Nanoplastics in aquatic environment: What can we do with our current knowledge?

Orizio F.[1*], Panio A.[1], Bruno A.[1], Magnani D.[1], Pompa P. P.[2], Labra M.[1]
*F.orizio@campus.unimib.it
[1] Department of Biotechnology and Biosciences, University of Milano Bicocca, P.za Della Scienza 2
[2] Italian Institute of Technology (IIT), Via Morego, 30, 16163, Genova, Italy

Abstract:

Plastic pollution is one of the most important issues for aquatic ecosystems.
In the environment, plastics may be present in different dimensions, and the least known are nanoplastics.
A unique definition of "nanoplastics" is still not available. In our study, we refer to nanoplastics according to the European commission definition of nanomaterial size: "*material containing particles, where one or more external dimensions is in the size range 1 nm - 100 nm"*.
Nanoplastics can be produced from fragmentation of bigger plastics due to UV photodegradation, hydrolysis, or microorganisms' action. They can be produced also in these nanoscopic dimensions to take part of cosmetics, 3D print or drugs.
The only method to study the interactions between nanoparticles and biological systems is by creating an artificial engineered system, because nanoplastics detection methods are still in early stages, in fact, no nanoplastics have still been detected in any environment.
Studies have been made about toxicity in many animals, plants and bacteria, but the nanoplastics tested were only made of polystyrene, and the concentrations tested were higher than the real concentrations that can be found in aquatic ecosystems.
Recently, a method to obtain plastic nanoparticles mimicking the degradation pathway that occurs under real environmental conditions has been developed. First studies using this new approach were made on PET (polyethylene terephthalate), a very common plastic in industry. Principal sources of PET are synthetic fibers and plastic bottles.
In our study, we assessed the effects of PET nanoparticles on the growth of three different bacteria (*Escherichia coli, Pseudomonas aeruginosa, Aeromonas* sp.), in a range of concentrations between 1 and 30 mg/L, in line with other nanotoxicology in vitro studies. To evaluate bacterial growth, optical density of test samples was measured at 600 nm of wavelength.
Moreover, we studied the interaction between PET nanoparticles, at a concentration of 2 mg/L, fluorescently-labelled, and the model organism *Daphnia magna*, using fluorescence microscopy.
Even if a conclusive answer about the role of PET nanoplastics is still lacking, these preliminary studies will help to understand the effects of nanoplastics composed by PET, a polymer that is highly frequent in the environment, the effects of which are still underestimated.