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]

INTERNATIONAL

- **International organizations** provide non-legally binding recommendations about microplastics that are likely to influence the development of national approaches and regulations in the future.
- In 2019, the **WHO published a report** assessing the impact of microplastics to the environment and human health, concluding that there are significant knowledge gaps and an urgent need for further research.
- The **United Nations (UN) 2030 Agenda for Sustainable Development** includes the Sustainable Development Goal (SDG) target 14.1 aimed at preventing and significantly reducing marine pollution of all kinds.
- The **G20 Implementation Framework for Actions on Marine Plastic Litter** aims to tackle the issue of marine plastic litter and microplastics on a global scale.
- Early this year, ministers from the G7 countries and the EU convened a **Microplastics Meeting** to build a shared understanding of the science available to support policy making in addressing the challenge of microplastics pollution. Members noted the **lack of standardized methodologies**.
- In 2016, the **World Economic Forum** issued a report calling for a rethink of our current plastic economy in order to reduce pollution.

CANADA

- Canada's vision is a future without plastic waste.
- In 2012, Canada established the **Wastewater Systems Effluent Regulations** that set **mandatory minimum standards** for secondary wastewater treatment; untreated and under-treated wastewater can no longer be discharged on fresh or marine water environment.
- In 2016, **microbeads were listed as a "toxic substance"** and under the Canadian Environmental Protection Act, personal care products containing **microbeads were prohibited** by the federal Government of Canada.
- Furthermore, both binding and non-binding measures that target plastic pollution have been implemented at provincial, territorial and municipal levels.

UNITED STATES

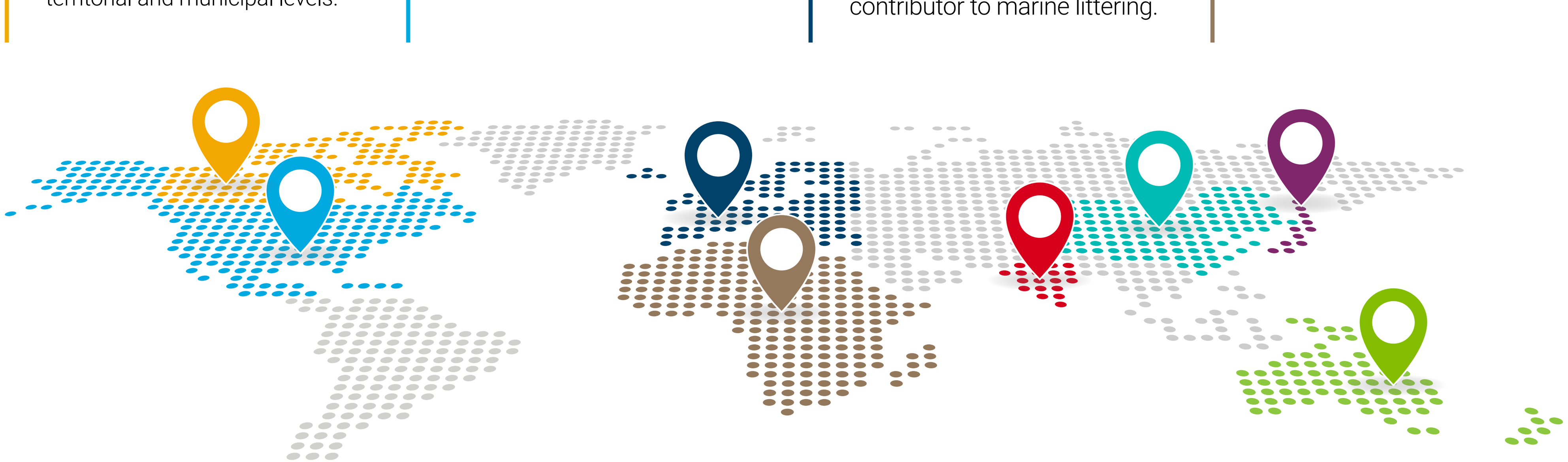
- The US federal government **Microbead-Free Waters Act** of 2015 prohibits the formulation and distribution of rinse-off cosmetics (toothpaste included) that intentionally contain plastic microbeads.
- Several states have passed legislation on microplastics. In 2014, Illinois was the first state to **ban synthetic plastic microbeads**. Subsequently, California passed legislation **banning microbeads** made from any kind of plastic, but only for "rinse-off" products (excluding deodorants, makeup and cleaners).

EUROPE

- **Several EU Member States** (e.g. Sweden, France, the United Kingdom & Ireland) have banned or will soon **ban the use of primary microplastics** in personal care products. Others like Germany have taken a more conservative approach and concluded that microplastics from cosmetic products only play a minor role in the environmental pollution from plastic and are emphasizing the need for **global action to tackle microplastic pollution**.
- Countries with important **fisheries and aquaculture sectors** (Iceland, Norway) are exploring options to tackle the problem of the **disposal of fishing gear waste**, a key contributor to marine littering.

AFRICA

- In most African countries, **microplastic pollution** is not considered an emergent issue of concern, as such, proper management of solid waste is often lacking.
- Plastic pollution is taken more seriously and many African countries have introduced **bans on the use of plastic bags**.



INDIA

- **Plastic pollution** is being fought at numerous levels: by state governments, NGOs and individuals.
- Although several states have taken strict measures to regulate the use of plastic, India still struggles to manage its huge plastic waste.
- Regulations for the use of **microbeads in consumer goods** are still under development.

CHINA

- As one of the world's **largest sources of marine plastics**, China participated in the December **2017 UN Environment Assembly** that sets a non-binding target to **prevent and reduce** any kind of marine pollution by 2025.
- In January 2018, the **National Development and Reform Commission (NDRC)** took significant steps to reduce plastic pollution.
- On January 1 2018, China also **restricted the importation** of recyclable material, including the **introduction of a ban** on the importation of 24 kinds of solid materials.

JAPAN

- Along with the United States, Japan did not sign the **"Ocean Plastic Charter"** that was endorsed by the G7 members and the European Union at the **G7 summit in Canada** in June 2018 as the country first wants to carefully assess the impact of tight regulations on plastic products on people's daily lives and its industries.

AUSTRALASIA

- In June 2018, New Zealand passed **legislation banning the use of microbeads** in a range of personal care products – Australasia is speculated to follow.

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