

## Questions and Answers on Microplastics

BfR FAQ of 1 December 2014

A world without plastics is hardly imaginable nowadays. World production of plastics keeps growing and increasingly more plastics find their way into the environment. This problem of plastic pollution has been known for quite some time in aquatic ecosystems.

Microplastics are small plastic particles and fibres which are being detected in the environment to an ever greater extent. Since plastic degrades very slowly, it has to be assumed that plastic debris will accumulate in the environment. The potential risks to consumer health through the possible introduction of microplastics into the food chain are currently a topic of public concern.

In the following, the Federal Institute for Risk Assessment (BfR) answers frequently asked questions on microplastics.

### What are microplastics?

The term microplastics describes small plastic particles of different origins, sizes and chemical compositions. The sizes of microplastics are not uniformly defined in literature and usually range from 0.001 mm to smaller than 5 mm.

Generally two types of microplastic are being distinguished, namely primary and secondary microplastics:

- Primary microplastics are manufactured industrially in the form of plastic-based granulates and pellets (resin pellets). Various synthetic polymers such as polyethylene (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), polyvinyl chloride (PVC), polyamide (nylon) and ethylene-vinyl acetate (EVA) are used.
- Secondary microplastics are formed by chemical and physical ageing and degrading processes of products such as plastic bags and plastic bottles. Secondary microplastics constitute one of the main sources of microplastics in the environment.

### How do microplastics get into the environment?

Primary microplastics are used as granulates or resin pellets in the manufacture of plastic products. They are also used specifically in industrial sand blasting equipment, cleaning pastes and some cosmetic products. As sewage plants do not filter out these particles to a sufficient extent, a large portion find their way back in to the water.

Another cause of plastic pollution is careless behaviour of consumers. Casually discarded packaging, bags, bottles, canisters etc end up as litter in the environment. As plastic hardly degrades, it persists in the environment for an indefinite period. Through ageing and degradation Secondary microplastics can also emanate from synthetic garments, such as fleece which is a fabric commonly made of polyester or polyacrylic fibres. It has been shown that during wearing and washing of such textiles, microfibers are released into the air and sewage.

### Why are plastic microparticles used in cosmetic products?

Microplastic particles are used in products such as shower gels, exfoliants/peeling products and toothpastes to achieve particularly gentle removal of dirt, dead skin cells or dental plaque.

**Does the use of microplastics in cosmetics have to be declared?**

All of the ingredients of a cosmetic product are listed in decreasing order of their concentration in the list of ingredients (INCI List). However, whether an ingredient is added to a cosmetic product as a microplastic particle or bead does not have to be disclosed.

To manufacture microplastic particles, the raw materials such as ethylene, are polymerised into large complexes in order to form a particle. In addition to their use as “cleaning beads”, polyethylene polymers are also added to cosmetics to control viscosity or to assist in the formation of films. The polyethylene used for those purposes, however, is a liquid rather than a particle. Therefore, the ingredients list does not provide any information on the physical characteristics of a raw material.

**Do consumers face a health risk if they use cosmetic products containing microparticles made of plastic?**

The BfR has dealt with the question as to whether a health risk can emanate from the dermal or unintentional oral intake of microplastic particles from shower gels, peels, toothpastes etc. The BfR considers a health risk for consumers unlikely as the microplastic particles used in peels and shower gels are larger than 1 micrometre (1  $\mu\text{m}$  equates to 0.001 mm). With particles of this size, absorption through healthy and intact skin is not to be expected if the product is put to its intended use. Even if toothpaste is swallowed, the molecular size of the beads prevents their gastrointestinal uptake. Ingested particles should be excreted in the faeces. Additionally, health-affecting quantities of ethylene should not be released from the polyethylene microplastic particles during passage through the gastrointestinal tract.

For a more detailed safety assessment of polyethylene plastic particles in cosmetic products please visit:

<http://www.bfr.bund.de/cm/349/polyethylene-containing-microplastic-particles.pdf>

**Can microplastic particles be contained in food?**

Information on the many different entry paths or on the occurrence, composition, particle size and quantity of microplastic particles in foods is limited. Microplastics can in principle find their way into the environment in different ways. Therefore, it seems hypothetically possible that they could eventually transfer to foods via the air, seawater, fresh water and groundwater.

There were reports in the media in 2013 about findings of microplastics in honey. However, the corresponding analytical data has only been published incompletely and there has only been a single publication up to now. Additionally, this publication mentions synthetic fragments and fibres rather than microplastics. It was reported in 2014 that microplastics had been identified in beer and mineral water, but the chemical composition of the discovered particles was not more precisely specified. As the analysis is based on samples which were not taken representatively, no inferences on average levels in foods available on the German market are possible.

The BfR has assessed several publications on the incidence of microplastic particles in fish, mussels and crabs. Blue mussels sampled along the coast of France, Belgium and the Netherlands had 2 microplastic particles per gram of mussel meat. Filamentary plastic particles were found in natural, wild North Sea mussels and commercially traded mussels in quantities of between 2.6 and 6.1 particles per 10 g of mussel meat, dependent upon their origin. The majority of the studies on the incidence of microplastic particles in fish examine the content of the gastrointestinal tract. As the stomach and the intestine of fish are not usually eaten,

however, no conclusions can be drawn on the intake of microplastic particles by consumers via this route. There is no reliable data on this with regard to crustaceans.

### **Are there any analytical methods to detect microplastics in consumer products and foods?**

At present, there is no uniform definition of microplastic and no validated, i.e. generally recognised and tested methods of identifying and quantitatively analysing microplastics. The wide variety of plastic raw materials makes the qualitative analysis of microplastics (i.e. the identification of the plastic material) and especially the quantitative analysis (i.e. the number of microparticles measured) more difficult. Various analytical approaches to determine and quantify microplastics are currently under discussion by experts.

### **What is the BfR doing with regard to microplastics?**

Studies of the intake of microplastic particles in blue mussels (*Mytilus edulis*) and oysters (*Crassostrea gigas*) commenced at the BfR in 2013. The prime objective was initially to develop a standard protocol for the contamination of mussels with defined particles in order to produce contaminated reference material. With the established method, it was possible to reliably contaminate Baltic blue mussels and oysters to a sufficient extent with plastic particles of different sizes, shapes and raw materials. The results of the initial experiments on the intake speed and distribution of microplastic particles in the shellfish are in good agreement with published data. Follow up studies on the oral intake and possible effects of resorbed microparticles in various tissues are planned.

Together with the German Federal Institute of Hydrology and Federal Environment Agency, the BfR initiated a first interdepartmental meeting on the subject of microplastics among the federal authorities in July 2014. Representatives of 12 different departmental research institutions took part. Each Institute presented their research priorities and their scientific expertise regarding microplastics and a joint action plan for the establishment of an assessment concept was discussed. Therein essential aspects such as the life cycle of microplastics were taken into consideration and key questions were formulated.

Studies to identify factors that influence the intake and discharge of microplastic particles in blue mussels are currently being conducted at the BfR. Additionally methods are being developed to qualitative and quantitative detect microplastics in water and mussel tissue.