The genotoxicity effect of nanoplastic as a factor of other contaminants in adult Zebrafish (Danio rerio)

NISHA SINGH[1*], JACKY BHAGAT[2], AND GOPALA KRISHNA DARBHA[1]

[1] Indian Institute of Science Education and Research- Kolkata (IISER-K), West Bengal 741246, India (nstomar188@gmail.com)

[2] Mie University, Tsu, Mie 514-8507, Japan

Fine particles of plastics have recently emerged as one of the major contaminants in the aqueous systems. Nanoplastics (NPs) result from the fragmentation of large plastic debris under environmental factors. Unlike their bulk counterpart nano fractions have unique property owing to their large surface area to volume ratio. Furthermore, NPs known to cross membrane barriers, have the tendency to sorb and interact with the other contaminants present in the environment. Therefore, NPs may influence mobility, uptake, toxicity, and impact of other pollutants on the exposed organisms. It's surprising that little attention has been given to NPs and their co-toxic effect in the presence of other contaminants. Therefore, the present study aimed to understand the DNA damage in zebrafishes (*Danio rerio*) in presence of polystyrene (PS) NPs (50 nm and 100 nm) alone and combined with metal oxide nanoparticles (nCuO, nZnO) and polycyclic aromatic hydrocarbons (chrysene and fluoranthene). Exposure was carried out on adult zebrafish for 5 days with PSNPs alone and in combination using tap water. Gene damage was assessed in the exposed fishes using comet assay and expressed as percentage tail DNA (TDNA).

It was observed that 50 nm particles caused significantly higher TDNA 15.14±1.07 % (day 5) as compared to 100 nm NPs (12.12±1.48 %). A combination of nCuO and either of PSNP produced higher DNA damage as compared with control values. A similar trend was observed for nZnO in combination with either of PSNPs. Extending the incubation time to 72 h, the level of DNA damage increased in all exposed cells. TEM imaging confirmed the interaction between NPs and nanoparticles. Although a concentration-dependent increase in DNA damage was observed in fluoranthene and chrysene alone, the combination with NPs showed lower DNA damage at the same concentration. The study reflects that the small size polystyrene NPs are more genotoxic to zebrafish. In addition, we demonstrated that the combination of NP with fluoranthene and chrysene reduces the genotoxicity. These results make an important contribution in understanding the combined toxicity of NPs with other contaminants on zebrafish.