UPSTREAM
There's a better way than throw-away

The Human Health Threats of Micro-Plastics

Micro-plastics are in our Drinking Water, Food, Air and Consumer Products

We drink micro-plastics.

They contaminate tap water around the world.

- 81% of tap water samples tested from around the world contained micro-plastic particles with an average of 5.45 particles per liter.
- Most of the particles were micro-fibers.[1]

Bottled water is even more contaminated.

- 93% of bottled water samples from 19 locations world-wide across 11 leading brands contained micro-plastic, with an average of 10.4 plastic particles per liter.
- Most of the particles were fragments of consumer products.[2]
- Plastic bottles and beverage cartons may be a source of plastic particles into the bottled water.[3]

We eat micro-plastics.

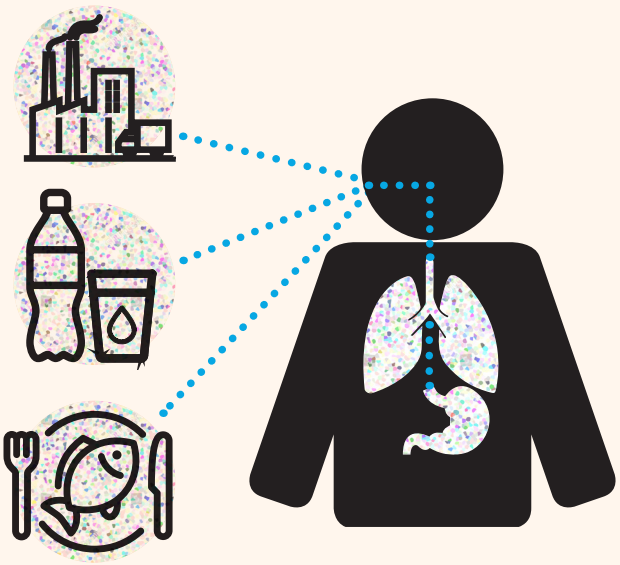
They have been found in honey and sugar.[4]

Micro-plastics contaminate seafood.[5]

- They are directly ingested by humans during the consumption of mussels and other bivalves.[6]
- Micro-plastics have been found in the gut of wild-caught and commercially sold fish (28% of fish sampled from Indonesian supermarkets and 25% of fish sampled from California grocery stores).[7]

We inhale micro plastics.

- Sources of airborne plastics include agricultural films that have degraded,[8] fibers released from clothes dryers,[9] and the release of plastics from marine ecosystems (mostly packaging materials) during formation of sea salt aerosol (i.e. release caused by wave action).[10]
- Tires have recently been acknowledged as a source of micro-plastics in the air.
- Air in urban areas tends to be more heavily contaminated.[11]



Humans are exposed to micro-plastics through the air, water, and food chain.

Micro-plastics are in our bodies.

- We know that people ingest micro-plastics because new research has found micro-plastic particles in human stool.[12]
- Micro-plastics from prosthetics have been shown to enter the Gastrointestinal Tract (GIT) and pulmonary system and can cross the respiratory or GIT epithelium and cause inflammation.

Most plastics produced today are used to make packaging.

- As a result of the global shift from reusable to single-use containers, plastic packaging comprises 42% of all plastic produced.[13]

What happens when micro- and nano- plastics enter the human body?

Micro-plastics can:

- translocate across the gut and enter the circulatory system,[14]
- accumulate in the major organs, and
- travel through the lymph system ending up in the liver and spleen.[15]

Inhaled micro-plastics, depending on size and shape, can:

- travel through the respiratory system,
- become lodged in the lungs, and
- possibly translocate to other parts of the body.[16]

More research is needed to determine what impacts micro- and nano- plastics have on humans once they enter the body. However, based on a growing body of evidence demonstrating adverse impacts on the health of marine organisms due to micro-plastic exposure, scientists have raised concern that micro-plastic exposure can:

- inflammation (linked to cancer, heart disease, inflammatory bowel disease, rheumatoid arthritis, and more),
- genotoxicity (damage that causes mutations that can lead to cancer),
- chronic diseases (such as atherosclerosis, cancer, diabetes, cardiovascular diseases), and
- autoimmune diseases.[17]

A major challenge for science and policy makers alike is that when illnesses arise, such as cancer, diabetes, and cardiovascular disease, they cannot be traced specifically to plastics. Such illnesses can be caused by many things.

Despite the lack of causal links to specific illnesses, the science shows that there is reason to be concerned. Although more research is needed, there is clear potential for risk to human health.

NOTES

1 Mary Kosuth, Sherri A. Mason & Elizabeth V. Wattenberg, Anthropogenic contamination of tap water, beer, and sea salt, 13(4) PLoS ONE e0194970 (2018), https://doi.org/10.1371/ journal.pone.0194970.

2 Sherri A. Mason, Victoria G. Welch & Joseph Neratko, Synthetic Polymer Contamination in Bottled Water, 6 Frontiers in Chemistry 407 (2018), https://orbmedia.org/sites/default/ files/FinalBottledWaterReport.pdf.

3 Darena Schymanski et al., Analysis of microplastics in water by micro-Raman spectroscopy: Release of plastic particles from different packaging into mineral water, 129 Water Res. 154, 154-62 (2018), https://www. sciencedirect.com/science/article/abs/pii/ S0043135417309272.

4 G. Liebezeit, E. Liebezeit (2013) Non-pollen Particulates in Honey and Sugar, 30(12) Food Additives and Contaminants Part A: Chemistry, Analysis, Control, Exposure & Risk Assessment 2136, 2136-40-- https:// www.ncbi.nlm.nih.gov/pubmed/24160778

5 M. Smith, D. C. Love, C.M. Rochman, and R. A. Neff, Microplastics in Seafood and the Implications for Human Health (2018) Curr Environ Health Rep.,5(3): 375–386.

6 L. Van Cauwenberghe,, C.R. Janssen (2014) Microplastics in bivalves cultured for human consumption, Environ Pollut. 193():65-70.

7 C.M. Rochman, T. A, Williams SL, Baxa DV, L. R., JT Miller, F.C Teh, S. Werorilangi (2015) Anthropogenic debris in seafood: Plastic debris and fibers from textiles in fish and bivalves sold for human consumption, Sci Rep.; 5:14340.

8 Kasirajan, S., Ngouajio, M., Polyethylene and biodegradable mulches for agricultural applications: a review. Agron. Sust. Dev. 2012, 32 (2)501-529.

9 Wright, S.L., Kelly, F.J., Plastic and Human Health: A Micro Issue? Environ. Sci. & Technol. 2017, 51(12)6634-6647.

10 Athanasopoulou, E., Tombrou, M., Pandis, S. N., Russell, A.G., The role of sea-salt emissions and heterogeneous chemistry in the air quality of polluted coastal areas, Atmos. Chem. Phys. 2008, 8:5755-5769.

11 Dris, R., Gasperi, J. Rocher, V., Saad, M. Renault, N., Tassin, B., Synthetic fibers in atmospheric fallout: a source of micoplastics in the environment? Mar. Pollut. Bull. 2016, 104 (1-2), 290-293.

12 Philipp Schwabl et al., Assessment of microplastic concentrations in human stool – Preliminary Results of A Prospective Study, 6 United Eur. Gastroenterology J. Supplement 1 (2019) (presented at UEG Week 2018), https://www.ueg.eu/education/document/assessmentof-microplastic-concentrations-in-human-stoolpreliminary-results-of-a-prospectivestudy/180360

13 Geyer, R., Jambeck, J.R., Law, K.R., Production, Use and Fate of All Plastics Ever Made, Sci. Adv. 2017 3:e1700782, p.1.

14 G.M. Hodges et al., Uptake and translocation of microparticles in small intestine: Morphology and quantification of particle distribution, 40(5) Digestive Diseases & Sci. 967, 967-75 (1995), https://www.ncbi.nlm.nih.gov/ pubmed/7729286; see also Anne des Rieux et al., Transport of nanoparticles across an in vitro model of the human intestinal follicle associated epithelium, 25(4-5) Eur. J. of Pharmaceutical Sci. 455, 455−65 (2005), https://www.ncbi.nlm. nih.gov/pubmed/15946828

15 C. Silvestre, D. Duraccio, S. Cimmino(2011) Food packaging based on polymer nanomaterials, 36(12) Progress in Polymer Sci. 1766, 1766-82 - https://www.sciencedirect.com/science/article/pii/ S0079670011000311

16 Sinja Rist et al., A critical perspective on early communications concerning human health aspects of microplastics, 626 Sci. of The Total Env't 720, 720-26 (2018), https://www.ncbi. nlm.nih.gov/pubmed/29396337.

17 Stephanie L. Wright & Frank J. Kelly, Plastic and Human Health: A Micro Issue?, 51(12) Envtl. Sci. & Tech. 6634, 6634-47 (2017)

UPSTREAM
There's a better way than throw-away
www.upstreamsolutions.org