

Hazard impacts of polytetrafluoroethylene micro-nanoplastics: *in vivo* study

M. Alaraby^{1,2*}, D. Abass^{1,2}, R. Egea¹, A. Velázquez¹,
A. Hernández¹, & R. Marcos¹

¹Group of Mutagenesis, Department of Genetics and Microbiology,
Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain

²Zoology Department, Sohag University (82524), Sohag, Egypt

* mohamed.alaraby@uab.cat

Background: Polytetrafluoroethylene (PTFE) widely used in household and cookware, has recently been identified as a potential source of micro- and nanoplastics (MNPLs). Despite its widespread use, the contribution of PTFE-derived particles to MNPL exposure and their associated biological risks remain poorly understood, representing a significant gap in toxicological research.

Aim: This study aimed to systematically evaluate the biological effects of PTFE-MNPLs of different sizes, categorized into microscale (MPLs) and nanoscale (NPLs) fractions.

Methods: A comprehensive experimental approach was applied using *Drosophila melanogaster* as an *in vivo* model. Well-characterized PTFE particles were used to assess uptake, internalization, and tissue distribution. Physiological endpoints included oxidative stress (ROS generation), DNA damage, and mitochondrial membrane potential disruption. Molecular responses were investigated through genome-wide transcriptomic (omics) analyses, complemented by targeted gene expression profiling using RT-PCR.

Results: Both PTFE-MNPLs, irrespective of size, were localized within the gut lumen, near the peritrophic membrane and symbiotic microbiota. Evidence of bioerosion and the formation of secondary nanoscale particles was observed. Exposure induced significant oxidative stress, DNA damage, and mitochondrial dysfunction, with more pronounced effects for NPLs. Transcriptomic analyses, supported by RT-PCR, revealed widespread alterations in gene expression associated with stress response, metabolic processes, and cellular transport.

Conclusions: PTFE-MNPLs, regardless of size, induce significant physiological and molecular alterations, highlighting their capacity to penetrate biological barriers and disrupt cellular function.