

## Opinion Article

# Reassessing Sustainability in the Cosmetic Industry: Long-Term Lung Health Impacts of Nanoparticle Emissions from Packaging Materials

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The beauty industry is no stranger to waste. Approximately 120 billion units of beauty packaging are produced every year, many of which are not recyclable [1]. Numerous beauty products use plastic in their packaging, or even within the products themselves in the form of micro and nanoplastics. As sustainable business practices have been gaining popularity in a variety of industries, skincare and beauty companies are beginning to recognize the dangers of plastics to the environment and human health. The effects on the environment aren't minor—research from *Frontiers Microbiology* shows that 14 million tons of microplastics now lie in the ocean [2].

To go into more detail, we must fully break down what microplastics are. Microplastics (MPs) are a subgroup of plastics that have become an increasing micro contaminant in our world today. They are found largely in aquatic systems around the world and can be due to difficulty in properly disposing of waste. MPs can be classified into primary and secondary MPs, which primarily originate from household cosmetics and degradation of larger plastic fragments [3]. The natural decomposition of microplastics can take decades to complete. This should be alarming because inhalation of microplastics and nanoparticles can result in pulmonary diseases such as pulmonary fibrosis and lung cancer [4].

Concerns about microplastics in beauty products are more widely known than nanoplastics. Microplastics are commonly found in face and body wash, where they create an exfoliant. However, they can also be used as thickness agents or fillers in beauty products like

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eyeliner, hand cream, and sunscreen (Beat the Microbead has a database where you can search your beauty products to see if they contain microplastics!) [5]. Microplastics are a well-known environmental hazard, and microbeads in cosmetics were even recently banned in the US. Congress stated that they passed the Microbead-Free Waters Act of 2015 to stop ocean wildlife from consuming microbeads after they travel through our water supply to lakes and oceans [6].

The formation of plastics that are smaller than 5mm are classified as microplastics, which are known as the secondary MPs. MPs can be further broken down into nanoparticles (NPs) with diameters that range from 1nm to 1000nm. NPs may also form from primary plastics, which are common in cosmetic and personal care products [7]. The inhalation of these plastics can cause breathing difficulties and cytotoxic and inflammatory effects. Harmful additives such as plasticizers can be found in MPs, which act as endocrine disruptors and are easily subject to migration [4].

While the presence of microplastics in cosmetics has gained attention in recent years, nanoplastics are starting to cause concern as well. Nanoplastics were discovered to be an unexpected byproduct of microbeads in beauty products. A study that examined three commercial facial scrubs containing polyethylene microbeads found that “considerable quantities” of nanoparticles were also present in these products. It was speculated that “the physical degradation and breakdown of the microbeads during their manufacture or during preparation of the personal care products could lead to the formation of nanoplastics” [8]. This study shows that where microplastics are present in beauty products, nanoplastics could be as well, which leads to further and less explored environmental and human health concerns.

In recent years, nanoparticles have been cited as a growing concern for human health. In a study led by the University of Edinburgh/MRC Center for Inflammation Research, scientists noted that carbon nanotubes, which are used to create strong plastics, act very similar to asbestos fibers. The study concluded that inhaling carbon nanotubes can be as harmful for the lungs as breathing in asbestos. The scientists exposed mice to tiny carbon nanotubes and found that the lining of the animals' internal organs became inflamed and formed lesions [9]. Breathing in asbestos fibers increases the risk for mesothelioma (a deadly cancer that covers your internal organs), asbestosis (a chronic lung disease), and lung cancer.

Several studies have been conducted over the years in order to investigate human exposure to microplastics and nanoplastics. Through inhalation, smaller microparticles are able to reach the alveolar surface and these nanoparticles can make their way into the bloodstream, overcoming the pulmonary epithelial barrier. This can cause damage to various regions of the body, including our central nervous system (CNS) [4]. The fact that the beauty industry so willingly incorporates nanoparticles within products and/or their packaging raises concern for the ethical side of the industry [10]. This may explain the rise in popularity of biodegradable, eco-friendly packaging, and “clean” beauty products.

Although there have been several studies on human exposure to MPs and NPs, most of the studies are focused on the gastrointestinal system due to ingestion of contaminated food and water [4]. Knowing that there are MP-NPs that we may be exposed to daily from cosmetics consequently drives us to wonder how many harmful toxins we are actually getting exposed to. For this reason, more studies must be conducted that focus on human exposure via inhalation to analyze the harmful short and long-term effects that MP-NPs have on the human body and the health of our respiratory system.

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