GERMAN FEDERAL INSTITUTE FOR RISK ASSESSMENT

BfR
Bundesinstitut für Risikobewertung

Microplastics

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Outline

I) Topics and Activities on Microplastics: BfR & other German Regulatory Bodies/Authorities

- Regulatory framework
- Risk Assessment
- Research Activities

II) New Challenge: Nanoplastics

III) Conclusions

Microplastics: Statements, Documents, Fora (selected)

2015: UBA report “Sources of microplastics relevant to marine protection in Germany”

2015: BfR Statements 013/2015 about „Microplastics in Food“

2016: EFSA-Statement about „Microplastics and nanoplastics in food, with particular focus on seafood“

2017: BMBF launches large research programme on plastics in the environment

2019: New BfR FAQs about Microplastics „Facts, research and open questions“

2019: ECHA draft restriction on Microplastics under public consultation

2019: 2 BfR fora on Microplastics

22.01.2019: Event during „International Green Week“

06.- 07.06.2019: 18th BfR Forum Consumer Protection „Microplastics“


www.bfr.bund.de

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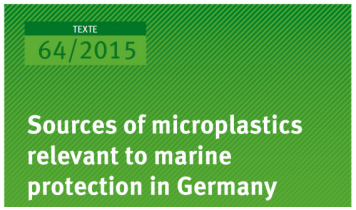
Microplastic Particles in Food

BfR Opinion No. 013/2015 of 30 April 2015


TEXTE 64/2015

Sources of microplastics relevant to marine protection in Germany


STATEMENT

EFSA Journal

ADOPTED: 11 May 2016

doi: 10.2903/j.efsa.2016.4501

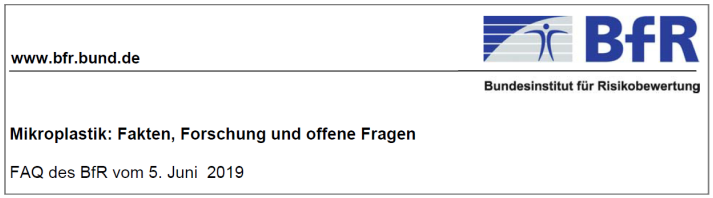
Presence of microplastics and nanoplastics in food, with particular focus on seafood

EFSA Panel on Contaminants in the Food Chain (CONTAM)


Eine Initiative des Bundesministeriums für Bildung und Forschung

Plastik in der Umwelt

Quellen • Senken • Lösungsansätze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Mikroplastik: Fakten, Forschung und offene Fragen

FAQ des BfR vom 5. Juni 2019

Microplastics: Human Health or Environmental Risks?

Material Characteristics	+	Hazard Potential? Human and Environment	+	Exposure?
➢ **Different material types** - Different polymers: PE, PP, PVC etc. - In addition: tire abrasion textile fibers ➢ **Different sizes & size ranges** ➢ **Different shapes & morphologies** (incl. solid vs. gel state)		➢ **Particle effects?** - Possible, but not a high concern ➢ **Particles as carriers?** - Leaching of monomers, oligomers - Leaching of additives - Co-exposure with environmental chemicals (“Carrier Hypothesis”) - Possible, but also not a high concern		➢ **External Dose** - Different sources for exposure ➢ **Exposure routes** - Oral: most important - Inhalation: also relevant ➢ **Internal dose** - Uptake (size dependent, low) - Systemic distribution

BAM PTB Umwelt Bundesamt BfR Bundesinstitut für Risikobewertung MRI Max Rubner-Institut BAM BfR Bundesinstitut für Risikobewertung

Microplastics in Food: Comparison of Intake

- **Example: Bottled water with microplastics (mineral water)**

	returnable-PET	one-way-PET	returnable-glass
Number of particles (Schymanski et al., 2018)	118	14	50
Estimated concentration (Welle & Franz, 2018)	**7.3 µg/L**	**1.8 µg/L**	**8.7 µg/L**

- **Example: Contamination of food via microplastics in house dust**

Study	Seifert et al., 2000	Dris et al., 2017	Catarino et al., 2018
Applied data and assumptions	• 10.9 mg dust/day/m² • ca. 33% plastics in dust • meal taken from plate with surface area = 491 cm² (∅ = 25 cm) • 3 meals + 1x cooking, 20 min each	• 1600-11000 particles/day/m² • minimum particle: ∅ 10 µm, length 200 µm, density 1 • 3 meals + 1x cooking, 20 min each	• 114 particles/20 min/plate (491 cm²) • minimum particle: ∅ 10 µm, length 200 µm, density 1 • 3 meals + 1x cooking, 20 min each
Plastics uptake/day	**9,8 µg**	**23 – 155 µg**	**7162 µg**

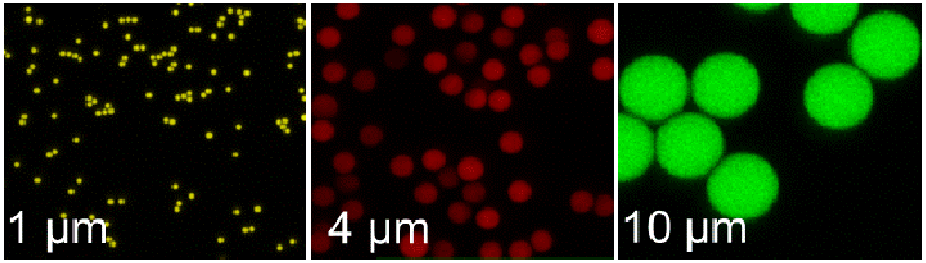
Direct possible intake via house dust (approx. 10-7000 µg/day) is probably significantly higher than the intake related to food processing (3- 16 µg/day from bottled water) and food.

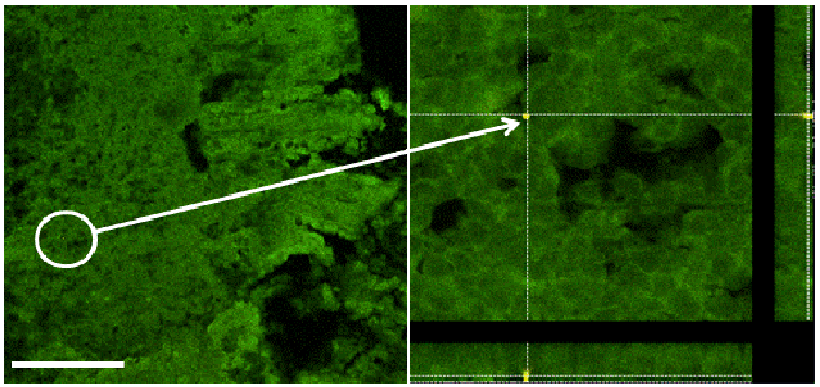
Microplastics: Uptake *in vivo*

in vivo mouse study

- **Very low oral bioavailability**
- Confocal microscopy to determine the organ burden -> very few single particles in GI tract
- Measurements of oxidative stress ->
  no elevated ROS-level measurable

- 28-day-oral diet study (HOTT-Reporter mice for oxidative stress)
- 3 different polystyrene particles





Particle translocation via GI tract is strictly size dependent. Micro-sized particles translocate in very low amounts only (<1%). Particle mediated effects (in particular ox. stress) could not be detected.

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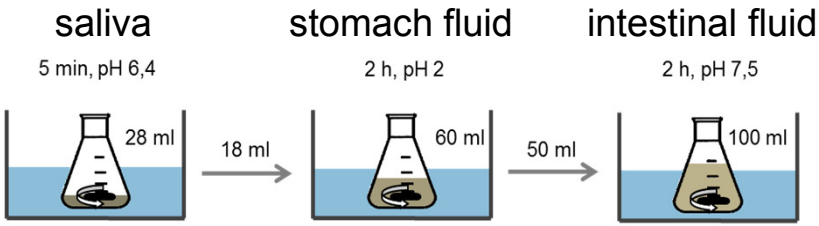
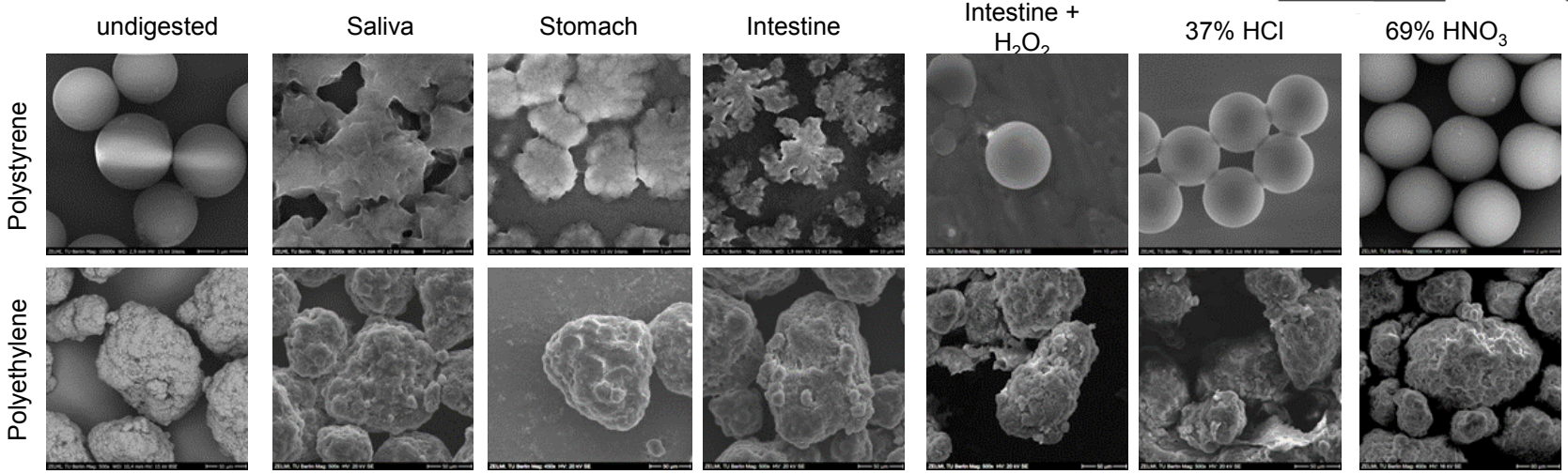
Microplastics: Fate in the Digestive Tract

- Artificial digestion of microplastics with the use of artificial fluids (Saliva, stomach fluid, intestinal fluid)





- Structural changes because of the adsorption of organic matrix
- After chemical digestion, particles remained unaffected

PhD-Projekt Valerie Stock

Conditions in human GI tract are not sufficient to digest microplastic particles.

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Microplastics as vehicles („Carrier Hypothesis“)

Monomers, Oligomers

- Different polymers (PE, PP, PVC ...)
- **Polymers are biologically inert** but may release monomers & oligomers in trace amounts (some with known hazards)

- not a high concern

Plastic Additives

- **Plenty of additives included** (for different reasons)
- ECHA listed more than 400 additives
- Some with known hazards
- Max. up to 4% (w/w)

- not a high concern

Environmental Chemicals

- **Particles as vehicles for POPs (**PCB & PAHs)?
- Available ecotoxicity studies show lower bioavailability & lower toxicity **(microplastic as “sink”?)**

But: - no human relevant data
- only few material types studied

Transfer of POPs via microplastics seems neglectable compared to other sources.
- not a high concern

Modelling:
Only approx. 0.1% of all POPs estimated to be bound to microplastics (Gouin et al. 2011 Environ Sci Technol)

Microplastics: Research Activities at BfR

	BfR Junior Research Group Department Food Safety	**BfR Department Chemical and Product Safety**	**InnoMatLife**
Funding	BfR internal	BfR internal	BMBF (01.04.2019- 31.03.2022)
Topics	• Oral bioavailability of micro- and nanoplastics • Influence of digestion fluids • Uptake into intestinal cells • Transport through the intestinal barrier • Effects on intestinal- and liver cells • Mechanisms of action	• Material characterization • Visualization • Quantification	• Adsorption/ absorption & desorption of POPs (PCB, PAHs, heavy metals) to different polymers • Systematic investigation of “Carrier Hypothesis” (human relevant models) • Development of grouping/ categorization and read-across approaches http://www.innomatlife.de/

Nanoplastics: Same Questions- New Challenges

Material Characteristics	+	Hazard Potential? Human and Environment	+	Exposure?
➢ Methods available for microplastics - Detection - Quantification - Chemical Identification - … However: Harmonization & standardization needed ➢ Methods for nanoplastics much more challenging. Still under development.		➢ **Much less studies for nanoplastics** - Only very few materials studied (PS). - Mostly *in vitro* data.		➢ **External Dose** - Sources unclear (no data) - Also no estimations/ models ➢ **Exposure routes** - Oral: most important ➢ **Internal Dose** - Uptake (size dependent) - Systemic distribution

Little knowledge, little data on nanoplastics.
There is an urgent need to develop reliable methods in particular for the quantification and determination of nanoplastics in different media.

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Conclusions

- EU plastics directive (2019/904) in force since 2019-06-05
- An restriction proposal (under REACH) on intentionally added microplastics is currently under public consultation
- In general, the restriction proposal is supported by the German Authorities/Institutions acting in this field, a joint position how to best tackle the microplastics problem has not been concluded on.
- Germany also endorses measures to generate incentives for industry to reduce plastics
  - such as reduction of plastics usage in general
  - an increase in recyclable products
  - (refer to EU Circular Economy Action Plan or EU plastic waste management)
  - (refer to German Federal Council Resolution 2019)
- Germany strongly supports research activities to e.g. develop analytical methods for detection and quantification of micro-/nanoplastics, to increase knowledge on toxicity, to generate reliable data for assessments and to develop alternative products – there are activities from different German Federal Ministries (e.g. BMBF funds a large research programme) and Competent Authorities (e.g. ongoing research at BAM, BfR)

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Thank you for your attention

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