Photoaging of Polystyrene-based Microplastics Amplifies Inflammatory Response in Macrophages

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Background:

The continuous release of municipal and industrial products into the environment poses a growing concern for public health. Among environmental pollutants, polystyrene (PS-MP) stands out as a primary constituent of environmental plastic waste, given its widespread use and high production rates owing to its durability and user-friendly properties.

Methods and Results:

PS-MPs were photoaged by exposure to visible light (VeraSol-2 device) to simulate environmental weathering due to solar irradiation (PS-MPSs^{3h}). Physical characterization revealed that the irradiation treatment results in particle degradation and the possible release of smaller nanoparticles. RAW264.7 cell line were exposed in vitro to "real-life" concentrations of pristine PS-MPs and PS-MPs^{3h}, to assess cytotoxicity, intracellular oxidative stress, primary genotoxicity, and inflammatory effects. Significant toxicity-related outcomes were observed in cells treated with both PS-MPs and PS-MPs^{3h} even at low concentrations (0,10 ug/ml and 1 ug/ml). PS-MPs^{3h} exhibited greater adverse effects compared to PS-MPs, including reduced cell viability, increased ROS production, elevated DNA damage, and upregulation of IL-6 and NOS2 gene expression.

Conclusions and Significance:

Changes induced by environmental aging in the physicochemical composition of PS microplastics play a crucial role in the adverse health outcomes associated with microplastic exposure.

Keywords: (max 5)

Polystyrene microplastics, Photoaging, Macrophages, Inflammation

References:

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