WHITE PAPER

Growing Concerns Over Microplastics in Water

The Trouble with Microbeads

Background

"One word, plastics." That famous line from the 1967 Academy Award-winning film *The Graduate* has proven to be prophetic. Today, the globe is choking on the stuff…literally. Scientists estimate that nearly 270,000 metric tons of plastic are now dispersed throughout the world's oceans. They even came up with some creative names for these gyres, from ocean "convergence zones" to oceanic "garbage patches."[1]

Whatever we call them the point is the same. In less than 50 years, there is hardly a waterway, river, pond or life form on the face of the planet free of petrochemical plastics in one form or other. You need not go very far to find evidence of a mounting environmental crisis right in front of us. Just walk around your neighborhood—*any* neighborhood—and you will find the scenery dotted with plastic bottles, plastic bags, and, on closer inspection, tiny plastic particles representing virtually every facet of the plastics' spectrum, including microbeads.

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What are microbeads? Unlike much larger plastic items that litter the globe and ensnare everything from sea turtles and dolphins to otters, and even whales, microbeads are potentially even more lethal. They are tiny bits of polyethylene (PE), polymethyl methacrylate (PMMA), nylon, polyethylene terephthalate (PET), and polypropylene (PP) that are added to creams, soaps, and toothpaste as exfoliants "to produce a 'feel good factor."[2] They are also so small, they easily wash down the drain, work their way largely undisturbed through filtration plants, and pass into waterways and the ocean by the trillions each year. Just how big of a problem do they pose? In the San Francisco Bay area, researchers estimate there are some 471 million microbeads released into the water by wastewater treatment facilities alone every day.[3] Other scientists estimate that eight trillion plastic microbeads enter U.S. waterways on a daily basis.[4]

Mounting Scientific Evidence of a Health Hazard

What does this all mean for us? In addition to endangering hundreds of species of fish, wildlife, and the environment itself, microbeads are entering into our food chain by the trillions. Think about it. We brush our teeth with the things. We rub them into our skin, and we are ingesting these microscopic pieces of plastic in quantities that may shock you. According to the study, scientists found "anthropogenic debris" in about a quarter of the fish for sale in California. If you are a sushi or calamari lover, enjoy that polyethylene special![5]

Worse still, microbeads can attract persistent organic pollutants (POPs) and other toxins that are in seawater and then pass those poisons on up the food chain via plankton or zebra mussels to fish, shrimp, clams, then on to humans. Large doses of polyethylene in rats, for example, are known to cause cancer while oral intake of the world's most common plastic can also cause liver and kidney disease.[6]

Those facts are not lost on the world's health officials and legislators. Following the lead of several states, President Barrack Obama recently signed into law a bipartisan bill banning the sale and distribution of products containing microbeads throughout the U.S. by 2019. Canada is proposing to do the same with an enforcement date of 2018.[7]

Some countries and organizations have been slower to react and instead adopted a non-legislative approach to the issue. EU policy initially followed the findings of a Cosmetic Europe study noting that EU wastewater facilities were removing the majority of microbeads in the wastewater flow and thus they posed only "a minor source of plastic debris to the marine environment."[8] Cosmetics Europe, which represents more than 4,000 personal care product manufacturers, is now recommending that its members discontinue the use of microbeads by 2020. Critics still say that is too long. Others worry that the trade organization is leaving open the door for member companies to use biodegradable plastics.[9]

Addressing a Global Issue

As the call to ban microbeads gains momentum around the globe, one obvious question is what are the best instruments available to trace, identify, and classify microbeads in products, food, and the environment.

When it comes to brand-name products, identifying microbeads can be as simple as knowing what to look for on content labels. As mentioned earlier, the majority of microplastics consist of polyethylene (PE), polymethyl methacrylate (PMMA), nylon, polyethylene terephthalate (PET), and polypropylene (PP). However, microbits of other petroleum-based chemicals, such as bisphenol A (BPA) and Bisphenol S (BPS) used in hard plastics and can liners, also pollute the environment, are mixed in with microbeads, and pose significant health threats.[10] In other instances of products with no or misleading labels the only way to identify the presence and type of microplastics is through analytical testing.

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Ian Robertson is a materials characterization scientist at PerkinElmer. A leading authority on plastics identification, Robertson says that microbeads can constitute about 10% of a product's volume. They are also not biodegradable and identifying each microscopic piece of plastic in our food and water can be challenging.

"Each of the microbead plastics has its own unique signature that requires positive identification," Robertson says, adding that the primary analytical technique for identifying polymers and additives is infrared (IR) spectroscopy. Since introducing the first IR spectrometer in 1944 and the first IR microscope in 1954, PerkinElmer has become the global leader in IR technology. The company offers the most advanced instruments from the Spotlight 400 IR Imaging system to the portable, fast, and easy-to-use Spectrum Two™ IR. Outfitted with ready-made protocols, a materials library, and the unique Spectrum Touch™ software, the Spectrum Two instrument is the ideal choice for synthetic polymer identification in microbeads.

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