A Responsible Approach to Microbeads

Kernels of apricot and almond shells, common salt and even sugar can be used as exfoliants in lieu of microbeads. Products derived from rice and bamboo have also been developed; amorphous synthetic silica microbeads are also effective as exfoliants, opines Dr. S. Sivaram.

On 28th December, 2015, the US President, Barack Obama signed into law a bill phasing out the manufacture of face wash, toothpaste, shampoo and other such personal care products containing plastic microbeads by 1st July, 2017 and the sale of such products by 1st July, 2018 (Microbead-Free Waters Act). The Netherlands, Austria, Luxembourg, Belgium and Sweden will enact similar laws shortly. International Maritime Organization is discussing possible regulatory interventions. Plastic microbeads or microplastics are those tiny, almost invisible materials, hardly talked about in the plastic industry, yet pollute lakes, rivers and oceans and is causing substantial damage to marine flora and fauna[1]. One tube of face wash can contain over 350,000 microbeads. It is estimated that close to five trillion microbeads are spread across all the oceans of the world.

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Need to Know

What are microplastics? Why are they attracting such huge attention from scientists, environmentalists, marine biologists and Governments? Why are they used extensively in personal care products such as shampoo, toothpaste, deo, lipstick and face wash? Are safer alternatives available for this application? Is an ocean clean up strategy feasible? We shall try and address some of these issues.

Microplastics are pieces of polymers of less than 5 mm in diameter. They have been found to be pervasive in lakes, beaches and oceans. Estimates place the quantity in oceans at close to 300,000 tonnes. Experts speculate that this is only a lower estimate, since oceans work like a giant shredder breaking tiny plastics into tinier ones which are then widely dispersed through the world's oceans. Plastics enter waterways not merely as microbeads; they enter in various dimensions, typically, less than 1 mm, between 1 and 5 mm and between 5 and 200 mm. Plastic bottles constitute the majority of the bigger size material. It is now recognised that the 'shredder' action of the ocean currents coupled with sunlight continuously reduces the size of

Table 1: Estimates of Plastics Floating in the Ocean (Billion)

Gyre	< 1 mm	1 - 5 mm	5 - 200 mm	>200mm
North Pacific	688	1160	132	3
North Atlantic	324	532	73	2
South Pacific	176	269	44	1
South Atlantic	106	167	24	0.5
Indian Ocean	455	749	92	2
Mediterranean	85	146	16	0.4

(Source: M. Eriksen et al, PLOS One, December 2014)

plastics; ultimately becoming so small, that they find its way into the stomachs of marine creatures. The world's ocean systems consist of five gyres. A gyre is a place where currents meet and form a whirlpool. They serve the purpose of circulating water around the world. It is in the vortex of these gyres that microplastics accumulate and keep swirling about. The Great Pacific garbage patch with an estimated diameter of 2500 kms has emerged as one of the defining pictures of this century, a testimony to the havoc humans can wreck on our ecosystems[2]. This patch is currently twice the land area of the state of Texas!

Lakes in Midwest North America and European Alps have high concentrations of microplastics, typically 100 particles per square metres[3]. Recent studies have indicated that blue mussels ingested with HDPE microbeads show strong inflammatory response and chemical leachates such as nonylphenols, Triclosan and flame retardant chemicals were found in the guts of marine lugworms[4,5].

In a paper published by Richard C. Thompson and co-workers from the University of Southampton in May 2004, the authors examined 17 beaches around UK and collected samples from estuaries and subtidal sediments. They showed the presence of alkyd, PMMA, nylon, ethylene-propylene rubber, polyethylene, PET, PP and polyvinyl alcohol in these waters. Plankton samples archived from as early as 1960s showed the presence of such materials whose abundance increased over time reflecting the increased usage of these materials[6]. More recently in a study published, a team from the University of Georgia estimated that 100 million tonnes of plastics waste was produced by two billion people living within 50 kms of a coastline. Of this, roughly 5 to 12 million tonnes found its way into the ocean[7]. Thus, the anthropogenic origin of the ocean debris is incontrovertible.

Going Forward

Plastic microbeads have been used in many personal care products as exfoliating agents to remove dead skin and for unblocking skin pores. The most common plastics that has been used are PE, PP and PET. A number of FMCG companies have announced a gradual phase out of microbeads in personal care formulations. What is interesting and ironic is that safer alternatives were always available, yet not seriously considered. Kernels of apricot and almond shells, common salt and even sugar can be used as exfoliants. Products derived from rice and bamboo have also been developed. It has also been announced that amorphous synthetic silica microbeads are effective as exfoliants.

Much discussion has ensued on whether the oceans can be cleaned up and made free of the debris. The mitigation strategies proposed appear expensive and difficult to execute, given the scale of the problem[1]. In a pioneering, not for profit and crowd funded venture founded by a Dutch entrepreneur and environmentalist, Boyan Slat, the first pilot scale experiments commenced in May 2015 to explore technologies for clean-up of the oceans. It is in this context that we must be vary of new technologies such as the one that has been recently announced of using nylon microbeads for waterless washing machines. Although the company claims that this technology is a sustainable solution (uses less water, detergents, less electricity consumption), the ultimate fate of the used nylon microbeads have not been clearly defined.

In hindsight, we could have avoided this large scale calamity, only if we were somewhat more circumscept; after all, an exfoliant needs to be only a gentle abrasive and thus there is no reason to be where we are today. How can we avoid such errors in the future? Is there a new 'thought framework' needed before we embark on proposing technology solutions? Who defines what is the sustainable solution; the industry which introduces the technology or the customer or community for whom the technology is intended? Are we wiser today regarding predicting unintended consequences? These are difficult questions for which we have no easy answers.

References

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