Surfactant agents in micro- and nanoplastic research: friend or foe?

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As microplastics are posing a challenging problem for the environment, there is an increasing need for relevant studies (both in terms of exposure and effects) on the effects on humans and (aquatic) animals. Within this context, the availability of standard reference micro-and nanoplastic particles is recognized. Small micro- and nanoplastics in various shapes and size can be produced by cryomilling, however, a main challenge appears to be linked to the hydrophobicity of the plastics resulting in insoluble plastic particles. Surfactant agents such as Triton X-100 are often used to reduce hydrophobicity and thus increase solubility of the plastics. Nonetheless, these surfactants could in their turn affect cells or organisms during experimental exposure causing unreliable results.

The goal of this study was to identify and recommend surfactant agents to be used to prepare test solutions of micro- and nanoplastics reference materials for exposure studies. The performance of the surfactants was studied by analysing the capability of reducing the hydrophobicity and the toxicity of the surfactants. The latter was tested on human colorectal adenocarcinoma (Caco-2) cells and alveolar cells (BEAS-2B), the two most important intake pathways of micro- and nanoplastics. To understand the possible toxic effects of surfactants on the (physiology of the) cells, four different assays were used to determine the mitochondrial activity, total protein count, cell viability, and reactive oxygen species (ROS)-production. Tests were initiated by seeding cells at 20,000 cells/well in a multiwell plate and grown for 24 hours. Subsequently, the cells were exposed to a concentration range of surfactant ranging from 1 x 10^{-6} mg/ml to a maximum 5 mg/ml. After a 48 hour exposure period, the four previously mentioned assays were performed. The results clearly indicate surfactant-specific effects on the cells, and Triton X-100 shows the highest cytotoxicity.