-23M (35), Laureth-23 (25), PEG-90 (19), and PEG-100 (16).

Figure 3.5

OF THE SUB-CATEGORY FACIAL CARE OF GILLETTE PRODUCTS, 1 OUT OF 3 PRODUCTS IN OUR DATABASE CONTAINS RED INGREDIENTS.

Shave Gel or Foam contains Polyethylene or PTFE." It is worth mentioning that some of the so-argued older versions of these products have, up until recently, found their way into our database. Even though these ingredients were phased out, people are still using the older versions of these products. Based on P&G's clarification, we have updated our dataset and took these older versions of these products out of the analysis done in this report.

Nevertheless, Gillette removing Polyethylene or PTFE from their formulae is certainly welcome news. Yet, various other plastic ingredients need to be dealt with before Gillette products can be considered environmentally friendly and can move to our green category.

ORAL-B:
Revolution without change

The vision of Oral-B's sustainability plan "Healthy Smiles, Healthy Lives, Healthy Planet" is simple: "Advance healthy oral care habits to transform

ORAL-B

49% of the **158 Oral-B products** registered in BTMB contain red microplastics.

71% of the **158 Oral-B products** registered in BTMB contain orange microplastics.

Only **18%** of the **158 Oral-B products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 3 **most used red ingredients in Oral-B products** registered in BTMB are: Carbomer (40), PVP (38), and Povidone (1).
- The top 3 **most used orange ingredients in Oral-B products** registered in BTMB are: PEG-6 (57), Polysorbate 80 (41), and Poloxamer 407 (10).

Figure 3.6

people's health while reducing our impact on our planet."[53] The word 'microplastics' was not mentioned in their sustainability plans.

In their Sustainability Framework[54] Oral-B states that, in France, 92% of their PureActiv toothpaste is of natural origins. However, our database shows various plastic ingredients in their other products. We have seen that 49% of the 158 products in our database have red microplastics, all of which enter our mouths and eventually go down various bathroom sinks into our waters (See figure 3.6).

Oral-B aims to make 100% recyclable (HDPE tubes) by 2030 but states nothing about using recycled plastic or developing reusable packaging in contrast to other brands.

The biggest focus of Oral-B's plans lies in education about healthy oral care habits as well as their ingredients. Part of their plan is to enable customers to easily assess their ingredients and safety principles and to "continue to provide safe products with transparency", indicating they are now producing safe products that do not need to change.

HEAD & SHOULDERS:
Packaging, packaging, packaging!

Head & Shoulders' (H&S) plan is also quite simple. A concrete goal they set: 100% of packaging will be recyclable or reusable by 2030. By that same year, each bottle will contain 50% recycled plastic. They claim to have created the first recyclable bottle made from beach plastics, cleaning up 200 beaches around Europe in the process. Furthermore, they want to reduce the weight of their packaging, using less plastic to begin with[55].

We searched in vain for the word 'microplastics' in their plans, but we did find the actual thing abundantly in their products. We have seen that 96% of the 324 products registered in our database contain red microplastics, while only 2 products out of 324 we consider to be microplastic-free (See figure 3.7). Head & Shoulders cannot take the liberty to ignore the problem of microplastics in the fight against plastic pollution, therefore, it's essential H&S starts addressing their heavy reliance on these ingredients.

In Head & Shoulders' sustainability plan we detected three concrete themes of action, even though they all seem to concern plastic packaging. They say they are looking at the whole value chain, meaning they aim to improve manufacturing methods, packaging materials, waste management and wish to innovate so as to leave no plastics bound for landfills or oceans, without mentioning

HEAD & SHOULDERS

96% of the **324 H&S products** registered in BTMB contain red microplastics.

90% of the **324 H&S products** registered in BTMB contain orange microplastics.

Only **1%** of the **324 H&S products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The most **used red ingredient in the H&S products** registered in BTMB is Dimethicone (310).
- The top 5 **most used orange ingredients in the H&S products** registered in BTMB are: Dimethiconol (173), Trideceth-10 (164), Sodium Polynaphthalenesulfonate (68), Polyquaternium-76, Polyquaternium-10 (15), and Polysorbate 20 (15).

Figure 3.7

the plastics in their product formulae. Thus, Head & Shoulders' entire sustainability plan relies on the plastic of packaging and the plastic waste it produces. They do not mention microplastics in their plans. We believe focusing just on plastic packaging is not enough to tackle the plastic pollution crisis.

UNILEVER:

"Small Actions can Make a Big Difference"

Unilever's sustainability plan *'Climate Transition Action Plan*[56] consists of 53 pages, the most extensive we've seen from the four producers we have analysed in this report. It covers a variety of topics and methods, but most interestingly are their commitments to plastic packaging, their plans for the end-of-life of their products (both packaging and formulae) and their hinting at the biodegradability of their formulae.

They aim for 25% recycled plastic in packaging by 2025 and want to make 100% of the plastic packages reusable, recyclable or compostable. They eventually want to achieve 'Net Zero' in terms of packaging by collecting and processing more plastic packaging than they sell.

In the section specifically about the beauty and personal care branch, Unilever states that "several progressive commitments and actions [...] to drive a transformation in how our products are designed and formulated." No mention of microplastics or the nature of their ingredients.

Nowhere in the 53-page document does Unilever mention microplastics, but they do make an indirect indication by mentioning fossil fuel-based ingredients. Further along in their plans, they include a section on "the emissions from the disposal of waste products and packaging, including the biodegradation of product formulations." They say this accounts for about 9% of GHG (Greenhouse gas) footprint of the chain, the biodegradation of fossil fuel-based ingredients being a big part of that. Therefore, they have started an innovative programme that seeks to replace fossil fuel-based carbon with recycled or renewable carbon.

Elsewhere on their website they supply in-depth information on their ingredients. They even have a special section for microplastics. While answering our letter about their future plans regarding microplastics ingredients, they say:

"To clarify how we define microplastics, we consider them to be solid, water insoluble and non-biodegradable synthetic plastic particles up to five milimeters in diameter. This is in line with

ECHA's (European Chemicals Agency) proposed definition, in addition to the definition provided by UNEP (United Nations Environment Programme)."

Just like their competitors, Unilever also adheres to a limited definition of microplastics. In their letter, they mentioned that "all microplastic opacifiers have now been removed from our deodorant products in Europe, and we are in the process of removing them from our global range." They further explained that "we have removed styrene/acrylates copolymer from all our deodorant products in the European Union and the United Kingdom. The last few products containing this ingredient were manufactured in August 2021." The deodorants from the three brands of Unilever that we analysed in this report are indeed free of styrene/acrylates copolymer. However, this ingredient is still being used in other product types. It is a step in the right direction, however, not all plastic ingredients are addressed as they adhere to the limited definition of microplastics proposed by UNEP and ECHA. Furthermore, Unilever mentions the process of phasing out solid microplastics by replacing them with biodegradable polymers. In their letter Unilever goes on to say:

"We are also working to go above and beyond ECHA's proposed ban, having committed to making all our product formulations fully biodegradable by 2030. Our biodegradation standard is based on ingredients biodegrading completely in hours, days or weeks rather than the 'non-persistence' (i.e. months) being used by ECHA in its microplastic restriction. As it stands, approximately 90% of ingredients (excluding minerals and water) in our home, beauty and personal care products are now biodegradable"

We asked for a more detailed explanation about what methods Unilever would use to assess the biodegradability of these ingredients. To that Unilever responded by saying "The vast majority of our beauty and personal care products are disposed of down the drain following use, where they will often enter the aquatic environment, usually – but not always – via wastewater treatment. To assess the biodegradability of ingredients within our formulations, we use internationally accepted Organisation for Economic Co-operation and Development (OECD) test methods, widely considered as a representative, to estimate biodegradability in these environments. Only when ingredients are considered readily and ultimately or inherently and ultimately biodegradable will they meet the Unilever biodegradability standard."

The OECD methods Unilever refers to are some of the approved biodegradability tests by ECHA. In chapter 2 (and Appendix IV) we explain that these biodegradability tests insufficiently represent real-word conditions. Biodegradation rates of biodegradable microplastics are expected to be lower in the environment compared to the rates observed in these approved tests. Therefore, these biodegradable microplastics may still persist in the environment. Moreover, from Unilever's second response we are unable to see how they go "above and beyond ECHA's proposed ban", as the biodegradability tests used by Unilever appear to be the same as those approved by ECHA. Lastly, Unilever claiming that 90% of their ingredients are biodegradable does not mean their products are plastic free. These plastics have simply been excluded from ECHA's restriction proposal on intentionally added microplastics. If this proposal is adopted, these plastic ingredients could still be used in cosmetics. Unless this is addressed properly, we believe that Unilever's plans to be microplastic-free would be short-sighted.

DOVE:

Reducing virgin plastic

Dove does not address microplastics in its sustainability plans, nor do they discuss its plans for better formulae.

On their Dutch website, an FAQ is dedicated to

DOVE

56% of the **1.024 Dove products** registered in BTMB contain red microplastics.

76% of the **1.024 Dove products** registered in BTMB contain orange microplastics.

Only **16%** of the **1.024 Dove products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 5 **most used red ingredients in the Dove products** registered in BTMB are: Dimethicone (277), Carbomer (258), Acrylates Copolymer (106), Styrene/Acrylates Copolymer (96), and Acrylates/C10-30 Alkyl Acrylate Crosspolymer (77).
- The top 5 **most used orange ingredients in the Dove products** registered in BTMB are: Cyclopentasiloxane (257), Dimethiconol (196), PPG-14 Butyl Ether (150), PEG-100 Stearate (91), and PPG-2 Hydroxyethyl Cocamide (90).

Figure 3.8

microplastics which mentions the phasing out of microbeads in 2014.[58] For more information, they refer to a section of Unilever's website that seems to no longer exist. Furthermore, they write about working with several suppliers of bioplastics to develop sustainable ingredients, but give no further explanation, nor mention any transition from fossil fuel to biobased. Looking at the numbers arising from our dataset, Dove products contain many plastic ingredients (See figure 3.8).

ONLY 1 OUT OF 20 DOVE DEODORANT PRODUCTS IN OUR DATABASE IS GREEN, ACCORDING TO OUR PRODUCT CATEGORISATION.

Dove does have three clear aspirations for their plastic packaging: aiming for either No Plastic, Better Plastic or Less Plastic. The first aspiration has been put into practice in their beauty bars. Their single packs will now globally be packaged without plastic, and they are working on doing this for the multipacks as well. Secondly, they want to reduce the use of virgin plastic in their packaging. They launched 100% recycled plastic bottles and implemented this for some products across all ranges, where technically feasible. Lastly, they are working on new reusable, refillable, stainless steel deodorant sticks, which will be launched somewhere in the future.

REXONA:
Sustainability plans not found

Unilever's extensive plans allow some of its brands to hide behind them and not formulate any plans of their own. This is what happened with Rexona. This is underwhelming and disappointing, specifically because only 8% of Rexona products in our database are green.

We were unable to find any sustainability plans online apart from the following quote[60]:

"As part of our commitment towards sustainability, we are supporting ALUPRO (the aluminium packaging recycling organisation) and BAMA (the British Aerosol Manufacturers' Association) to encourage all UK local authorities to collect empty aerosols."

Given the significant amount of microplastics used in Rexona products, it is high time for Rexona to put this issue high on their agenda. We encourage them to be more transparent about the environmental impact and safety of their ingredients.

OF THE SUB-CATEGORY DEODORANT PRODUCTS OF REXONA IN OUR DATABASE, ONLY 1 OUT OF 20 PRODUCTS ARE GREEN.

REXONA

13% of the **166 Rexona products** registered in BTMB contain red microplastics.

92% of the **166 Rexona products** registered in BTMB contain orange microplastics.

Only **8%** of the **166 Rexona products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 3 **most used red ingredients in the Rexona products** registered in BTMB are: Dimethicone (18), Dimethicone Crosspolymer (10), and Polyquaternium-7 (1).
- The top 5 **most used orange ingredients in the Rexona products** registered in BTMB are: Gelatin Crosspolymer (126), Cyclopentasiloxane (85), PPG-14 Butyl Ether (80), Steareth-2 (50), and Sreareth-20 (45).

Figure 3.9

AXE:

Masculinity above planet

Axe is following in the footsteps of Rexona in hiding behind Unilever's sustainability plans. While Axe doesn't want to say anything about microplastic pollution, we encourage them to address this issue actively and aim to become completely microplastic-free.
In contrast to Rexona, Axe does have a page dedicated to their company values, but this mostly discusses their Diversity and Inclusion policies and how they have realised they have to do better in their portrayal of Masculinity. At the very end of this page, they do have a short section about the environment called "For the planet", stating[61]:"By 2025 we're aiming for all of our packaging to be recyclable or to include recycled stuff."

In their entire sustainability plan, they do not mention any specific numbers or quantifiable goals to address plastic pollution. They do say that their body spray cans are "infinitely recyclable" and their stick packs contain 50% recycled plastic, which will be increased to 66% by the end of the year. They mention that their body wash and hair care bottles are made from 100% recycled plastic.

Birds eye view: a need for more action

Looking closer at the sustainability plans and the product data of all the above popular consumer

AXE

16% of the **297 Axe products** registered in BTMB contain red microplastics.

57% of the **297 Axe products** registered in BTMB contain orange microplastics.

41% of the **297 Axe products** registered in BTMB are green, according to our product categorisation.

MOST USED MICROPLASTICS

- The top 3 **most used red ingredients in Axe products** registered in BTMB are: Acrylates Copolymer (28), Carbomer (9), and PVP (4).
- The top 5 **most used orange ingredients in Axe products** registered in BTMB are: PPG-12 (51), PPG-6 (38), Cyclopentasiloxane (23), PEG-40 Hydrogenated Castor Oil (21), and Steareth-20 (12).

Figure 3.10

OVERVIEW: SUSTAINABILITY PLAN *microplastics* *

Box 3.2

STARRING	WORKING ON FORMULAS/ BIODEGRADABILITY	MENTION OF MICROPLATICS	MENTION OF SOMETHING THAT COULD MEAN MICROPLASTICS	COMMITTED TO STOP USING ANY MICROPLASTICS*
L'ORÉAL GROUPE	✓	✗	✗	✗
L'ORÉAL PARIS	✓	✗	✗	✗
ELVIVE ELSEVE	✓	✗	✓ (SILICONES)	✗
GARNIER	✓	✗	✗	✗
Beiersdorf	✓	✓ (UNEP DEFINITION)	✓	✗
NIVEA	✓	✓ (UNEP DEFINITION)	✓	✗
P&G	✗	✗	✓ FOUND A WAY TO MAKE POLYMERS OUT OF RENEWABLE SOURCES	✗
Gillette	✗	✗	✗	✗
Oral-B	✗	✗	✗	✗
Head & Shoulders	✗	✗	✗	✗
Unilever	✓	✗ A SECTION ON MICROPLASTICS ON THE INGREDIENT PAGE OF THEIR WEBSITE. UNEP DEFINITION	✓ FOSSIL-FUEL-BASED INGREDIENTS	✗
Dove	✓	✗ A SECTION ON MICROPLASTICS ON THE INGREDIENT PAGE OF THEIR WEBSITE. UNEP DEFINITION	✓ FOSSIL- FUEL-BASED INGREDIENTS	✗
Rexona	✓	✗	✓ FOSSIL- FUEL-BASED INGREDIENTS	✗
AXE	✓	✗	✓ FOSSIL- FUEL-BASED INGREDIENTS	✗

*Redaction 05/2022: As a consequence of email conversation with some producers, this table has been updated and brands have been reassessed only in the context of this table. You can observe these changes in the following columns: "Working on formulas/biodegradability": "mention of something that could mean microplastics" & "committed to stop using any microplastics". For detailed explanation, please see page 58.

brands, one thing is clear to us: not nearly enough is being done to address the microplastic pollution caused by the personal care and cosmetic products of these brands (See box 3.2).

There's a strong focus on addressing the plastic pollution problem by making the packaging more 'sustainable'. Although an equally important issue, it's only part of the plastic pollution problem as a whole.

Microplastics are largely missing from many brands' sustainability quests. Only 1 (Nivea) out of 10 brands we delved into directly mentioned 'microplastics' in their public sustainability plans.* At the parent company level, only Beiersdorf and Unilever (2 out of 4) have public plans of tackling microplastics. However, all four producers mentioned plans to tackle microplastics in our direct email interactions with them.

However, their understanding of microplastics is limited to solid, insoluble particles of plastic under the size of 5mm. At Plastic Soup Foundation, we believe this way of defining microplastics is short-sighted. Excluding liquid, water-soluble, nano and biodegradable polymers from the microplastic equation will only create an even bigger problem for the future as explained at length in the previous chapter.

There is a clear need for more sincere actions to tackle the plastic pollution arising not only from the packaging but also, from the product itself. This is concerning because microplastic pollution is irreversible and impossible to clean up. It is urgent to take steps right now to ensure that we do not continue to wash down microplastics into our environment. If we've reached the boundaries of what the Earth can bear, ecological restoration is no longer possible. There is now enough evidence to recognise plastic pollution as the tenth planetary boundary.[62] The time for action is now, and the brands responsible for bringing products to market with plastics inside should not be allowed to shy away from their responsibility to ensure the environmental safety of these ingredients. There's no time for empty promises of 'green', 'sustainable', 'revolutionary', 'eco-friendly' cosmetics with no clear and future-proof plan of action.

*Redaction 05/2022: As a result of reassessment of the table on page 34, we came to a conclusion that only 1 out 10 brands (Nivea) mention the word microplastics in their public sustainaility plans. For detailed explanation, please see page 58.

4

A FUTURE FILLED WITH INTENTIONALLY *added loopholes*

After looking closely into the current use of plastic ingredients by some of the popular brands in Europe, and analysing their commitments in addressing the microplastics problem, it is quite clear that there is immense room for improvement. The existing loopholes on the policy level can make the current situation tenfold more complicated. Considering this, the bright future of a ban on intentionally added microplastics may just be an illusion.

Let us demonstrate what the future might hold if the EU doesn't ensure a future-proof policy on intentionally added microplastics.

A wall to hide behind

An inadequate piece of legislation gives the cosmetics industry ample room to work around it by taking advantage of the existing loopholes. For instance, primary nanoplastics are left out of ECHA's current restriction proposal, which may drive industry to use plastics < 0.1 µm rather than search for environmentally friendly alternatives.

With the current restriction proposal by ECHA, the cosmetics industry is already defending their use of water-soluble, liquid, and biodegradable synthetic polymers, arguing that these types of polymers are not defined as microplastics and hence, do not pose a threat to the environment. We received written responses from L'Oreal, Unilever, Beiersdorf and P&G, and they all mentioned that they would be looking at ECHA's definition of microplastics as a reference point as shown in chapter 3. However, the environmental safety and biodegradability of these ingredients cannot be ensured sufficiently. Besides, the unjustified delays in the form of the transition periods granted to the cosmetics industry would potentially allow pollution to continue for up to 8 years, while the alternatives to microplastics used in care products and cosmetics are widely available.

As part of the Beat the Microbead campaign, we have awarded hundreds of microplastic-free brands with our 'Zero Plastic Inside' acknowledgment logo. These brands do not use any problematic plastic ingredients and demonstrate that it is in fact possible to produce quality personal care products and cosmetics without the use of microplastic ingredients.

Greenwashing could become uncontrollable

By adhering to ECHA's current proposal, plastics can still be used in nano, soluble, liquid, and (bio) degradable forms. The cosmetics industry would be free to use labels such as 'microplastic-free' or 'biodegradable ingredients' on their products. This is worrying because as shown in chapter 2, there are many concerns regarding these substances that do not justify their exemption. If we continue on this course, we run the risk of an entangled future where the term 'microplastic-free' would lose its value.

Product advertising based on sustainability claims are coming under increased scrutiny by legislators. According to the EC, marketing products as 'conscious', 'eco-friendly' or 'sustainable' without substantiating these claims could give consumers a false sense of their environmental benefits.[63] In response, the Commission is currently working on 'Initiatives on substantiating green claims', to avoid greenwashing and make sustainability claims more reliable. This initiative should increase consumer trust in green labels (See box 4.1).

Companies that still use synthetic polymers left out of the scope of ECHA's current proposal could claim that they don't use microplastics in their products. By overlooking these consequential drawbacks, the European Commission might be undermining its own intention to make businesses accountable for their green claims.

A problem for the future

Adopting a limited definition of microplastics for the upcoming legislation would merely create a problem for the future. ECHA and its scientific committees have recognised that microplastics pose an unacceptable risk to the environment,

with possible consequences for human health. Therefore, regulating all synthetic polymers is justified.

Only a decade ago, solid microplastics were not a pressing issue and the cosmetics industry was not worried about their use. Now, microplastics are found in every corner of our planet. Taking this lesson from the past, we need to ensure that other kinds of plastic ingredients are regulated now. Red flags around these excluded intentionally added plastic ingredients are already arising. Ignoring these early signs of caution would only create a much bigger problem for the years to come.

GREENWASHING

Greenwashing is designed to make people believe that a company is doing more to protect the environment than it really is. Greenwashing is dangerous as it misleads consumers into thinking they are helping the planet by choosing those products. Here are 3 ways to spot the false green claims:

1. **False claims or vague language:** advertising products with terms such as 'eco-friendly' and 'sustainable' without supporting them with actual actions and evidence.
2. **Green packaging:** look out for earth-friendly colours on packaging and 'conscious' or 'sustainable' lines, admitting the rest of their products aren't.
3. **Self-invented labels:** Companies highlighting only one aspect of a product or include labels such as 'planet positive', invented by themselves.

IN ORDER TO KEEP BRANDS AND BUSINESSES ACCOUNTABLE, REMEMBER TO TRUST ACTIONS, NOT WORDS!

Box 4.1

5

RECOMMENDATIONS

Recommendations for decision-makers

This report invites decision-makers to adopt an ambitious restriction and base their policy on the precautionary principle to ensure the safety of the environment and human health. We call upon the Commission and the EU Member States to support ambitious legislation.

1. **Recognise the scientific evidence** on the adverse effects of microplastics on the environment and human health. Immediate steps are justified to prevent more microplastic leakage. The restriction process should not be delayed any longer.

2. **Secure a comprehensive definition of 'microplastics',** so that the restriction also includes soluble-, liquid-, and biodegradable polymers. Furthermore, include nano-sized plastics, by not setting a lower size limit.

3. **Deny or, where it concerns essential use, limit transitional periods.** Reject unnecessary transitional periods for microplastics in cosmetics.

4. **Adhere to the 'no data, no market' principle** by registering all synthetic polymers under REACH. Only in this way can a high level of protection for human health and the environment be ensured. Manufacturers and producers can also be held responsible in this way for all ingredients they put in their products.

Europe has formulated the ambition to create a Circular Economy. However, there is nothing circular about intentionally added microplastics in products, such as cosmetics, ending up in our waterways.

Recommendations for the cosmetics industry

1. **Do more than the bare minimum.** Go beyond the ECHA proposal, pay attention to the science-based red flags. Ensure the environmental and human health safety of ingredients that you bring to market.

2. **Phase out all microplastics from your products.** Establish a concrete, time-bound plan to phase out all microplastics, including the ones that fall outside of the scope of ECHA's restriction proposal. Put the same level of care into making your products plastic-free on the inside as you do on the outside. Publicly commit to ambitious plans and targets to rid your cosmetics of microplastics.

3. **Refrain from making false green claims.** Make sure you can substantiate and provide evidence for all the environmental benefits of your products. Do not gloss over the relevant information but explain your claims to consumers properly. Make the planet your priority instead of profiting even more from false claims.

4. **Be transparent** about your process of transitioning to sustainable ingredients. Show more accountability for the ingredients you put into your products. Make this information easily accessible on your platforms.

5. **Invest in sustainable chemistry.** We have already crossed the chemical pollution planetary boundary. The time to innovate is now. Be part of the solution. Devote your resources to find more sustainable replacements for synthetic polymers. Investigate chemical innovations that do not pollute, eliminate hazardous substances, and prevent potentially toxic waste.

Recommendations for consumers

1. **Demand transparency** from your favourite brands. You have a right to information about the substances you are exposed to every single day. You have a right to know if substances in your cosmetic products are tested thoroughly. You have the power to make companies accountable and encourage them to change.

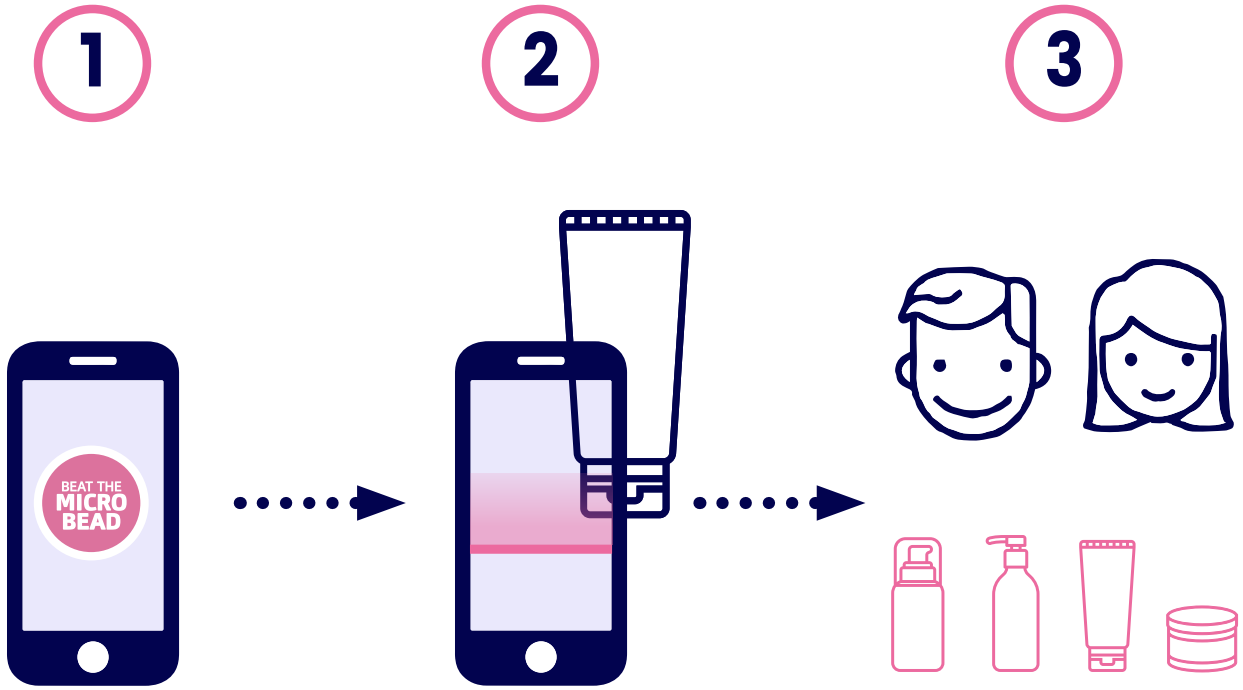
2. **Make your voice be heard.** Let the policy-makers know that you do not want plastic inside

of your cosmetics. Sign petitions, send letters to your local politicians and support organisations that are putting in the work to make our planet's future plastic-free.

3. **Scan before you buy.** Use tools that empower you to make the right choice and help you learn about the problem. The Beat the Microbead app is free to use and the fastest way to learn if your cosmetics and personal care products contain microplastic ingredients.

4. **Choose Zero Plastic Inside.** There are many cosmetics brands that do not want to contribute to this irreversible microplastic pollution. Support these businesses and choose 100% microplastic-free products.

5. **Spread the word.** Talk to friends, family, neighbours, and colleagues. Share on social media and tell people around you about the intentionally added plastics inside personal care and cosmetic products and let them know what they can do about it.



Download the app

Scan your products in the shop

Only buy products that are microplastic-free

END NOTES

1. ECHA. *Microplastics*, under "What are the concerns?" (n.d.). Helsinki: European Chemicals Agency. Accessed: February 2022. Available at: https://echa.europa.eu/hot-topics/microplastics.

2. Leslie, H. A. *Review of microplastics in cosmetics: Scientific background on a potential source of plastic particulate marine litter to support decision-making* (2014). Amsterdam: Vrije Universiteit. Accessed: February 2022. Available at: https://research.vu.nl/en/publications/review-of-microplastics-in-cosmetics-scientific-background-on-a-p.

3. Sludge is a glutinous watery material produced during biological aerobic or anaerobic treatment of wastewater.

4. With more and more alarm bells ringing about the suspected health risks that plastic poses, new scientific research is needed now more than ever. That's why the Plastic Soup Foundation has created a new research and advocacy alliance: the Plastic Health Coalition. This website is a public knowledge platform for anyone interested in learning more about the potential health impacts of (micro- and nano) plastics and their additives. The latest scientific findings are presented, as well as the latest (inter) national news on plastics and health.

5. Pettinelli, Carlo & Sadauskas, Kestutis. *Request to the European Chemicals Agency to prepare a restriction proposal conforming to the requirements of Annex XV to REACH* (2017, November 9). Brussels: European Commission. Accessed: February 2022. Available at: https://echa.europa.eu/documents/10162/5c8be037-3f81-266a-d71b-1a67ec01cbf9.

6. ECHA. *Annex XV report, Proposal for a restriction for intentionally added microplastics* (2019, August 22). Helsinki: European Chemicals Agency. Accessed: February 2022. Available at: https://echa.europa.eu/documents/10162/05bd96e3-b969-0a7c-c6d0-441182893720.

7. ECHA. *Combined Risk-Assessment Committee (RAC) and Socio-Economic Analysis Committee (SEAC)'s opinion on Annex XV dossier proposing restrictions on intentionally-added microplastics* (2020, December 10). Helsinki: European Chemicals Agency. Accessed: February 2022. Available at: https://echa.europa.eu/documents/10162/a513b793-dd84-d83a-9c06-e7a11580f366.

8. ECHA. *Annex XV report, Proposal for a restriction for intentionally added microplastics* (2019, August 22). Helsinki: European Chemicals Agency. Accessed: February 2022. Available at: https://echa.europa.eu/documents/10162/05bd96e3-b969-0a7c-c6d0-441182893720.

9. Ibid.

10. ECHA. *Combined Risk-Assessment Committee (RAC) and Socio-Economic Analysis Committee (SEAC)'s opinion on Annex XV dossier proposing restrictions on intentionally-added microplastics* (2020, December 10). Helsinki: European Chemicals Agency. Accessed: February 2022. Available at: https://echa.europa.eu/documents/10162/a513b793-dd84-d83a-9c06-e7a11580f366.

11. Rethink Plastic Alliance. *Phasing out the use of microplastics: The road to an effective EU restriction of intentionally-added microplastics* (2021, March 21). Brussels: Rethink Plastic Alliance. Accessed: February 2022. Available at: https://rethinkplasticalliance.eu/wp-content/uploads/2021/03/the_road_to_an_effective_EU_restriction_of_intentionally-added_microplastics.pdf.

12. CARACAL. *Overall work plan for REACH Committee and CARACAL* (2022, January 14). Circabc. Accessed: February 2022. Available at: https://circabc.europa.eu/ui/group/a0b483a2-4c05-4058-addf-2a4de71b9a98/library/ac07ff0e-7f98-486b-badd-6514047c672d/details.

13. Client Earth & EEB. *Analysis of intentionally-added microplastics' emissions to the environment up to 2030* (2021, November 23). London: Client Earth. Accessed: February 2022. Available at: https://www.clientearth.org/media/txwaa4wt/analysis-of-intentionally-added-microplastics-emissions-to-the-environment-up-to-2030-november-2021.pdf.

14. Rethink Plastic, #BreakFreeFromPlastic & EEB. *Why should "No Data, No Market" apply to polymers?* (2021, October). Brussels: Rethink Plastic Alliance. Accessed: February 2022. Available at:

END NOTES

https://rethinkplasticalliance.eu/wp-content/uploads/2021/10/Updated-polymer-registration-design.pdf.

15. European Commission. REACH (n.d.). Accessed: February 2022. Available at: https://ec.europa.eu/environment/chemicals/reach/reach_en.htm

16. Arp, H. P. H. & Knutsen, H. 'Could We Spare a Moment of the Spotlight for Persistent, Water-Soluble Polymers?' (2019). In *Environmental Science & Technology* 54(1), 3–5.

17. Huppertsberg, S. et al. 'Making waves: Water-soluble polymers in the aquatic environment: An overlooked class of synthetic polymers?' (2020). In *Water Research,* Volume 181, 15 August 2020.

18. Reemtsma, T. et al. 'Mind the Gap: Persistent and Mobile Organic Compounds - Water Contaminants That Slip Through' (2016). In *Environmental Science & Technology* 50(19), 10308-10315.

19. Leslie , H. A. (rep.). Plastics in cosmetics: *Are we polluting the environment through our personal care?* (2015). Nairobi: UNEP GPA. Accessed: February 2022. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/9664/-Plastic_in_cosmetics_Are_we_polluting_the_environment_through_our_personal_care_-2015Plas.pdf.

20. Bertling, J., Hamann, L. & Hiebel, M. 'Microplastik und Synthetische Polymere in Kosmetikprodukten Sowei Wasch-, Putz- und Reinigungsmitteln' (2018). Oberhausen: Fraunhofer UMSICHT, 2018, IV, 104 S. doi:10.24406/UMSICHT-N-490773.

21. Dhanirama, D., Gronow, J. & Voulvoulis, N. 'Cosmetics as a potential source of environmental contamination in the UK' (2012). In *Environmental Technology* (United Kingdom) 33, 1597–1608.

22. Nendza, M. 'Hazard assessment of silicone oils (polydimethylsiloxanes, PDMS) used in antifouling-/foul-release-products in the marine environment' (2007). In *Marine Pollution Bulletin* 54, 1190–1196.

23. Dhanirama, D., Gronow, J. & Voulvoulis, N. 'Cosmetics as a potential source of environmental contamination in the UK' (2012). In *Environmental Technology* (United Kingdom) 33, 1597–1608.

24. Fournier, S. B. et al. 'Nanopolystyrene translocation and fetal deposition after acute lung exposure during late-stage pregnancy' (2020). In *Part Fibre Toxicol.* 17(1), 55.

25. Vethaak, D. & Legler, J. 'Microplastics and human health' (2021). In *Science* 371.

26. Yong, C. Q. Y., et al. 'Toxicity of microplastics and nanoplastics in Mammalian systems' (2020). In International *Journal of Environmental Research and Public Health* vol. 17.

27. Huang D, et al. 'Microplastics and nanoplastics in the environment: Macroscopic transport and effects on creatures' (2021). In *Journal of Hazard Materials* 407.

28. Haider, T. P., et al. 'Plastics of the Future? The Impact of Biodegradable Polymers on the Environment and on Society' (2019). In *Angewandte Chemie - International Edition* vol. 58, 50–62.

29. Ibid.

30. Zimmermann, L., Dombrowski, A., Völker, C. & Wagner, M. 'Are bioplastics and plant-based materials safer than conventional plastics? In vitro toxicity and chemical composition' (2020). In E*nvironment International* Volume 145, 106066.

31. Abdolahpur Monikh, F. et al. 'Can Current Regulations Account for Intentionally Produced Nanoplastics?' (2022). In *Environmental Science & Technology,* 14 March. doi:10.1021/acs.est.2c00965.

32. For a more extensive scientific overview of these three substances groups, see our scientific statement: 'The Forgotten Synthetic Polymers and their Environmental and Human Health Concerns. An opinion-paper on water-soluble, liquid, semi-solid & biodegradable polymers and engineered nanoplastics.'

33. IPCP. *Statement on the Registration of Polymers under REACH and List of Signatures in Support* (2021, April 30). Accessed: March 2022. Available at: https://www.ipcp.ch/activities/polymer-statment

34. Leslie , H. A. (rep.). *Plastics in cosmetics: Are we polluting the environment through our personal care?* (2015). Nairobi: UNEP GPA. Accessed: February 2022. Available at: https://wedocs.unep.org/bitstream/handle/20.500.11822/9664/-Plastic_in_cosmetics_Are_we_polluting_the_environment_through_our_personal_care_-2015Plas.pdf.

END NOTES

35. Ooms, J. et al. *Test to assess and prevent the emission of primary synthetic microparticles (primary microplastics)* (2015, November 27). Deventer: TAUW. Accessed: February 23, 2022. Available at: https://www.health.belgium.be/sites/default/files/uploads/fields/fpshealth_theme_file/microplastics_manual_voor_de_website_env2.pdf.

36. ECHA. *Annex to the Annex XV Restriction Report Proposal For a Restriction* (2019). Helsinki: European Chemicals Agency. Accessed: February 23, 2022. Available at: https://echa.europa.eu/documents/10162/db081bde-ea3e-ab53-3135-8aaffe66d0cb.

37. Statista. *Leading 20 health and beauty brands ranked by consumer reach points in Europe in 2020* (May 2021). Accessed: February 2022. Available at: https://www.statista.com/statistics/900345/most-chosen-health-and-beauty-brands-europe/.

38. L'Oreal. *L'Oreal For the Future* (2020), p. 13. Accessed: February 2022. Available at: https://www.loreal.com/-/media/project/loreal/brand-sites/corp/master/lcorp/documents-media/publications/l4f/loreal-for-the-future--booklet.pdf

39. Ibid., p. 9.

40. L'Oreal Paris. *Our Sustainable Growth*, under "The Elvive Commitment" (n.d.). L'Oreal Paris USA. Accessed: February 2022. Available at: https://www.lorealparisusa.com/our-sustainable-growth

41. L'Oreal Groupe. L'Oréal Paris Unveils Its Sustainable Initiatives To Preserve Our Planet (n.d.). Accessed: February 2022. Available at: https://www.loreal.com/en/news/brands/because-our-planet-is-worth-it-loreal-paris/

42. Ibid.

43. Garnier. *Garnier commits to Green Beauty for the world with Sustainable Solutions* (n.d.). Accessed: February 23, 2022. Available at: https://www.garnier.in/green-beauty#greenscience.

44. Ibid.

45. Beiersdorf. *Care without microplastics* (n.d.). Accessed: February 23, 2022. Available at: https://www.beiersdorf.com/sustainability/environment/fully-circular-resources/care-without-microplastics

46. Nivea. *One Skin. One Planet. One Care* (n.d.). Accessed: February 2022. Available at: https://www.nivea.nl/over-ons/nivea-duurzaamheid

47. Nivea. *Wat Zijn Microplastics & Welke Soorten Bestaan Er?* (n.d.). Accessed: February 2022. Available at: https://www.nivea.nl/over-ons/nivea-duurzaamheid/duurzamere-ingredienten-en-formules/microplastics

48. P&G. *It's Our Home: Climate Transition Action Plan* (2021). P&G USA. Accessed: February 2022. Available at: https://downloads.ctfassets.net/oggad6svuzkv/6c8spc91y3m5xLRvGfU4AI/630a468e13377bf4892ad72d8a59e315/PG_CTAP.pdf

49. Rethink Plastic Alliance. *Phasing out the use of microplastics: The road to an effective EU restriction of intentionally-added microplastics* (2021, March 21). Brussels: Rethink Plastic Alliance. Accessed: February 2022. Available at: https://rethinkplasticalliance.eu/wp-content/uploads/2021/03/the_road_to_an_effective_EU_restriction_of_intentionally-added_microplastics.pdf.

50. Abdolahpur Monikh, F. et al. 'Can Current Regulations Account for Intentionally Produced Nanoplastics?' (2022). In *Environmental Science & Technology*, 14 March. doi:10.1021/acs.est.2c00965.

51. IPCP. *Statement on the Registration of Polymers under REACH and List of Signatures in Support* (2021, April 30). International Panel on Chemical Pollution. Accessed: February 2022. Available at: https://www.ipcp.ch/activities/polymer-statment.

52. Gillette. *Bringing Out the Best in the World Around Us* (n.d.). Accessed: February 2022. Available at: https://gillette.com/en-us/about/sustainability

53. Oral B. *Oral Health Sustainability* (n.d.). Accessed: February 23, 2022. Available at: https://www.oralb.co.uk/en-gb/oral-health-sustainability

54. Oral B & Crest. *Sustainability Framework: Fact Sheet* (n.d.). Oral B. Accessed: February 2022. Available at: https://res.cloudinary.com/mtree/image/upload/v1609996119/OralB_GB/en-gb/-/media/OralB_GB/PDF/PGOralCare_Framework_Fact_Sheet_FINAL_external_Jan5.pdf

END NOTES

55. Head & Shoulders. Sustainability. *Leave no Trace on the Planet.* (n.d.). Accessed: February 2022. Available at: https://headandshoulders.com/en-us/about/sustainability

56. Unilever. *Climate Transition Action Plan* (2021). Accessed: February 2022. Available at: https://assets.unilever.com/files/92ui5egz/production/e9b9909cdc75cc67f8614af1c6accaba92e361e5.pdf

57. Unilever. *Microplastics* (n.d.). Accessed: February 23, 2022. Available at: https://wiop.unilever.nl/your-ingredient-questions-answered/microplastics/

58. Dove. *Veel Gestelde Vragen, under "Micro Plastics"* (n.d.). Accessed: February 23, 2022. Available at: https://www.dove.com/nl/secure/contactus/dove-faq.html

59. Dove. *Care For the Planet: Our Plastic Mission* (n.d.). Accessed: February 2022. Available at: https://www.dove.com/us/en/stories/about-dove/plastics-commitment.html

60. Unilever. *Rexona* (n.d.). Accessed: February 23, 2022. Available at: https://www.unilever.com/brands/beauty-personal-care/rexona/

61. Axe. *Our Values: The new axe effect, under "Our Planet"* (n.d.). Accessed: February 2022. Available at: https://www.axe.com/ca/en/our-values.html

62. Arp, H. P. et al. 'Weathering plastics as a planetary boundary threat: Exposure, fate, and Hazards' (2021). In *Environmental Science & Technology,* 55(11), 7246-7255.

63. European Commission. *Initiatives on substantiating green claims* (n.d.). Accessed February 2022. Available at: https://ec.europa.eu/environment/eussd/smgp/initiative_on_green_claims.htm

64. Statista. *Leading 20 health and beauty brands ranked by consumer reach points in Europe in 2020* (May 2021). Accessed: February 2022. Available at: https://www.statista.com/statistics/900345/most-chosen-health-and-beauty-brands-europe/

Annex I

Beat the Microbead campaign and the app

We started campaigning against microbeads in 2012. Since then, the Beat the Microbead (BTMB) campaign has successfully raised awareness, not only about microbeads but other plastic ingredients, through accumulating scientific information on these ingredients, and reaching out on a large scale to brands, governments, and consumers.

One of the earliest accomplishments of the BTMB campaign was to get the multinational company Unilever to promise to phase out microbeads from their entire product range by the end of 2012. In 2013, this commitment was also adopted by the biggest personal care & cosmetics brands in the world, such as L'Oréal, Colgate-Palmolive, Beiersdorf, Procter & Gamble, and Johnson & Johnson. This move resulted in the removal of microbeads from all rinse-off products under the European Union Ecolabel.

Another huge achievement came in late 2015, when the president of the USA, Barack Obama, signed a ban on microbeads. Since the beginning of Beat the Microbead, a total of 15 countries has taken steps to ban microbeads. Our continuous campaigning has put this topic on the map and has made the issue of microplastics in cosmetics a global concern.

From microbeads to microplastics

In 2012, we started by highlighting the 5 types of microbeads made of Polyethylene, PET, PMMA, PP & nylon. Microbeads refer to the visible plastic particles smaller than 5mm usually of spherical shape with certain functions such as scrubbing and peeling or used as rinse-off products.

However, since then there have been a number of ground-breaking research papers on what exactly microplastics are. For this reason, we expanded our campaign against all kinds of plastic ingredients in personal care and cosmetic products.
Now, thanks to extensive research conducted by TAUW, UN Environment Report, and the European Chemical Agency (ECHA), we know there are more than hundreds of microplastic ingredients widely used in cosmetics and personal care products.

The Beat the Microbead app

As a consumer, it is impossible to remember the complicated names of all these ingredients. That's why we came up with an app to scan the ingredients of care and cosmetic products to reveal the microplastics within. With the BTMB app, we want to spread our knowledge to consumers while creating a base that makes it easier to grasp the vastness of the microplastics issue. It is the fastest way to visualise the invisible plastic ingredient in cosmetics and care products.
The BTMB app is available in the App Store™ and on GooglePlay™ for anyone in eligible countries to download on their portable device for free. Almost two years since its release, our app has already been downloaded more than 400,000 times.

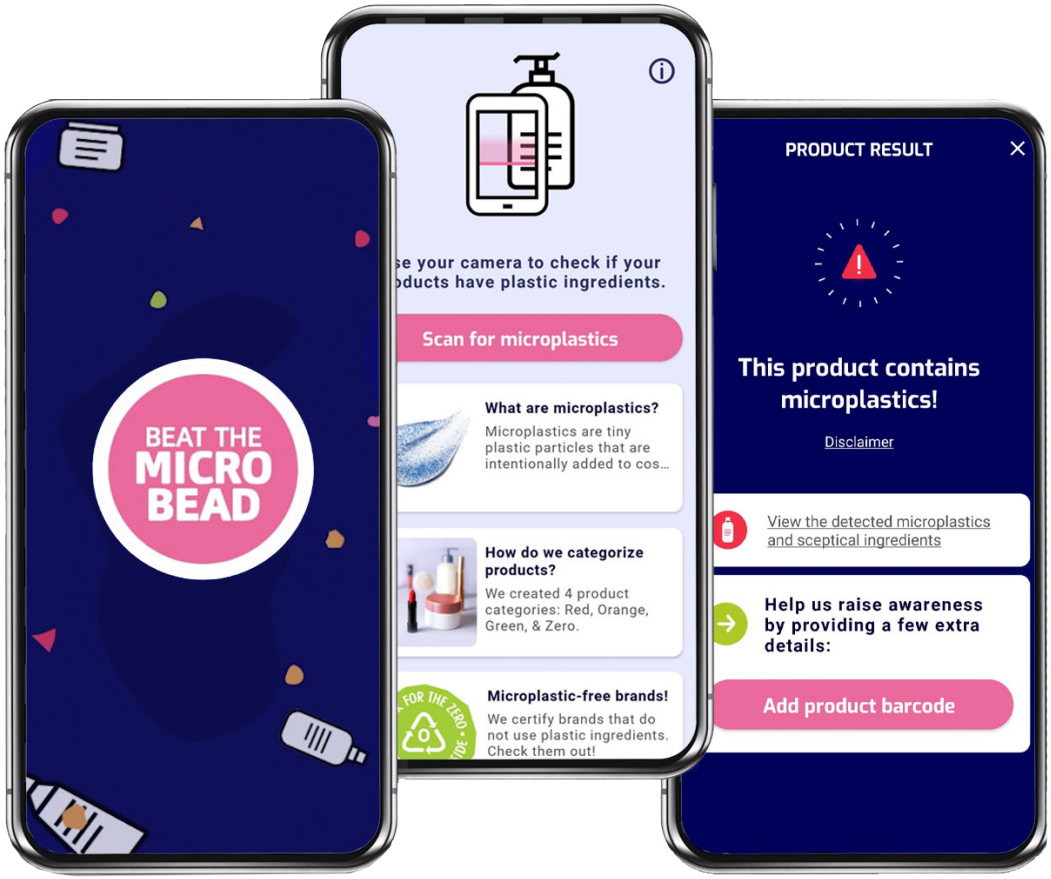
Using the BTMB app is very simple. Just click on the 'Scan for microplastics' button on the main page and point the camera to any product at hand. As long as the ingredient list is in English and held within the provided frame for a decent quality picture, the BTMB app should be able to tell you immediately whether the scanned product contains any microplastics. Next, a question pops up about whether you're willing to help us register the scanned product in our database by providing a few extra details. These include a scan of the barcode, the brand name, and the product type.

All ingredient lists scanned by BTMB users are gathered, examined for mistakes by our team, and used to support our campaign for a microplastic-free world. So far, more than 3 million cosmetic and personal care products have been scanned with the BTMB app; the additional information needed for registering a product in our database has been provided for around 180.000 products. Over 33.000 scans have already been approved by our team!

Annex I

Apart from helping consumers make informed decisions on the spot, the BTMB app helps PSF in building an extensive catalogue of ingredients used in cosmetics. Had all the relevant data been handed to us by the companies themselves, there would be no need to rely on public support to recover them bit by bit.

To put it mildly, most cosmetic companies are not keen on sharing the details of their formulae with us – and, for obvious reasons, given the outcomes of this report. Until the moment the cosmetics and personal care sector is willing to cooperate with us or anyone else wanting to research the topic of microplastics, we are determined to use every tool at our disposal.



Annex II

Our methodology

The product-level facts in this report are based entirely on the data generated by the Beat the Microbead (BTMB) mobile application. The products included were registered in our database from June 1, 2020, until January 1, 2022.

What follows is a short summary of our thought process when deciding on which cosmetics companies and brands should be included in this report.

Step one: four companies, ten brands
This report focuses on the following ten brands, owned by four multinational companies:

- L'Oreal Paris, Elvive/Elseve, Garnier (L'Oreal)
- Nivea (Beiersdorf)
- Gillette, Oral-B, Head & Shoulders (Procter & Gamble)
- Dove, Rexona, Axe (Unilever)

Two main factors influenced our decision:
First, we wanted to ensure that the data presented here would not be a mere reflection of the Dutch market, where most of our BTMB users are situated. For this purpose, we largely based our choice of targeted companies and brands on the *Leading 20 health and beauty brands ranked by consumer reach points in Europe in 2020* report, by the Statista Research Department[64]. Our focus in choosing these producers and brands is based on the fact that they are the biggest players in the market with popular brands. They are by no means the worst players in the market. In order to obtain the product level information, we looked into the Beat the Microbead app database. This data is collected through the citizen science efforts of the app users.

Second, we wanted to focus on companies that, in our experience, have been resistant in the past to changing their practices or even acknowledging the issue of microplastics in cosmetics. With this report, we intend to raise consumer awareness and, ultimately, provoke an industry shift towards green cosmetics and personal care products.

Step two: choosing products
After determining the producers and brands to engage with, we looked at how many of the registered products from these companies in the database had either red, orange or both ingredients, and which microplastic ingredients were most common in these products. We looked at over 7,704 cosmetics and personal care products from these ten most popular brands of the four largest cosmetics manufacturers in Europe. With this information, we were able to draw up the percentages presented in chapter 3.

Step three: including sustainability plans and future goals
In addition, we delved into the sustainability plans of the selected companies as published online to get a sense of how the topic of plastics is currently treated. We searched for any mention of plastics in their plans for a sustainable future, whether that be goals for recyclable or recycled plastic packaging or green formulae free of microplastics. Additionally, we sent a letter to the parent companies of these brands to inquire about any future plans to tackle this issue. In this report, we also analyse their response and adjusted our dataset with updated information.

Limitations

Despite the increasing popularity of the BTMB app, we are still far from having a complete overview of the cosmetics industry and its innumerable number of products. Inevitably, our data collection method has certain limitations; the main ones are summarised below:

i. A little more than half of the BTMB dataset for this report originates from the Netherlands (53%), where most of our users are based. Other significant contributors are Spain, Great Britain, Germany, USA, and Belgium. To the extent that the citizens of these countries show distinct consumer habits, these are, at least to some

extent, reflected in our data.

ii. The products registered in our database include those currently picked up from supermarket shelves, products stored for years in bathroom cabinets, and anything in between. There is no direct way for us to identify when each of them was actually produced which makes it difficult to keep a diary of the changes made to formulae. That is why we asked the producers and brands addressed in this report for updated information on their products.

iii. Eco-focused cosmetics consumers or those consuming above average are probably keener on using the BTMB app – their preferences might be overrepresented in our dataset.

iv. Due to time and other resource constraints, it is almost impossible presently to examine all the deviations appearing in concurring scans of a given product. As long as these constitute genuine changes in the formulae and not mere mistakes in recording, they will be included in a future report.

v. For similar reasons, we decided against using the scan count of each product to gauge their popularity and adjust their numbers – in our analyses, each product barcode is represented once. If a barcode comes with different variations in ingredients, it is not been accounted for in the context of this report. We have asked the brands for the latest product information to update our dataset.

vi. Despite our best efforts to maintain a database free of mistakes, there is always the possibility of human error – especially since each entry needs to be 'manually' checked and registered.

Annex III

Letter to targeted brands

Subject: Your products contain microplastics

Dear Ms./Mr.,
With this letter, we would like to address the issue of microplastics in your products. We have been campaigning on this topic for almost 10 years with our Beat the Microbead campaign.

In 2020, we launched the Beat the Microbead app and since then it has been downloaded more than 400,000 times. With this app, our users have scanned over 3 million cosmetic and personal care products for the presence of microplastic ingredients.

As a result of their help, we now have thousands of scans of your popular brands in our database. After analysing those, we discovered that the **x% of your** products contain either red & orange microplastics, or both (see below).

The information available on your website about your sustainability plans makes no mention of tackling microplastic pollution caused by the ingredients of your personal care & cosmetic products. Therefore, we ask you to do the following:

- Please inform us whether you have removed microbeads and/or other plastic ingredients from your product formulae. If that is the case, we will update the Beat the Microbead database.

- Please inform us about your plans to tackle your contribution to pollution created by intentionally added plastic ingredients.

We are planning a campaign to make the analysis of the data from the Beat the Microbead app publicly available. It is crucial for us to communicate the latest insights, and that is why we would ask you to respond to this letter by sending us the above requested information by **11th February, 2022.**

In this campaign, we have implemented the following traffic light rating system: **Red, Orange, and Green.**

RED: Products in this colour category contain microplastics. Our list of microplastics is derived from the research conducted by UNEP, Taut, and ECHA. We consider these reports to be the best-substantiated overview currently available of the different microplastics potentially present in cosmetics and personal care products. This list contains over 500 synthetic polymers.

ORANGE: Products in this colour category contain what we call 'sceptical' microplastics. These include, but are not limited to, Polyquaternium, Polysorbate, PEGs, and PPGs. By 'sceptical microplastic' ingredients we mean synthetic polymers for which there is not enough information available concerning their risks. We will keep adding suspicious substances to this list and will remove the ones which have been proved to not pose a risk to the environment and/or human health.

GREEN: Products in this category do not contain any known or 'sceptical' microplastics.

Zero Plastic Inside certificate:
ZERO: The brands and companies on this list are free from any plastic ingredients in their products and carry our 'Zero Plastic Inside' logo.

Our goal is to provide the consumer with transparent and clear information on products that contain these intentionally added microplastics.

Public disclosure of information on the environmental and human health risks related to these plastic ingredients is still lacking. Considering the enormous and ever-increasing number of synthetic polymers in circulation to which people

and the environment are exposed daily, we believe more transparency and knowledge about these risks needs to be publicly shared.

We are willing to cooperate with producers and companies within the cosmetics sector, and we do so regularly. Of course, we are eager to discuss this further with you.

We are looking forward to hearing from you.

Regards,

Maria Westerbos
Director & Founder

Jeroen Dagevos
Head of Programs

Annex IV

THE FORGOTTEN SYNTHETIC POLYMERS AND THEIR ENVIRONMENTAL AND HUMAN HEALTH CONCERNS

A perspective-review on water-soluble, liquid, semi-solid & biodegradable polymers and engineered nanoplastics

The scientific community's and the public's attention towards environmental contamination by synthetic polymers has increased substantially over the past decade[1–3]. Great effort has gone into investigating the extent of the pollution through data collection and the development of analytical tools. As a result of these efforts, we now know that plastic pollution stretches from the Himalayas[4] to the deepest ocean trenches[5], to our homes[6]. Most of this research has focussed on water-insoluble polymers, in the macro- and micro-size ranges. Currently, various legislative developments to reduce plastic pollution are underway at the European level. For example, the Single-Use Plastic (SUP) directive aims to reduce the use of certain plastic products[7], and the European Chemicals Agency (ECHA) has proposed a restriction on intentionally added microplastics (>100 nm) in among others agricultural products, detergents and cosmetics[8]. An EU-wide restriction of microplastics is considered justified due to concerns similar to those of persistent, bioaccumulative and toxic (PBT) substances[8]. Some groups of synthetic polymers have however been exempted in this restriction proposal, even though PBT concerns and similar hazards can exist for these polymers too. With this statement, we address the most relevant and pressing concerns for these exempted synthetic polymers and stress the need for hazard assessments to identify hazardous polymers within these groups. Whilst knowledge gaps concerning PBT characteristics of synthetic polymers still exist, we argue that the precautionary principle should apply.

Water-soluble, liquid and semi-solid polymers

Water-soluble polymers

Synthetic water-soluble polymers (WSPs) are "substances that dissolve, disperse or swell in water and, thus, modify the physical properties of aqueous systems in the form of gelation, thickening or emulsification/stabilization"[9]. Annual production volumes of major WSPs such as polyethylene glycol (PEG) and polyacrylic acid (PAA) are estimated in the millions of tons range in Europe alone[10]. Many WSP applications in, for example, paints, building materials, agricultural products, personal care products, pharmaceuticals and oil & gas extraction[11] enable direct or indirect discharge into the environment (see references within[10]). This combination results in a high potential for the increasing presence of WSPs in the environment. Scientific studies indicate that concerns regarding persistency and toxicity that exist for insoluble polymers are also true for some WSPs. Some WSPs are very resistant to degradation and therefore persistent in the environment[12–14], which in itself is a cause of concern. With the continuous release of a persistent substance, environmental concentrations will inevitably increase, as will the probability of adverse effects. Once adverse effects are observed, reversing contamination could take centuries or even longer[3,15]. Moreover, as WSPs are considered desirable for a wide range of applications, for example as soil conditioners or flocculent agents in wastewater treatment (e.g., polyacrylamide), they may act as such flocculants and soil conditioners in areas they were not intended for. When present in the environment in sufficiently high concentrations, this could potentially lead to long-lasting changes to natural ecological processes[16].

Other WSPs are more prone to degradation and will degrade into various transformation products (e.g., smaller and more mobile polymers, oligomers, monomers and other chemical by-products)[16], which may exhibit persistent and toxic characteristics[17]. Polyacrylamide (PAM) is a prominent example of this as its monomer acrylamide is a known neurotoxin and potential carcinogen[10,11] and has been included in the

'Substances of Very High Concern' candidate list[18]. The bioavailability of WSPs seems to be of less concern as WSPs themselves are often too large to cross biological cell membranes[11,13], however, their transformation products may behave very differently[11].

WSPs can enter drinking and waste-water treatment plants and are often deliberately added to these plants to flocculate colloids and organic matter to a WSP-rich sludge. WSPs that do not end up in the sludge, and potentially in soils later as fertilizers, will then enter drinking water or surface waters. The extent of WSPs and degradation products that are present or accumulating in drinking water, surface water, sediments or soils is not investigated due to lacking analytical tools. Therefore, despite increasing exposure to WSPs, the environmental and health risks resulting from them remains highly uncertain[10,17].

Liquid and semi-solid polymers

Some synthetic polymers are used in a liquid or semi-solid phase when being applied in products. Depending on their molecular structure, these polymers can be water soluble -- for example polyethylene glycol (PEG) -- and readily dispersed in water. They can also form insoluble droplets, such as polydimethylsiloxane (PDMS) oils, also called dimethicone oils[19,20]. The phase of a polymer depends not only on the monomers that make up the (co)polymer but also on properties like chain length, degree of crosslinking and molecular weight.

For instance, the longer the chain length of the dimethicone, the larger the viscosity, and the higher the melting point. Therefore, dimethicones can span from liquids to semi-solids to amorphous, rubbery solids. Lastly, the ratio of different monomers in copolymer material can also determine the phase of the polymer[21]. The use of liquid and semi-solid polymers is widespread; every year 23,700 tonnes of soluble, semi-solid and liquid polymers are used in cosmetic products in Germany alone, compared to 922 tonnes of solid synthetic polymers (<5 mm). Many of these soluble, liquid and semi-solid polymers are released into the wastewater[22]. An example of a liquid polymer of concern and commonly used in personal care products is dimethicone. Dimethicone meets the persistent criteria as described in REACH legislation, has been identified as a CMR (carcinogenic/mutagenic/reprotoxic) substance and exhibits endocrine disrupting properties[23]. Moreover, some dimethicones have been identified as a potential risk to the environment[20,23]. Thus, liquid or semi-solid polymers should not be presumed to be benign, as they can be of environmental concern as well.

Engineered nanoplastics

Though some debate exists about the exact cut-off between a microplastic and nanoplastic, nanoplastics are often defined as 1 to < 100 nanometres[8,24]. Plastics of 100 to <1000 nm can be referred to as submicron plastics and plastics > 1000 nm can be referred to as microplastics[24].

Engineered nanoplastics (ENPs) are nanoplastics that are deliberately produced at the nanoscale to allow for specific product characteristics. While not all applications of engineered nanoplastics or plastic nanomaterials will facilitate discharge into the environment (e.g., medical devices), others will. In cosmetic products, for example, these engineered nanoplastics can be as small as 10 nanometres and can be directly or indirectly emitted into the environment via wastewater[21].

Secondary nanoplastics which have fragmented from larger plastic objects are another source of environmental pollution[25]. Substantial knowledge gaps about the presence of nanoplastics in the environment, however, still exist, particularly because analytical tools to detect these particles in environmental matrices are still in the development phase[25,26]. Concerns have been expressed by the scientific community with regards to the environmental and human health hazards of nanoplastics[26,27]. These hazards are related to

the physical *and* chemical characteristics of nanoplastics and are outlined below.

Hazardous chemicals
Environmental contaminants are known to be absorbed into the surface of plastic (references in[2]). Nanoplastics have a large surface-volume ratio and the resulting high surface area allows for greater chemical reactivity and sorption[26]. Organisms can thus be exposed to hazardous chemicals after the ingestion or inhalation of plastic particles.

Moreover, plastics contain a complex mixture of chemicals including additives (e.g., plasticizers, flame retardants), starting materials and side products from processing. When plastics are ingested or inhaled, these chemicals can migrate from the plastic into the exposed organism. A continuously growing body of scientific evidence has demonstrated that plastic chemicals can result in a wide range of adverse health effects[28,29]. The role of (engineered and secondary) nanoplastics in mediating chemical effects has, however, been insufficiently investigated.

Bioavailability and translocation
Experimental studies with nanoplastics have demonstrated that these particles are taken up via inhalation or ingestion by different organisms, for example, rats[30,31] and scallop[32]. Uptake in plants via their roots has been demonstrated for plastic particles in the micrometer, submicron and nanometer-size ranges[33–35]. Animal studies have shown that plastics can pass barriers present in the gut[31], lung[36], placenta[37] and brain[38], a process referred to as 'translocation'. Translocation of nanoplastics and small microplastics (< 10 micrometer) across important human barriers such as the gut[39,40], lung[40], placenta[41] and brain (personal communication R. Westerink) has also been demonstrated in human cell models. It has moreover been shown that smaller particles more easily translocate than larger particles[32,37,42]. Consequently, nanoplastics have a higher potential to penetrate tissues and reach organs compared to larger plastic particles[31,43,44].

Particle toxicity
While a material may be chemically inert, the particle itself may exert toxicity. An example of this is black carbon, where exposure to the particle has been linked to the development of lung diseases including cancer[45]. Particle toxicity has also been demonstrated for small plastic particles and includes immune responses, inflammation, DNA damage (see references in[46,47]) cellular damage[46,48] and behavioural changes[38,49] among others. In humans, exposure to micro- and nanoplastics can induce oxidative stress and an increased vulnerability to develop neuronal disorders[50]. Moreover, interstitial lung disease has been demonstrated for workers processing nylon and other synthetic fibres, indicating a link between plastic fibrous dust inhalation and respiratory problems[51–53]. Lastly, plastic is a constituent of airborne particulate matter[47,54] and air pollution is estimated to cause 4.2 million deaths annually[55]. This, along with understanding of the particle toxicity of plastics has led to the hypothesis that plastic particles may in part be responsible for these deaths[56].

Many features of plastics such as size, shape and chemical make-up ultimately determine the extent of particle toxicity. It has, for example, been suggested that toxicity increases with decreasing particle size[44,57]. However, what features of plastic contribute most to particle toxicity remains to be further investigated.

Biodegradable polymers

A relatively new group of polymers are biodegradable polymers. Biodegradable plastics are designed for conversion into CO2, methane, biomass and mineral salts by the action of microorganisms (a process called mineralization) under specified conditions. The speed and degree of biodegradation in the environment, however, is largely dependent on the prevailing conditions (e.g.,

temperature, humidity)[58] and polymer fragments may therefore remain in certain environments over long time scales. Biodegradable plastics can be made from renewable feedstocks (bio-based) or fossil fuels[59], and should not be confused with bio-based plastics or compostable plastics. Bio-based plastics are derived from biological raw materials and can, but do not necessarily have biodegradable properties. Compostable polymers biodegrade according to defined standards yet require very specific conditions present in industrial composting facilities. Though developed as an "environmentally-friendly" alternative to conventional plastics, various questions regarding the persistency and toxicity of biodegradable polymers remain.

Standards for assessing the biodegradability of plastics

Various standardized laboratory tests have been developed to assess the biodegradation of plastics in different environmental compartments, for example in water[60], aquatic sediments[61] or soil[62]. Depending on the plastic application, different tests have been approved by ECHA. For engineered microplastics, a tiered approach is used, distinguishing between a 'screening tier' and a 'higher tier' assessment[8]. The latter is only required when a plastic fails to meet any biodegradability criteria of the screening tier. Biodegradability criteria differ between tests, yet all require partial mineralization within a specified time frame, and most of these tests are conducted at average temperatures of at least 20 °C and in oxygenrich conditions. While these experimental conditions may be useful for determining the maximum degree of biodegradability, they poorly reflect relevant environmental conditions such as colder climates and low oxygen availability. In those conditions, microbial activity may be much lower and hence biodegradation rates are also lower[58,63]. Consequently, these plastics can still be persistent in the environment. In addition, any standardized lab test will always present an oversimplification of real-world conditions and many variables affecting biodegradation rates such as nutrient availability or weather conditions are not included in the approved tests. While it is applaudable that standards are available, the current standards are not rigorous enough and it has been argued that degradation under actual field conditions should be studied[58,64]. By comparing results from field studies to the standardized test results, the standard can be calibrated.

Toxicity of biodegradable polymers

Apart from limited understanding of the real-world biodegradation of these materials, concerns also exist with regard to the presence of hazardous chemicals. Chemicals used in biodegradable plastics can have similar toxicity to conventional plastics[65,66], showing that "bio-based and biodegradable material, despite being marketed as better alternatives, is not necessarily safer than conventional plastics"[66]. Chemicals and micro-sized particles of biodegradable materials have been shown to adversely affect marine[67] and freshwater organisms[68], crop growth[69] and soil quality[70] as well as bacteria71, among others.

Precautionary principle

The European Union (EU) wants to restrict intentionally added microplastics in products such as cosmetics that pose a potential risk to the environment and to human health. By including only solid, non-biodegradable plastics between 5 mm and 100 nm we argue that ECHA is overlooking other potential sources of plastic pollution. As outlined above, the presence of WSPs in the environment is expected based on their production volumes and high potential for environmental discharge. The understanding of their distribution, concentrations, and impact is unfortunately still highly uncertain, in part due to the lack of suitable analytical methods to investigate them. Moreover, little is known about the transformation products of many WSPs, and their persistency and toxicity. With regards to liquid and semi-solid polymers, the example of demethicone illustrates that these polymers can be of environmental concern as

well. Regarding engineered nanoplastics, such as those applied in personal care products, these can cross biological barriers and exert toxic effects. Moreover, little is known about the environmental behaviour (e.g., stability), fate and health risks of the new generation of nanoplastic materials (plastics with nano-scale additives that give the material extra properties), a currently booming industry. ECHA justifies the lower limit of 100 nm by arguing that a lower size limit (of 1 nm) cannot be enforced. However, an interdisciplinary group of scientists recently argued that this claim is invalid and that "intentionally added plastic particles in the nano-range (<100 nm) could be reintroduced into the restriction proposal"[72]. With respect to biodegradable polymers, real-world conditions are poorly reflected in current standardized biodegradation tests and various concerns about their toxicity exist.

While not all synthetic polymers within the discussed groups may be harmful to environmental and human health, too many knowledge gaps currently exist to determine which ones pose a risk, and which ones do not. Future research and hazard assessments will hopefully provide new insights and identify sub-groups requiring strong regulation. Until that time, we call upon policymakers to adopt the precautionary principle for all synthetic polymers and encourage them to consider the hazards these materials pose when developing new regulatory measures. In the case of ECHA's restriction proposal, the exemption of above-mentioned groups is particularly unjustified for applications for which ample non-synthetic polymer alternatives already exist (e.g., personal care products). Additionally, regulations can be introduced that will require more short-term and long-term hazard toxicity testing before authorizing synthetic polymers to be placed on the market at certain volumes. One avenue for this would be to include the registration of polymers under REACH[72,73]. Moreover, we call upon industry to move away from these potentially "regrettable substitutions" that are currently not covered by planned regulations. We furthermore encourage industry to seek materials and substances for which safety has been established. Lastly, we call upon the scientific community to focus their efforts on filling the knowledge gaps presented here.

References

1. Triebskorn, R. et al. Relevance of nano- and microplastics for freshwater ecosystems: a critical review. *TrAC Trends in Analytical Chemistry* **110**, (2018).
2. Barboza, L. G. A., Dick Vethaak, A., Lavorante, B. R. B. O., Lundebye, A. K. & Guilhermino, L. Marine microplastic debris: An emerging issue for food security, food safety and human health. *Marine Pollution Bulletin* **133**, 336–348 (2018).
3. Macleod, M., Peter, H., Arp, H., Tekman, M. B. & Jahnke, A. The global threat from plastic pollution. *Science* **373**, 61–65 (2021).
4. Neelavannan, K., Sen, I. S., Lone, A. M. & Gopinath, K. Microplastics in the high-altitude Himalayas: Assessment of microplastic contamination in freshwater lake sediments, Northwest Himalaya (India). *Chemosphere* **290**, (2022).
5. Chiba, S. et al. Human footprint in the abyss: 30 year records of deep-sea plastic debris. *Marine Policy* 0 (2018).
6. Dris, R. et al. A first overview of textile fibers, including microplastics, in indoor and outdoor environments. *Environmental Pollution* **221**, 453–458 (2017).
7. Plastic Soup Foundation. SUP Directive Products. https://www.plasticsoupfoundation.org/en/single-use-plastics-directive/what-products-are-in-the-sup-directive/.
8. European Chemicals Agency. Annex XV Restriction Report. Proposal for a Restriction. (2019).
9. Kadajji, V. G. & Betageri, G. v. Water soluble polymers for pharmaceutical applications. *Polymers* **3**, 1972–2009 (2011).
10. Huppertsberg, S., Zahn, D., Pauelsen, F., Reemtsma, T. & Knepper, T. P. Making waves: Water-soluble polymers in the aquatic environment: An overlooked class of synthetic polymers? *Water Research* **181**, (2020).

Annex IV

11. Xiong, B. et al. Polyacrylamide degradation and its implications in environmental systems. *Nature Partner Journals: Clean Water* **17,** (2018).
12. Hennecke, D., Bauer, A., Herrchen, M., Wischerhoff, E. & Gores, F. Cationic polyacrylamide copolymers (PAMs): environmental half life determination in sludge-treated soil. *Environmental Sciences Europe* **30**, (2018).
13. Duis, K., Junker, T. & Coors, A. Environmental fate and effects of water-soluble synthetic organic polymers used in cosmetic products. *Environmental Sciences Europe* **33**, (2021).
14. Jop, K. M., Guiney, P. D., Christensen, K. P. & Silberhorn, E. M. Environmental Fate Assessment of Two Synthetic Polycarboxylate Polymers. *Ecotoxicology and Environmental Safety* **37**, 229–237 (1997).
15. Cousins, I. T., Ng, C. A., Wang, Z. & Scheringer, M. Why is high persistence alone a major cause of concern? *Environmental Science: Processes and Impacts* **21**, 781–792 (2019).
16. Arp, H. P. H. & Knutsen, H. Could We Spare a Moment of the Spotlight for Persistent, Water-Soluble Polymers? *Environmental Science and Technology* **54**, 3–5 (2020).
17. Reemtsma, T. et al. Mind the Gap: Persistent and Mobile Organic Compounds - Water Contaminants That Slip Through. *Environmental Science and Technology* **50**, 10308–10315 (2016).
18. European Chemicals Agency. Substance information acrylamide. https://echa.europa.eu/substance-information/-/substanceinfo/100.001.067.
19. Heldebrant, D. J. et al. Liquid polymers as solvents for catalytic reductions. *Green Chemistry* **8**, 807–815 (2006).
20. Nendza, M. Hazard assessment of silicone oils (polydimethylsiloxanes, PDMS) used in antifouling-/foul-release-products in the marine environment. *Marine Pollution Bulletin* **54**, 1190–1196 (2007).
21. United Nations Environment Programme & Institute for Environmental Studies VU University. Plastics in Cosmetics. Are we polluting the environment through our personal care? (2015).
22. Fraunhofer Institut fur Umwelt Sicherheits und Energietechnik Umsicht. Microplastik und Synthetische Polymere in Kosmetikprodukten Sowei Wasch-, Putz- und Reinigungsmitteln. (2018).
23. Dhanirama, D., Gronow, J. & Voulvoulis, N. Cosmetics as a potential source of environmental contamination in the UK. *Environmental Technology* (United Kingdom) **33**, 1597–1608 (2012).
24. Hartmann, N. B. et al. Are We Speaking the Same Language? Recommendations for a Definition and Categorization Framework for Plastic Debris. *Environmental Science and Technology* **53**, 1039–1047 (2019).
25. Mitrano, D. M., Wick, P. & Nowack, B. Placing nanoplastics in the context of global plastic pollution. *Nature Nanotechnology* **16**, 491–500 (2021).
26 Stapleton, P. A. Toxicological considerations of nano-sized particles. *AIMS Environmental science* **176**, 100–106 (2019).
27. Mitrano, D. Nanoplastic should be better understood. *Nature Nanotechnology* **14**, 299 (2019).
28. Hahladakis, J. N., Velis, C. A., Weber, R., Iacovidou, E. & Purnell, P. An overview of chemical additives present in plastics: Migration, release, fate and environmental impact during their use, disposal and recycling. *Journal of Hazardous Materials* **344**, 179–199 (2018).
29. Muncke, J. et al. Impacts of food contact chemicals on human health: A consensus statement. *Environmental Health* **19**, (2020).
30 Fournier, S. B. et al. Nanopolystyrene translocation and fetal deposition after acute lung exposure during late-stage pregnancy. *Particle and Fibre Toxicology* **17**, 1–11 (2020).
31. Walczak, A. P. et al. Bioavailability and biodistribution of differently charged polystyrene nanoparticles upon oral exposure in rats. *Journal of Nanoparticle Research* **17**, 1–13 (2015).
32. Al-Sid-Cheikh, M. et al. Uptake, whole-body distribution & depuration of nanoplastics by the scallop Pecten maximus, at environmentally realistic concentrations. *Environmental Science & Technology* (2018).
33. Li, L. et al. Effective uptake of submicrometre plastics by crop plants via a crack-entry mode. *Nature Sustainability* **3**, 929–937 (2020).
34. Liu, Y., Guo, R., Zhang, S., Sun, Y. & Wang, F. Uptake and translocation of nano/microplastics

Annex IV

by rice seedlings: Evidence from a hydroponic experiment. *Journal of Hazardous Materials* **421**, (2022).

35. Yin, L. et al. Interactions between microplastics/nanoplastics and vascular plants. *Environmental Pollution* **290**, (2021).

36. Fournier, S. et al. Nanopolystyrene Translocation and Fetal Deposition After Acute Lung Exposure During Late-Stage Pregnancy. *Particle and Fibre Toxicology* **17**, 1–11 (2020).

37. Huang, J.-P. et al. Nanoparticles can cross mouse placenta and induce trophoblast apoptosis. *Placenta* **36**, 1433–1441 (2015).

38. Mattsson, K. et al. Brain damage and behavioural disorders in fish induced by plastic nanoparticles delivered through the food chain. *Scientific Reports* **7**, 1–7 (2017).

39. Walczak, A. P. et al. Translocation of differently sized and charged polystyrene nanoparticles in in vitro intestinal cell models of increasing complexity. *Nanotoxicology* **9**, 453–461 (2015).

40. Donkers, J. M. et al. Advanced epithelial lung and gut barrier models demonstrate passage of microplastic particles. *Microplastics and Nanoplastics* **2**, 6 (2022).

41. Kloet, S. K. et al. Translocation of positively and negatively charged polystyrene nanoparticles in an in vitro placental model. *Toxicology in Vitro* **29**, 1701–1710 (2015).

42. Jani, P., Halbert, G. W., Langridge, J. & Florence, A. T. Nanoparticle Uptake by the Rat Gastrointestinal Mucosa: Quantitation and Particle Size Dependency. *Journal of Pharmacy and Pharmacology* **42**, 821–826 (1990).

43. Kashiwada, S. Distribution of nanoparticles in the see-through medaka (Oryzias latipes). *Environmental Health Perspectives* **114**, 1697–1702 (2006).

44. Huang, D. et al. Microplastics and nanoplastics in the environment: Macroscopic transport and effects on creatures. *Journal of Hazard Materials* **407**, (2021).

45. Lequy, E. et al. Contribution of long-term exposure to outdoor black carbon to the carcinogenicity of air pollution: Evidence regarding risk of cancer in the gazel cohort. *Environmental Health Perspectives* **129**, (2021).

46. Wright, S. L. & Kelly, F. J. Plastic and Human Health: A Micro Issue? *Environmental Science and Technology* **51**, 6634–6647 (2017).

47. Vethaak, D. & Legler, J. Microplastics and human health. *Science* **371**, (2021).

48. Schirinzi, G. F. et al. Cytotoxic effects of commonly used nanomaterials and microplastics on cerebral and epithelial human cells. *Environmental Research* **159**, 579–587 (2017).

49. Brun, N. R. et al. Polystyrene nanoplastics disrupt glucose metabolism and cortisol levels with a possible link to behavioural changes in larval zebrafish. *Communications Biology* **2**, (2019).

50. Prüst, M., Meijer, J. & Westerink, R. H. S. The plastic brain: Neurotoxicity of micro- And nanoplastics. *Particle and Fibre Toxicology* **17**, 1–16 (2020).

51. Kern, D. G., Crausman, R. S., Durand, K. T. H., Nayer, A. & Kuhn, C. Flock worker's lung: Chronic interstitial lung disease in the nylon flocking industry. *Annals of Internal Medicine* **129**, 261–272 (1998).

52. Eschenbacher, W. L. et al. Clinical Pathology Workshop Summary Nylon Flock – Associated Interstitial Lung Disease. *American Journal of Respiratory and Critical Care Medicine* **159**, 2003–2008 (1999).

53. Kremer, A. M., Pal, T. M., Boleij, J. S. M., Schouten, J. P. & Rijcken, B. Airway hyperresponsiveness, prevalence of chronic respiratory symptoms, and lung function in workers exposed to irritants. *Occupational and Environmental Medicine* **51**, 3–13 (1994).

54. Kelly, F. J. & Fussell, J. C. Toxicity of airborne particles - established evidence, knowledge gaps and emerging areas of importance: Topical aspects of particle toxicity. *Philosophical Transactions of the Royal Society A* **378**, (2020).

55. World Health Organization. Air pollution. https://www.who.int/health-topics/air-pollution.

56. Jan Kole, P., Löhr, A. J., van Belleghem, F. G. A. J. & Ragas, A. M. J. Wear and tear of tyres: A stealthy source of microplastics in the environment. *International Journal of Environmental Research and Public Health* **14**, (2017).

57. Yong, C. Q. Y., Valiyaveettil, S. & Tang, B. L. Toxicity

Annex IV

of microplastics and nanoplastics in Mammalian systems. *International Journal of Environmental Research and Public Health* **17**, (2020).
58. Haider, T. P., Völker, C., Kramm, J., Landfester, K. & Wurm, F. R. Plastics of the Future? The Impact of Biodegradable Polymers on the Environment and on Society. *Angewandte Chemie - International Edition* **58**, 50–62 (2019).
59. Sander, M. Biodegradation of Polymeric Mulch Films in Agricultural Soils: Concepts, Knowledge Gaps, and Future Research Directions. *Environmental Science and Technology* **53**, 2304–2315 (2019).
60. International Organization for Standardization. ISO 14852 Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium - method by analysis of evolved carbon dioxide. (2018).
61. International Organization for Standardization. ISO 19679 Determination of aerobic biodegradation of non-floating plastic materials in a seawater / sediment interface - Method by analysis of evolved carbon dioxide. (2020).
62. International Organization for Standardization. ISO 17556 Determination of the ultimate aerobic biodegradability of plastic materials in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved. (2019).
63. Sintim, H. Y. et al. In situ Degradation of Biodegradable Plastic Mulch Films in Compost and Agricultural Soils. Science of the *Total Environment* **727**, (2020).
64. Sintim, H. Y. & Flury, M. Is Biodegradable Plastic Mulch the Solution to Agriculture's Plastic Problem? *Environmental Science and Technology* **51**, 1068–1069 (2017).
65. Zimmermann, L., Dombrowski, A., Völker, C. & Wagner, M. Are bioplastics and plant-based materials safer than conventional plastics? In vitro toxicity and chemical composition. *Environment International* **145**, (2020).
66. Zimmermann, L., Dierkes, G., Ternes, T. A., Völker, C. & Wagner, M. Benchmarking the in vitro toxicity and chemical composition of plastic consumer products. *Environmental Science & Technology* **53**, (2019).
67. Magara, G. et al. Effects of combined exposures of fluoranthene and polyethylene or polyhydroxybutyrate microplastics on oxidative stress biomarkers in the blue mussel (Mytilus edulis). *Journal of Toxicology and Environmental Health - Part A: Current Issues* **82**, 616–625 (2019).
68. Zimmermann, L., Göttlich, S., Oehlmann, J., Wagner, M. & Völker, C. What are the drivers of microplastic toxicity? Comparing the toxicity of plastic chemicals and particles to Daphnia magna. *Environmental Pollution* **267**, (2020).
69. Meng, F., Yang, X., Riksen, M., Xu, M. & Geissen, V. Response of common bean (Phaseolus vulgaris L.) growth to soil contaminated with microplastics. *Science of the Total Environment* **755**, 142516 (2021).
70. Qin, M. et al. A review of biodegradable plastics to biodegradable microplastics: Another ecological threat to soil environments? *Journal of Cleaner Production* **312**, 127816 (2021).
71. Adhikari, D. et al. Degradation of Bioplastics in Soil and Their Degradation Effects on Environmental Microorganisms. *Journal of Agricultural Chemistry and Environment* **05**, 23–34 (2016).
72. Abdolahpur Monikh, F. et al. Can Current Regulations Account for Intentionally Produced Nanoplastics? *Environmental Science & Technology* (2022).
73. Authored by and signed by members of the scientific community. Statement on the Registration of Polymers under REACH and List of Signatures in Support. https://www.ipcp.ch/activities/polymer-statment.

Redaction explanation

May 2022

Page 34 | Overview sustainability plans microplastics

After receiving further explanations from Unilever, we have changed the assessment of brands from Unilever under the column “Working on formulas/ biodegradability” & "Mention of something that could mean microplastics." Unilever confirmed that “any commitment we take as a company applies to our brands.” Hence, Dove, Rexona and Axe received a green tick under this column.

The name of the last column has been changed to “committed to stop using any microplastics” from “committed to using less microplastics”. This led to a reassessment of brands and producers. As it is challenging to define how “using less microplastics” can be precisely quantified, we have changed the name of this column to “committed to stop using any microplastics”. We took this step to provide more clarity. None of the brands and producers have committed to stop using all microplastics. Hence, all brands and producers receive a red cross under this column.

The assessment of P&G under the column “Mention of something that could mean microplastics” has been changed. As they mention that they have discovered a way to make polymers out of renewable crops. This could be a mention of microplastic ingredient.

Page 7 | Key findings

Page 35 | TEN BRANDS UNDER THE MICROSCOPE, Bird's-eye view: a need for more action

As a result of reassessing brands under the table on page 34, we came to a conclusion that only 1 out 10 brands (Nivea) mention the word microplastics in their plans. Only Nivea mentioned the word “microplastic” in their sustainability plan.

BEAT THE MICRO BEAD

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