Silica the best environmental alternative to plastic microbeads, study finds

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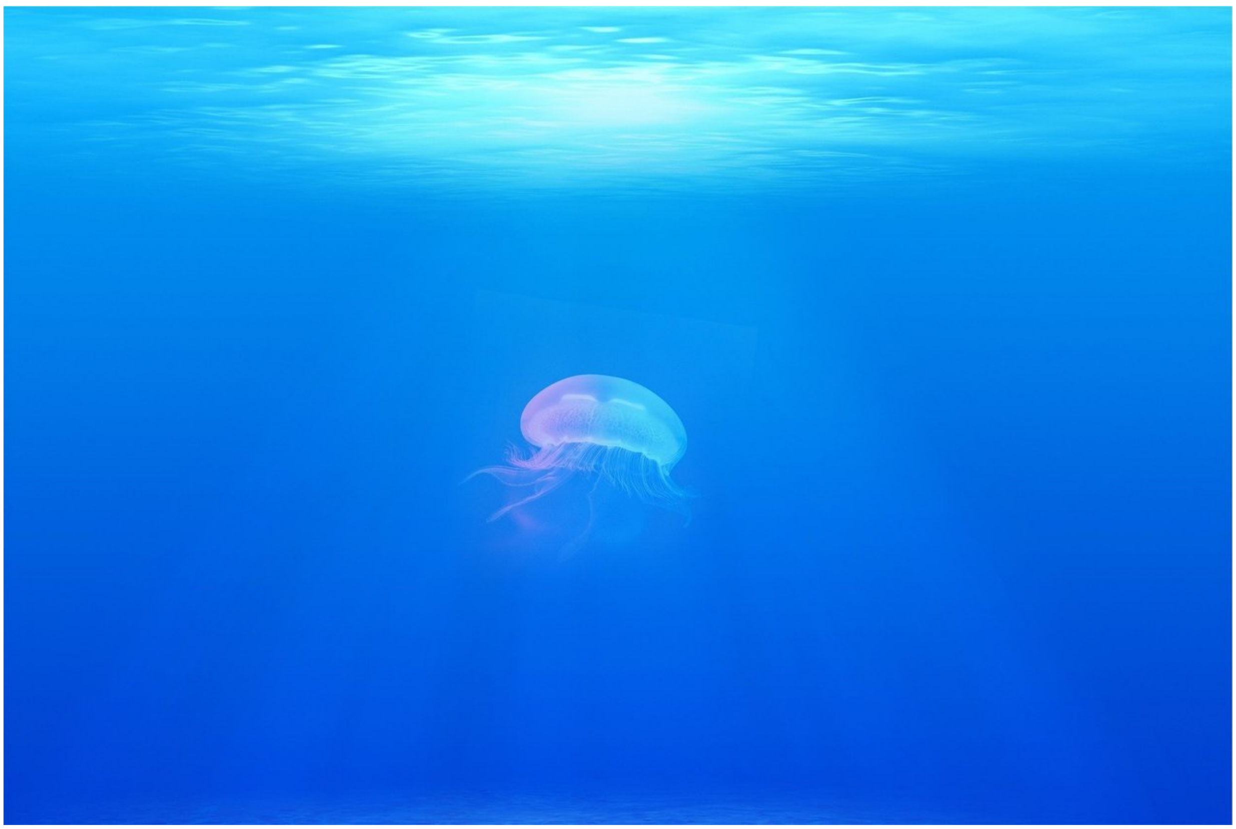

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Following bans on plastic microbeads in wash-off cosmetics, a new study weighs up the environmental costs of alternatives.

Microbeads have been included in personal care and cosmetic products ranging from toothpastes and sunscreen to body scrubs and industrial hand cleaners, usually to improve qualities like abrasiveness.

Microbeads are small, manufactured plastic pellets, typically measuring less than 0.5 millimetres (500 micrometres) in diameter. In many products they are designed to be washed off, where they pass through wastewater treatments plants and end up in marine ecosystems. Here, they can accumulate and be ingested by and cause harm to marine organisms.

This has led to them being banned in wash-off cosmetics in many regions, including the UK. Now, a research team from Imperial College London have assessed 29 alternatives to microbeads for their environmental impact.

They found that silica, a naturally occurring and abundant mineral, was the best alternative, performing overall better than plastic microbeads across all categories. The results are published today in *Nature Sustainability*.

Lead researcher Professor Nick Voulvoulis, from the Centre for Environmental Policy at Imperial, said: "Banning microbeads based on evidence of their long-term environmental impacts is a good step, but there may be unforeseen environmental impacts unless substitutes are chosen carefully. Not every apparently 'natural' alternative is desirable, so care is needed in selecting new cosmetic formulations."

The team evaluated 29 alternatives to microbeads, including different plastic formulations, minerals like silica, salt and pumice, and plant and animal-derived products like almond shells, oats and pearls. For each alternative, the researchers considered the environmental impact of their 'life cycle' - from extraction and manufacture to end use and disposal.

For each stage they evaluated different factors affecting environmental and human health, such as toxicity, ozone depletion, and use of scarce resources.

They found that two major factors influence the environmental credentials of the materials: the amount of energy-intensive processing they require (creating greenhouse gases), and, for plant-based materials, the amount of land and water they require.

This analysis showed that almond shells, often considered a desirable 'natural' alternative, require a lot of land and water to grow, and when grown in water-scarce areas, represent a poor environmental alternative. Citric acid requires far less water and land, but is heavily processed, requiring a lot of energy for manufacture.

The best-performing alternative, silica, is chemically inactive, non-toxic and naturally occurring, making it easy to source and process and unlikely to cause long-term negative effects.

However, the team also note that the 'best' alternative depends on the context. For example, titanium dioxide, used in toothpastes, has a relatively high environmental impact—but it is also used in sunscreens, where alternatives may not have the same health benefit of preventing skin cancers.

First author Claire Hunt, from the Centre for Environmental Policy at Imperial, said: "The ban on microbeads was largely driven by concern about the long-term impacts on marine ecosystems. We instead looked for the potentially hidden environmental costs of alternatives."This approach could be replicated in other areas looking to eliminate plastic waste and pollution, such as packaging alternatives using plant-derived materials or biodegradable plastics."

More information: Evaluating alternatives to plastic microbeads in cosmetics, *Nature Sustainability* (2020). DOI: 10.1038/s41893-020-00651-w , www.nature.com/articles/s41893-020-00651-w

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