Intestinal impact of PTFE-derived micro- and nanoplastics

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The increasing prevalence of micro- and nanoplastics (MNPLs) due to widespread plastic use poses a potential health threat, particularly via ingestion. Polytetrafluoroethylene (PTFE) MNPLs are a significant source of human exposure, yet their biological impacts remain underexplored.

The aim of this project is to assess the potential intestinal hazards posed by MNPLs released from PTFE using human-relevant in vitro intestinal models. Two PTFE-MNPL types- heterogeneous (HT) and homogeneous (HO)- were characterized and tested on undifferentiated and differentiated Caco-2/HT29MTX cell co-cultures. Cells were exposed to 50, 100, and 200 µg/mL of each MNPL type for 24 and 48 hours. Transmission electron microscopy (TEM) and confocal microscopy were used to analyze particle uptake and localization. Toxicity was evaluated through cell viability assays, ROS induction, IL-8 secretion, mitochondrial membrane potential, membrane integrity, and genotoxicity assessments.

Fourier Transform Infrared (FTIR) confirmed that both MNPL types shared identical functional groups despite their distinct morphology. Both PTFE-MNPL types exhibited cellular internalization without disrupting membrane integrity or barrier permeability. However, dose-independent oxidative stress and DNA damage were observed, with PTFE(HO)-MNPLs inducing stronger oxidative responses at higher concentrations.

In conclusion, PTFE-derived MNPLs, while not overtly cytotoxic, can cross intestinal barriers and induce oxidative and genotoxic stress. These findings raise concerns about long-term health impacts associated with chronic exposure to MNPLs from consumer products like non-stick cookware.

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