Tackling the growing issue of Microplastic Pollution: a global scientific effort

Despite growing public and scientific attention, the true risk of microplastics to the environment and human health remains unclear. Earlier in 2019, the World Health Organization (WHO) issued a report calling for more scientific research into microplastics, which will be the first step in addressing this complex issue.

Standardization in microplastics testing methods will pave the way for concrete regulatory actions to follow. **As awareness builds from consumers, organizations and scientists all over the world, so does the pressure to act now.**

> "The lack of standard methods for sampling and analyzing microplastics in the environment means that comparisons across studies are difficult… To better assess human health risks and inform management actions, a number of research gaps need to be filled."
>
> **The World Health Organization, 2019.[1]**

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Key facts

What are microplastics?

- Microplastics are any synthetic solid particle or polymeric matrix of plastic origin, with regular or irregular shape and with size ranging from 1 µm to 5 mm, of either primary or secondary manufacturing origin, which are insoluble in water.[2]

Classification:

- Generally, microplastics can be classified into two key groups:[3,4]

- **Primary microplastics** are plastics purposefully manufactured for specific applications including pellets for industrial production and microbeads for cosmetics and personal care products (e.g. shower gel, toothpaste)

- **Secondary microplastics** are plastics produced indirectly from degradation of larger plastic waste or debris both at sea or on land, which can result from mismanaged waste, photo-degradation or other weathering processes (e.g. paints, abrasion of tires through driving, textiles and clothing)

Scale of the problem:

- Demand for global production of plastics remains high – **322 million tons of plastics produced every year** – a number that is expected to double over the next 20 years.[1]
- Potential risks of microplastics:

Microplastics are ubiquitous; their presence in the ocean and freshwater, drinking water, food, the air and animals means they are inevitably ingested and transferred to humans via contaminated food, water or inhalation[1,5], with **the average person consuming up to 52,000 microplastic particles a year.**[6]

These particles have shown to **cause physical harm to the environment and animals**, including inducing inflammation and stress.[7]

Furthermore, microplastics have the ability to sorb organic and inorganic contaminants which can then **bioaccumulate** in humans and wildlife if ingested.[8]

Although, the available evidence suggests human health risks associated with ingesting microplastics is minimal[1], **there are significant knowledge gaps** including toxicological data of commonly ingested particles and the distribution and absorption of plastic particles within the tissues and organs of the human body.[9]

The WHO report states that: "there is insufficient information to draw firm conclusions on the toxicity of nanoparticles, no reliable information suggests it is a concern"[1], identifying **a call for further scientific research on microplastics**.

The impact

- **With the quantity of microplastics in the environment set to increase in the future**, it is crucial to urgently put efforts toward an ecotoxicological risk assessment of microplastics using clear, scientific methods to obtain a clear idea of the threat they may pose to humans – the recent call for further assessment of the impact of microplastics through scientific research by the WHO confirms this. But until rigorous scientific methods to measure microplastics are in place, we cannot fully assess the true impact.

What is being done?

- Agilent Technologies is committed to combatting the global issue of plastic pollution and is at the forefront of research in this area.
- Through collaborations with key organizations and opinion leaders across the globe, Agilent continue to create innovative tools and technologies to help better characterize microplastics, and their impact on our environment and health.
- There are currently two widely accepted analytical pathways to characterize microplastics that provide complementary yet differing information, which are being developed for standardization; both of which Agilent are well-positioned in:

Spectroscopy techniques

- Agilent's innovative approach to developing new solutions for microplastics testing has earned them multiple awards, notably for the **8700 Laser Direct Infrared (LDIR) Chemical Imaging System**, a chemical imaging tool that provides "rapid processing" and analysis of samples, including microplastics.[10]
- Through the company's expertise in infrared imaging, Agilent has also developed highly sensitive **Fourier transform infrared (FTIR) scanners** that are used for mobile and on-site characterization of microplastics in experimental studies.[11]

Gas chromatography combined with mass spectrometry

- Agilent is also a leader in the development of gas chromatography-based instruments, which can be used in the field of microplastics testing. **Thermal extraction desorption gas chromatography-mass spectrometry (TED-GC-MS)** is a new and fast method for the identification and quantification of microplastics in environmental samples without requiring sample preparation.[12]

Both techniques provides specific important information about a sample. For example, Gas chromatography combined with mass spectrometry can provide information about the concentration of microplastics, whereas infrared spectroscopy can provide complementary information regarding things like the number of particles, size, shape and surface area. Generating both sets of information are important to generate a robust picture about the sample being tested.

With this broader knowledge, the global community can develop new approaches and take the first step to ensure a safer and cleaner world.

1. WHO, 2019. https://apps.who.int/iris/bitstream/handle/10665/326499/9789241516198-eng.pdf?ua=1 2. Frias and Nash. Mar Pollut Bull, 2019, 138:145–147 3. https://portals.iucn.org/library/sites/library/files/documents/2017-002.pdf 4. http://www.gesamp.org/site/assets/files/1720/24472_gesamp_leaflet_pq.pdf 5. Smith et al., Curr Environ Health Rep, 2018, 5(3):375–386 6. Cox et al., Environ Int, 2019, 53(12):7068–7074 7. Barboza et al., Mar Pollut Bull, 2018 133 336–348 8. Endo and Koelmans. Haz Chems Assc with Ptcs in Mar Env, 2019. 9. http://www.fao.org/in-action/globefish/fishery-information/resource-detail/en/c/1046435/ 10. https://blog.agilent.com/2019/01/22/agilent-spectroscopy-product-is-named-a-top-innovation/ 11. https://www.agilent.com/cs/library/applications/5991-8271EN_microplastics_ftir_application.pdf 12. https://www.laboratory-journal.com/science/chemistry-physics/polymer-analysis-and-microplastics-environment

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