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# Micro- and Nano plastics: Small but Not Harmless

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Decades of unrestrained plastic production have led to an environmental problem that should not be underestimated: the emergence of micro- and nano plastics, which are found all around the world. Microplastics are synthetic or semi-synthetic particles measuring a few millimeters. Nano plastics are sized in nanometers (one millionth of a millimeter, and therefore invisible) and mainly result from the breakdown or degradation [physical, (photo)chemical, etc.] of microplastics. All of these particles are found in water (oceans, seas), soil, and air. They are everywhere! For example, roughly 1.5 million tons of microplastics end up in the oceans each year. This leads to uptake by small organisms at the base of the food chain and can eventually accumulate in the human body.

Especially through the air, nano plastics can be absorbed into the body. Although much more research is needed on the effects of these very small particles, there is undeniable evidence that nano plastics can enter the bloodstream and reach the brain. Nano plastics can pass through cell membranes and thoroughly disrupt the functioning of (human) cells. Because of their very large surface area relative to their volume, which is typical for nanoparticles, nano plastics have the ability to carry other (toxic) molecules on their surface, which in turn poses an even greater risk to human cells and other living organisms. Examples of these (toxic) molecules include plasticizers, flame retardants, heavy metals, and so on.

So, what is the source of micro- and nano plastics? These plastics are released from car tires, textiles or clothing, artificial turf fields (use of specific fillers), personal care products (cosmetics), cigarette

filters (= acetate), through the agricultural and horticultural sector, fishing nets (nylon), etc.

In particular, attention can be drawn to the use of synthetic fibers in clothing such as polyester, nylon, acrylic fibers, viscose (semi-synthetic). Clothing made from these fibers easily leads to microplastics. Especially with low-quality textiles, micro- and nano plastics are released quickly. The current super “fast fashion” is catastrophic in this regard because it often involves low-quality textiles that are also easily discarded (dumped). The response to this is to pursue quality in textile products so they can be used longer, possibly combined with using more natural fibers (cotton, wool, ...). In this way, sustainability can be pursued by choosing ecologically responsible materials!

It is often claimed that recycling provides a solution and thus would lead to less pollution from micro- and nano plastics. However, this is not correct. A truly effective approach is simply to produce less plastic materials and therefore drastically limit plastic consumption. Currently, almost 500 million tons of plastic are produced each year, and the significance of this amount is very noticeable in many areas. So far, this has resulted in about 20 million tons of microplastics in the oceans, increasing by 1.5 million tons per year. Each week, a person ingests about 5 grams of “plastic” (equivalent to a credit card). The result is a clear presence of micro- and nano plastics in the body, leading to inflammation, mutagenic effects, impaired lung function, hormonal changes, cancers, and more. There is actually chronic exposure to micro- and nano plastics. Undoubtedly, more research is needed to correctly

estimate the true scope and long-term effects of these plastics, but there are already significant consequences that cannot be denied. Recent research also points to other effects. Micro- and nano plastics interfere with the processes by which carbon (actually CO<sub>2</sub>) is absorbed from the atmosphere into the oceans. This absorption is weakened by the presence of micro- and nano plastics, and the opposite can even occur! So, micro- and nano plastics contribute to the warming of seawater and, through their presence and further breakdown, even cause acidification of the water. A rise in seawater temperature has climatological consequences, directly linking it to

observed climate change (warming, extreme weather events like very heavy rains).

The problem of micro- and nano plastics is definitely a huge challenge that can only be tackled through focused international and global cooperation. It is more than five to twelve, and there is really no alternative, given the alarming figures. A drastic decrease in plastic or synthetic material production is the most obvious solution to avoid irreversible damage to our planet and its inhabitants.