Structural and Dynamical effects of nanoplastics on biological macromolecules

Maria della Valle,[1,*] Gianluca D'Abrosca,[1] Marica Sassano,[1] Luigi Russo,[1] Carla Isernia,[1] Roberto Avolio,[2] Cristina Cocca,[2] Maria Emanuela Errico,[2] Gennaro Gentile,[2] Gaetano Malgieri, [1] and Roberto Fattorusso [1]

[1] Departmennt of Environmental, Biological and Pharmaceutical Science and Technology, University of Campania – Luigi Vanvitelli, via Vivaldi 43, 81100 Caserta, Italy.

[2] Institute for Polymers, Composites and Biomaterials - CNR, via Campi Flegrei 34, 80078 Pozzuoli, Naples, Italy.

*e-mail: maria.dellavalle@unicampania.it

The universal presence of micro- and nano-plastics and their unknown effects on the various biological systems are, to date, a significant concern. Plastic debris can be fragmented into smaller pieces by many physical and chemical processes, generating its own micro- and nano-plastics. Recently, this debris was shown to affect biota and to be gradually spreading through the food chain, becoming dangerous to humans [1].

In order to understand if nano-plastics (i.e polystyrene) may induce conformational changes that in turn inactivate biological macromolecules, we performed a structural and dynamical characterization with one of the well-known proteins, the human ubiquitin, in the presence of polystyrene nanoparticles by using a multidisciplinary approach in which TEM (Trasmission Electron Microscopy) and CD (Circular Dichroism) data were integrated with high-resolution NMR (Nuclear Magnetic Resonance) methodologies. Overall, our data strongly indicate that the addition of polystyrene to the ubiquitin induces structural perturbations that activate aggregation processes.

References

[1] Wang Y. L., Lee Y. H., Chiu I. J., Lin Y. F., Chiu H. W., Potent Impact of Plastic Nanomaterials and Micromaterials on the Food Chain and Human Health, *International Journal of Molecular Sciences* 2020, 21,1727.