MICROPLASTIC FACTSHEET

Plastic has become an omnipresent part of our everyday lives. In 2012, global production of plastic pellets totalled 288 million tons – an increase by more than 600% when compared to 1975. The bulk of plastic products comprise throw-away plastic (e.g., packaging) which is disposed of immediately after use.

THE PATH OF PLASTIC INTO OUR OCEANS

Plastic can have fatal consequences for a range of marine animals if they enter our waters. The most advantageous characteristic of plastic – its durability – is at the same time the biggest problem for the environment: plastic decomposes very slowly and thus can continue to endanger marine animals for decades or even centuries. Most plastic waste entering the oceans emanates from land – via rivers, waste water, wind, flooding or directly from the coastline. A smaller part of marine plastic waste comes from ships.

8.8 MILLION TONS A YEAR

A recently published study calculated that 192 coastal countries produced 275 million tons of plastic waste in 2010, of which 8.8 million tons entered the oceans.[2] If no counteractive measures are taken, the authors expect a ten-fold rise of plastic being washed into the oceans by 2025.

Macroplastic accounts for the larger portion of plastic in the ocean by mass (kg/km²).
Microplastic however is by far more numerous (items/km²). [3]

WHAT IS MICROPLASTIC?

The term microplastic was only introduced within the last decade to describe plastic particles smaller than 5 mm in diameter. Depending on the origin, we can differentiate between primary and secondary microplastic.

PRIMARY MICROPLASTIC

Primary microplastic is industrially manufactured in the form of resin pellets which are distributed to the producers of consumer products. Due to poor handling and accidental spillages plastic pellets are often leaked into the environment and are now commonly found on beaches, especially near ports and industrialised regions. For example, pellets comprise the main fraction of microplastic analysed in the Wadden Sea.[4]

There is also little awareness that a variety of cosmetic and personal care products contain plastic micro-beads. Adding such microplastic particles is apparently supposed to improve the effectiveness of peelings, toothpaste, shower gels, abrasives and many other products.

Microplastic composition

Plastic is an umbrella term for synthetic polymers made mainly from fossil fuels (petroleum) or, to a much lesser extent, from biomass (cellulose). There is a huge assortment of plastic varying in both composition and characteristic. The polymers are also mixed with chemical compounds, so called additives (e.g,. plasticisers), to give the materials specific desired properties. Some additives are extremely noxious and are released from the plastic under certain conditions.[4]

Certain products contain thousands of plastic particles. One tube of cosmetics, by way of example, was found to contain 356,110 microplastic particles, amounting to 4.2% of the product's total weight.[5] Plastic micro-beads are usually made of polyethylene (PE) or polypropylene (PP), but polyethylene terephthalate (PET), polymethyl methylacrylate (PMMA), and Nylon may also be used. With every use of these products, we unwittingly flush away plastic waste, polluting our rivers and lakes. The plastic micro-beads are so small that they simply pass through the wastewater treatment plants and, as such, eventually get washed into the oceans.

Microplastic in Swiss waters

The first analysis of microplastic pollution in a Swiss water body was published in 2012 by scientists from the École Polytechnique Fédérale de Lausanne. Investigating Lake Geneva they found a significant microplastic contamination.[6] By the end of 2014, results from a nationwide study on microplastic contamination of Swiss waters and beaches were published.[7] Most samples were found to contain plastic particles. While the bulk of particles was secondary microplastic (fragmented plastic), microplastic particles from cosmetics were also found.

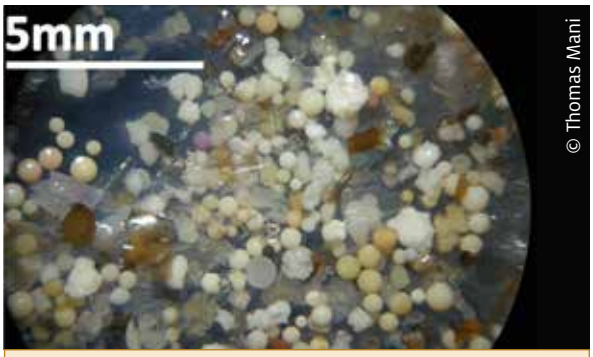
"Based on the results, it was estimated that about 10 kg of microplastic per day are carried into France by the Rhône and may therefore contribute to ocean pollution." [8]

SECONDARY MICROPLASTIC

Secondary microplastic is generated by the fragmentation of larger plastic items by UV radiation, physical abrasion (waves, rocks), and microbial processes. Synthetic textiles, too, may be a source of microplastic, when parts of fibres are loosened during laundering and then washed into the sewage. Microplastic particles are found in every ocean, from the Antarctic to the Arctic, on beaches, on the water surface, in the water columns and at the bottom of the seas. Both macroplastic and microplastic are also present in remote areas far away from civilisation. A recent study estimated that around 5.25 trillion microplastic particles, weighing some 269,000 tons, float on the surface of the oceans.[9] In other words, there is a huge amount of small plastic particles afloat in the oceans, weighing as much as 2,150 blue whales, the largest animals on earth. The study found that the amount of floating microplastic is much smaller than projected which indicates that there are oceanic sinks, like sequestration in sediment or intake by organisms. There is also large quantities of microplastic in rivers and lakes from where they may also eventually end up in the oceans. However, microplastic is not only found in water, but also on land. For example, high concentrations of microplastic was found in Swiss honey.[10]

INVISIBLE THREAT TO MARINE ANIMALS

To many marine animals, bags and other plastic parts floating in the water resemble their natural food. Plastic waste also constitutes a deadly trap, injuring animals or disabling them from swimming. Macroplastic waste kills up to 1 million sea birds, hundreds of thousands mammals, such as seals, whales and dolphins, and other marine animals, like sea turtles.[11] While the effect of macroplastic on marine animals is directly visible, it is a challenge to fully uncover the harmful effect of microplastic on living creatures.



microplastic sample from the Rhine river

Scientific papers describing small plastic fragments in the seas and in marine animals were first published around 1970. However, the attention of the scientific commu-nity was aroused only a decade ago, which is shown by the enormous increase in publications covering this issue over the past ten years.

PLASTIC PARTICLES IN THE BODY

Numerous publications have now shown that microplastic particles are ingested by birds, marine mammals, marine turtles, fish, and various invertebrates (such as mussels, crustaceans, worms and filter-feeding planktonic organisms).[12] A Belgian scientist has detected an average of one plastic particle per gram of flesh in mussels;[13] and that more than one third of 670 examined fish in the North Pacific were found to have plastic fragments in their stomach.[14] Further, laboratory experiments observed negative impacts of exposure to plastic particles on photosynthesis in algae. Intake of plastic by marine animals can cause internal injuries or intoxications, when the body absorbs noxious substances from the material. It has also been shown that microplastic particles may accumulate high concentrations of water-soluble contaminants like biocides or polychlorinated biphenyls (PCB). Microplastic particles are ingested by small marine animals which are generally prey for larger animals. Thus, the toxins enter the whole food chain and can thus eventually also reach our plates. Scientific research on the effects of microplastic on marine animals is still in its early stages. However, we already know of the grave consequences they can cause, such as tissue damage, inflammation and reduced fitness, negatively impacting nutrition and other aspects of life.

ALTERNATIVES TO MICROPLASTIC IN COSMETICS

It is imperative to reduce plastic pollution of the environment. **Microplastic pollution through cosmetics must be completely stopped. This is economically feasible in the short term, as there already are widely used natural alternatives to microplastic particles in cosmetic products – e.g., granulated nutshells or stone fruit shells, special silica or minerals such as salt crystals and chalk.**

INITIATIVES AGAINST MICROPLASTIC

Through the international campaign “Beat the Microbead”, numerous conservation organisations and associations from various countries have been campaigning for legal intervention to ban the use of microplastic in cosmetic products and, further, for the industry to replace synthetic polymers with natural ingredients.

A ban on the production and sale of cosmetic products that contain microplastic is under discussion in several countries around the world.[15] There have been correspondent legislative proposals in several US states and Canada. In the Netherlands and Switzerland, motions have been filed in parliament; and different measures are also being discussed in Australia, Austria and within the EU. Further, microplastic is one of the indicators within descriptor 10 "Marine Litter" of the EU Marine Strategy Framework Directive.

Potential measures to curb microplastic input from cosmetics into the environment from a scientific perspective

"An end-of-pipe type of solution to halting PCCP (note: personal care and cosmetic products) microplastic emissions via wastewater streams is challenging because treatment facilities are not designed to fully retain plastic particulates, and applying further nano- or microfiltration is expected to be costly both in terms of energy inputs and financial investments." [16; page 27]

"Taken together, these facts point to cleaner production as a more universally effective route to achieve a reduction in microplastic emissions from cosmetic and personal care products on the short term. While packaging and other macrosized plastic objects have the potential to be recycled, plastic cosmetic ingredients are impossible to recycle because the product is discharged into wastewater at end-of-life." [16; page 28]

SUMMARY

Microplastic is a global environmental problem which has the power to threaten marine life as well as freshwater organisms for decades and centuries, and the potential to poison the entire food chain.

A major portion of microplastic comprise fragments from larger plastic items. This necessitates measures to reduce macroplastic inputs. **The most important ones are the improvement of waste management, the reduction of plastic consumption, and the promotion of the production of plastic products which are recyclable and thus get an economic value.**

Another portion of microplastic, however, is emitted into the environment by everyday use of personal care products containing microplastic additives. **Plastic is not for the environment and therefore such products are not for the shelves!** Several producers have now announced that they will refrain from adding microplastic to their products, because they have become aware of the harmful effects these materials have on the environment. However, this is not enough to solve the problem. There are still numerous personal care and cosmetic products available in the market which contain microplastic, and the commitments suggested by manufacturers are often vague, and/or the phase-out periods continue to span several years. **Therefore, a legal ban on microplastic in cosmetic and personal care products is not only essential but also urgent.**

REFERENCES

1 Bundesamt für Umwelt BAFU. http://www.bafu.admin.ch/abfall/01472/01483/index.html?lang=en. Accessed on April 7, 2015.

2 Jambeck J.R., Geyer R., Wilcox C., Siegler T.R. Perryman M., Andrady A., Narayan R., Law K.L. (2015). Plastic waste inputs from land into the ocean. Science, Vol. 347, Issue 6223.

3 GESAMP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (2014). Microplastics in the ocean. WG 40 Brochure.

4 Liebezeit G. in cooperation with Fatehi Dubaish ICBM (2012). Mikroplastik – Quellen, Umweltaspekte und Daten zum Vorkommen im Niedersächsischen Wattenmeer. Natur- und Umweltschutz (Zeitschrift Mellumrat), Band 11, Heft 1, April 2012.

5 Position Paper 2013. Microplastic in consumer products and in the marine environment. 5 Gyres Institute, Plastic Soup Foundation, Surfrider Foundation, Plastic Free Seas Clean Seas Coalition. http://5gyres.org/media/5_Gyres_Position_Paper_on_Microplastics.pdf

6 Faure F., Corbaz M., Baecher H., de Alencastro L.F. (2012). Pollution due to plastics and microplastic in Lake Geneva and in the Mediterranean Sea. Arch. Sci., Vol. 65.

7 Faure F. und de Alencastro L.F. (2014). Evaluation de la pollution par les plastiques dans les eaux de surface en Suisse. Rapport final. Sur mandat de l'Office fédéral de l'environnement (OFEV). Juin 2014.

8 Bundesamt für Umwelt BAFU. Press Release. http://www.bafu.admin.ch/dokumentation/medieninformation/00962/index.html?lang=de&msg-id=55628. Accessed on April 7, 2015.

9 Eriksen M., Lebreton L.C.M., Carson H.S., Thiel M., Moore C. J., Borerro J.C., Galgani F., Ryan P.G., Reisser J. (2014). Plastic pollution in the world's oceans: More than 5 trillion plastic pieces weighing over 250,000 tons afloat at sea. PLoS ONE 9(12).

10 Kassensturz. March 25, 2014. http://www.srf.ch/konsum/themen/umwelt-und-verkehr/plastik-im-honig-testzeigt-verschmutzung-im-naturprodukt

11 UNEP (2006). Ecosystems and Biodiversity in deep waters and high seas. UNEP Regional Seas Reports and Studies No. 178. UNEP/IUCN, Switzerland 2006.

12 Holm P., Schulz G., Athanasopulu K. (2013). Mikroplastik – ein unsichtbarer Störenfried. Meeresverschmutzung der neuen Art. Biologie in unserer Zeit, Vol. 43, Issue 1.

13 Van Cauwenberghe L., Claessens M., Vandegehuchte M., Janssen C.R. (2012). Occurrence of microplastic in mussels (Mytilus edulis) and lugworms (Arenicola marina) collected along the French-Belgian-Dutch coast. In: J. Mees, et al. (ed.), Book of abstracts – VLIZ Young Marine Scientists' Day. Brugge, Belgium, 24 February 2012. VLIZ Special Publication, 55.

14 Boerger C.M., Lattin G.L., Moore S.L., Moore C.J. (2010). Plastic ingestion by planktivorous fishes in the North Pacific Central Gyre. Marine Pollution Bulletin 60 (12).

15 www.beatthemicrobead.org/en/results

16 Leslie H.A. (2014). Review of microplastic in cosmetics. Scientific background on a potential source of plastic particulate marine litter to support decision-making. Report R14/29. IVM Institute for Environmental Studies, Amsterdam, the Netherlands.