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Letter to the Editor

Losing Sight of Science in the Regulatory Push to Ban Microbeads from Consumer Products and Industrial Use

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DEAR SIR:

Here we go again.

Last summer, the state of Illinois was the first to ban tiny plastic microbeads in cosmetics, such as face wash. State legislators claimed the ban was a necessary response to what researchers and environmental groups claim is a serious environmental threat and the US Environmental Protection Agency (USEPA) has labeled as $13 billion annually in damages to marine life. On March 4 of this year, Illinois Congressmen Upton and Pallone introduced House Bill 1321 "to prohibit the sale or distribution of cosmetics containing synthetic plastic microbeads." Similar measures are now pending in 13 states and in the US Congress. New York's Attorney General Schneiderman, supported by Senator Gillibrand and a host of environmental groups, has proposed legislation to ban microbeads in cosmetics citing a need to "restore and protect New York's waters." Similar legislative efforts are underway in the European Union. It is rare when science and politics are on the same page, and this latest example of the rush to regulate is no exception.

In response, environmental groups have rallied to end this new threat—successfully lobbying several major corporations to phase out microbeads from personal care products. Procter & Gamble, Johnson & Johnson, Colgate, Unilever, and L'Oreal are among the companies announcing plans to replace microbeads with natural substances such as ground-up fruit pits, oatmeal, and sea salt.

If only our politicians would rush just as fast to address the larger environmental challenges posed by clothing fibers, antifouling boat paint particles and fibers, nutrient loading from sewage discharges, and a plethora of trace contaminants released daily to our nation's waterways. The current scientific research suggests plastic microbeads pose only a tiny [sic] fraction of humankind's assault on the aquatic environment.

Over the past 5 years, numerous studies reported in news media and the scientific literature have raised concerns about the widespread occurrence of macro- and microplastics in our oceans, the Great Lakes, and on beaches worldwide. The enormous floating trash island found in the Pacific Ocean south of Hawaii is a stark reminder of the potential size of the problem.

Regrettably, the decay of plastic consumer products to microplastics has confused our understanding of the environmental significance of microbeads—synthetic particles used in a wide range of industrial applications and consumer products that are typically too small to see with the naked eye. In the shipping industry, polyethylene microbeads are used as antifriction agents on ship decks. In personal care products, exfoliating microbeads are widely used in skin care products and facial cleansers. Most microbeads are finding their way into streams, lakes, and coastal areas through wastewater treatment plant effluents and combined sewer overflows. Nevertheless, the science being published concerns microplastics, which is a broad term that includes fragments of macroplastics, fibers, and microbeads.

There are legitimate concerns that these tiny plastic particles —barely perceptible without a microscope—are so small that fish and other marine life could easily swallow them, causing DNA damage and even death. A growing number of peer-reviewed, scientific articles report adverse effects to fish and shellfish from exposure to microplastics in laboratory studies and point to evidence indicating that aquatic ecosystems are at grave risk.

In 2014, University of Wisconsin-Superior researchers reported at the national meeting of the American Chemical Society (Anonymous 2013) that there was somewhere between 1500 to 1.7 million microplastic particles per square mile in the Great Lakes. That, in itself, is quite a large and impressive range.

So how do we determine the size of the environmental threat? Environmental sampling typically involves pulling a trawl net along the water surface for long distances and calculating the number of plastic pieces caught in the net per square mile, based on the area traveled by the boat towing the net. However, from an organism exposure context, we need to know the number of particles found per liter or gallon of water to assess exposure. Without knowing the true exposure, we cannot determine risk.

With few exceptions such as the University of Wisconsin-Superior study, researchers report between 1 and 3 microplastic particles per 300 to 700 liters (~80–185 gallons) of water. As a point of reference, consider that similar microsized algae, the preferred food for most small aquatic animals at the base of the food chain, occur at 10 000 to 10 million per liter in the Great Lakes. A study of the water near a major Chicago wastewater treatment plant reported there were approximately 1 billion more algae particles than microplastics in every liter of lake water.

Not surprisingly, University of Michigan researchers seeking to understand the amount of microplastics inside fish from the Great Lakes could not find any microbeads or fragments (MB Duhaime, University of Michigan, personal communication). The stomachs of fish caught from Lake Erie and Lake Huron (where high levels of microplastics were reported) contained no microbeads. Some of these fish (11% to 36% of 5 species), however, had small numbers of wool and synthetic fibers. A survey in the NE Pacific found that approximately 75% of the microplastics sampled were fibers—not microbeads (Desforges et al. 2014). A recent South Korea study (Song et al. 2014)

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found paint particles from ship hulls to be much more prevalent than microplastics (95% of total microparticles), and most particles were less than 200 μm in size, which are rarely being discussed in the microplastics science literature.

The presence of microbeads in the environment and their threat to aquatic life contrasts dramatically with well-known and as yet unresolved threats to water posed by agricultural and urban land use. According to USEPA, more than 50% of the nation's rivers and streams and nearly 75% of lakes suffer from some measure of environmental impairment. The leading causes of water quality impairments identified by USEPA are, in order: pathogens, nutrients, metals, organic enrichment/O_2 depletion, sediments, PCBs, Hg, acidity, temperature, turbidity, and pesticides (USEPA 2015). Among the many more glaring examples of the threat to human health and the environment was the decision by Toledo, Ohio, authorities last year to shut down the city's Lake Erie drinking water intakes due to concerns about toxic harmful algal blooms generated from excessive sewage discharges and fertilizer runoff.

Without doubt, scientific study must continue to better understand and monitor the significance of microbeads released to the aquatic environment. Our current scientific understanding is immature and continues to evolve as new information becomes available from researchers worldwide. There is much more to learn.

However, while scientists develop that knowledge and better understand the true ecological risk ramifications surrounding industrial and consumer uses of microbeads, let us ask our politicians to pay closer attention to the decades-longer challenges posed by more obvious sources of environmental pollution. We know they can act fast when they put their minds to it.

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