

## “Microplastics and Food” Current situation and FAQs

**Bund für Lebensmittelrecht  
und Lebensmittelkunde e. V.**

Postfach 06 02 50  
10052 Berlin  
Claire-Waldoff-Straße 7  
10117 Berlin

Tel. +49 30 206143-0  
Fax +49 30 206143-190  
bll@bll.de · www.bll.de

**Büro Brüssel**  
Avenue des Nerviens 9-31  
1040 Brüssel, Belgien

Tel. +32 2 508 1023  
Fax +32 2 508 1025

Plastics and plastic products are indispensable for the production, processing and marketing of food. Plastic packagings help to present food in a safe, hygienically acceptable and quality-preserving way.

However, the thoughtless or deliberate release of plastic products has globally become an environmental problem, particularly with regard to the oceans. When exposed to UV radiation and friction, plastic products break down into fragments and eventually form minute to microparticles (so called microplastics). Microparticles from this and other sources may be present in many environmental areas. According to current knowledge, there are no indications of health risks from the intake of microplastics with food.

A central goal for the protection of the oceans and inland waters is conscious and careful handling of plastic products through the application of globally effective concepts for reduction, recirculation and reuse (recycling). This also includes food packagings and plastic materials with food contact despite the fact that these should not be considered one-sidedly as the decisive cause.

The national and European food industry has great interest in the objective elucidation of these relationships and in a precautionary reduction of possible contaminations. At the same time, food packagings are required in order to maintain the high level of food safety and food quality. The global situation of plastic emissions can be improved in a sustainable way only with the involvement of all socially relevant stakeholders.

In the course of intensive efforts to research the relationships and relevance of microplastics to the environment and human health, the following questions related to food are raised and answered based on the current state of knowledge. However, because of a lack of data many questions cannot be answered conclusively.

## FAQ on microplastics and food

- **What are microparticles and microplastics?**

“Microparticles” in general are defined as particles smaller than 1 mm in size; they can be of different characters.

“Microplastics” are solid and insoluble particles or fibres which are smaller than 1 mm in size; they can be made from different types of polymers and are released into the environment directly or indirectly by human actions<sup>(2)(5)</sup>.

Currently there is no international standardization of the definition and description of their characteristics available. According to the latest terminology, a difference is made based on the source and type of release of the microplastics: Primary microplastics have been produced in a targeted way (type A) or released during use (type B). Secondary microplastics form in the environment by slowly degrading into fragments<sup>(5)</sup>.

Therefore, the nature of microplastic particles released into the environment is as varied and different as the polymers themselves. The chemical composition as well as shape and geometry of the individual microparticles are dependent on the respective original material (elastomers, thermoplastic, duroplastic). Moreover, they are mixed during the course of their creation, which involves mechanical and chemical degradation into fragments and macroparticles.

Microplastic particles of type A, which have been produced for certain uses (cleaning agents, cosmetics) are homogeneous and their material composition is known.

- **How do microplastics enter the environment?**

For decades, microplastics have been present in all environmental areas; this is due to the fact that plastic materials are ubiquitous in the modern environment, and abrasion and thus release into the air and water is an inevitable process.

According to a new study of the Fraunhofer Institute UMSICHT<sup>(5)</sup>, the largest producers of microplastic particles (type B) in terms of quantity are abrasion products from traffic (e.g. tire abrasion and asphalt) and infrastructure (e.g. construction activities, weathering processes) followed by fibres released from

private households (e.g. laundry, carpets) and industrial plants (e.g. the use and processing of textiles that contain synthetic fibres).

The source and routes of entry of secondary microplastics are based on the release of plastic products. This includes on the one hand used plastic products (household and packaging waste) that are released into the environment in an uncontrollable fashion and thus find their way directly, or via wind, rain and surface waters into inland waters and oceans. On the other hand, there are plastic products that are intentionally released (garbage dumping, fishing nets, cultivation foils from agricultural land, fertilizers) which then decompose when exposed to the respective prevailing physical and chemical conditions.

Multifarious factors can influence the degradation of plastics into fragments; the duration of the degradation processes can currently only be estimated with great degree of uncertainty<sup>(5)</sup>.

- **Are microplastics also specifically produced and used?**

One source of primary microplastics (type A), which is less significant in terms of quantity, includes the deliberately produced and purposefully used microparticles, which are mainly released via industrial and domestic wastewater. Such polymer-based (PE/PU/PP) microparticles can be used as fillers and binding agents in detergents, personal care products and cosmetics, e.g. scouring lotions, toothpastes and peelings. They are added with the purpose of increasing the action of such products by mechanical effects. They can make up as much as up to 10 percent of the product<sup>(4)</sup>. Cosmetics and detergent producers increasingly disclaim using polymer-based microparticles. Primary microparticles are also used as blast-cleaning abrasives for surface treatment.

- **What is known about the environmental effects of microplastics?**

It has only been in the last few years that the environmental relevance of microplastics has been moved into the scientific spotlight although the practice of marine littering in particular has been going on for decades. It is known that plastic fragments floating in the oceans degrade over time into smaller and smaller particles. Marine animals may confuse these particles (regardless of their size) with food and ingest them. Animals may be directly injured by the

ingestion of these plastic parts or may even starve. Another possibility is enrichment along the marine food chain.

The possible consequences for the environment are currently the subject of several extensive national and international research projects<sup>(6)</sup>.

Although comprehensive research results and comparable studies are still not available, the Federal Government is taking a precautionary approach to the environmental impact of microplastics. Within the past two years, 30 research projects on microplastics in the environment and possible mitigation measures have started in Germany, supported by the Federal Government<sup>(3)(6)</sup>.

However, because of a lack of data, it is not possible to conclusively answer many questions related to the pollution of German waters, the environmental toxicity of microplastics and the effects on humans, animals and plants.

- **Can microplastics be introduced into the food chain and drinking water?**

Microparticles are ubiquitous; for example, they can be found as dust or soot particles in the atmosphere as well as in rainwater. Any mechanical strain on materials results in abrasion and the release of microparticles. It is in particular the ubiquitous polymer materials that contribute to the spreading of microparticles because of the inevitable abrasion and release of fibres and dust when used. Therefore, microparticles belong to the human environment because their presence in the breathable air, on agricultural products, in food and even in potable water cannot be prevented.

Basically, microplastics can be introduced into food as well as food raw materials via the air, soil, sea water, fresh water and ground water. Furthermore, abrasion from technical equipment or the packaging materials used is also inevitable. The Federal Institute for Risk Assessment (BfR) has no reliable findings available on relevant routes of entry, presence, composition, particle size and the amount of microplastic particles in food<sup>(4)</sup>.

In 2013/2014, reports were published on the detection of microplastics in honey, beer and mineral water. Today it is known that these examination results included fragments and fibres from the immediate environment of the samples; thus these were real measuring errors. It is therefore not possible to draw any conclusions about the contents in food from these reports<sup>(4)</sup>.

The results published at the end of 2017 by the Chemisches und Veterinäruntersuchungsamt Münsterland-Emscher-Lippe (CVUA Münster) according to which low concentrations of microplastic particles were detected in mineral water from different packaging systems (returnable and disposable plastic bottles, cartons and glass bottles) have to be further verified. Up to now, the material composition has not been examined; the source of the respective microplastics as well as the question of whether they are environmental influences is not clear. The fact is that these results are way below the limiting values for the legally approved and scientifically assessed migration of plastics into food (see also the reply to the question, "How many microplastic particles were detected in food or drinking water?").

According to the experts, it can be excluded that specifically released microplastic particles (type A) from cosmetics and detergents can enter groundwater via wastewater, water bodies and oceans and are transferred from there via drinking water into food during processing and the human food chain.

- **Is the intake of microplastics via fish and fish production possible?**

The BfR assessed publications on the presence of microplastic particles in fish, mussels and crustaceans. Depending on their origin, filamentous plastic particles were detected in blue mussels from different coastal regions and in mussels from retail.

The risk of an intake of microplastics via the consumption of fish which contain a low amount of particles in their intestine is considered to be low because the gastrointestinal tract of fish is usually not eaten, except for some small fish varieties. Several international research groups are currently working on the issue of whether microplastics can migrate into the muscle tissues of fish. Up to now, however, no microplastics have been found in the muscle tissues of fish which is eaten.

- **How many microplastic particles were detected in food or drinking water?**

Individual research projects, e.g. on the presence of microplastics in fish, mussels, sea salt, drinking water and mineral water, reported very low levels of microplastics, especially if the number of particles found is related to the usual level of consumption of such foods.

Since microparticles are present everywhere and are unavoidable in the environment or in the air, such findings give no indication of special exposure to the consumer.

Results on microplastic particles found in food for the most part need an objective assessment, both in terms of the applicable legal regulations as well as in terms of the absolute concentration and realistic consumption habits.

Examples in figures: In mussels between two and six microparticles (as fibres) were found in 10 gram mussel meat<sup>(4)</sup>. A 2017 publication on mineral water results described the number of particles detected as being between 5 and approximately 200 per litre of water<sup>(2)</sup>. This would sum up to 0.06 microgram polymers per litre at the most. According to the European Regulation (EU) No 10/2011 on plastic materials and articles intended to come into contact with food, the transfer of substances of up to 60 milligram per kilogram is tolerable - this is a thousand times the amount.

- **Which measuring methods are available for microplastics?**

Currently there is no uniform definition for microplastics available and thus there is no validated method, which means there is generally no recognized and tested method for the identification and quantification of microplastics. The large variety of polymers makes the qualitative and in particular the quantitative analyses of microplastics difficult. Different analytical approaches for the detection and quantification of microplastics are currently under development.

For food producers, there currently is no reason to test the products for microparticles within their due diligence nor are there appropriate analytical-technical possibilities available. The method published by the CVUA Münster is specifically aimed at basic research and is exclusively applied for research. It is not available for routine food tests in official or private laboratories.

- **What are the health concerns and related scientific assessments?**

There is currently no known detrimental effect on human health, which can clearly be traced to the intake of microplastics by humans through the consumption of plants or animals from inland and marine waters<sup>(2)</sup>.

Regarding the issue of possible health hazards, the European Food Safety Authority (EFSA) in 2016<sup>(1)</sup> commented on this subject and arrived at the conclusion that a reliable risk assessment is not yet possible because of the insufficient data situation and lack of analytical procedures. It was recommended that research be continued into the toxicity of orally ingested microplastic particles and the related effects on human health.

In order to be able to assess the actual risk of microplastics in the food chain, more reliable data is needed. The BfR has initiated several studies on this subject and is currently performing studies on the intake of microplastic particles via the intestine, and possible health effects; these include amongst others, animal studies with different fluorescent-labelled microplastic particles. The results are not yet publicly available. According to the BfR, the data obtained so far does not indicate any adverse effects of the plastic particles used in the mouse model. Moreover, in-vivo studies using model systems of human gastrointestinal barriers show that the bioavailability of orally ingested microplastic particles is infinitesimally small<sup>(2)</sup>.

- **What measures are planned for the control of microplastics?**

Public and political awareness of the relevance of microplastics in the global environment is high, resulting in a pooling of research efforts. Eventually, effective strategies will only be found at a European or international level. According to the recommendations from the study of the Fraunhofer Institute UMSICHT, research activities should not solely focus on the pollution of the oceans, but rather take the different environmental settings into consideration. Measures aimed at the most important sources, which include traffic, construction and infrastructure<sup>(5)</sup>, shall have priority here.

The Federal Government initially supported research projects that aimed at reducing plastic waste in the oceans in order to prevent the formation of microplastics. The food industry is involved in and contributes to measures in the field of food packagings, e.g. by deposit systems, recycling or promotion of reusable packagings.

Nevertheless, the supply chain believes that plastics and plastic products are essential for the production, processing and marketing of food and that suitable packagings continue to have their role in a safe, hygienically acceptable and quality-preserving way for food in the future.

- **Why is legal regulation not appropriate at present?**

The findings of EFSA and BfR to date show that the topic requires more research. The premise for a scientific evaluation includes more analyses focussing on the presence, composition and sources of microparticles as well as a reliable exposure assessment. Without such an assessment there are no reliable starting points on which a regulation could be based. Moreover, as already explained, there are no validated methods available as of today that could be used for the reliable and feasible detection of the presence of microplastics. On this basis, even when referring to the precautionary principle, the legislator cannot take meaningful action.

Dr. S. Stähle, 10/2018

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Sources and current documents:

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- 2) Deutscher Bundestag, Drucksache 19/2451 vom 4.6.2018: Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten der Fraktion BÜNDNIS 90/DIE GRÜNEN: „Mikroplastik – Gefahr für Umwelt und Gesundheit“
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- 4) Bundesinstitut für Risikobewertung: „Mikroplastik in Lebensmitteln“, Stellungnahme Nr. 013/2015 des BfR vom 30. April 2015
- 5) Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik UMSICHT (Juni 2018) „Kunststoffe in der Umwelt: Mikro- und Makroplastik – Ursachen, Mengen, Umweltschicksale, Wirkungen, Lösungsansätze, Empfehlungen“ Kurzfassung der Konsortialstudie
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