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Editorial corner – a personal view

Insights into carcinogenic potential of micro(nano)plastics

Kalappa Prashantha[a*], *Krishnappa Amita*[b]

[a]Centre for Research and Innovation, Adichunchanagiri School of Natural Sciences, Adichunchanagiri University, B.G. Nagara, Mandya District-571448 Karnataka, India
[b]Department of Pathology, Adichunchanagiri Institute of Medical Sciences, Adichunchanagiri University, B.G. Nagara, Mandya District-571448 Karnataka, India

The term microplastics (MPs) has been the subject of research for a while, but nanoplastics (NPs) are a relatively new concept. Microplastics (https://doi.org/10.1016/j.marpolbul.2018.11.022), are any synthetic solid particle or polymeric matrix, with size ranging from 1 μm to 5 mm, of either primary or secondary manufacturing origin, which are insoluble in water. Nanoplastics (https://doi.org/10.1016/j.envpol.2018.01.024) present colloidal properties in aqueous system with size less than 1 μm and result from the degradation of industrial plastic objects. Micro(nanoplastics) (MNPs) is relative new term used to discuss both micro- and nanoplastics, are plastic fragments, ubiquitously found within the environment and living organisms including human tissue. Human beings are being exposed to micro(nano)plastics (MNPs) predominantly through ingestion and inhalation. MNPs are complex materials composed of polymer matrix with additives such as flame retardants, UV-stabilizers, colorants and surface finishers among others. These additives are added to polymers during the compounding process and most of them are typically not chemically linked to polymers. As a result, these additives can leach to external medium easily. MNPs have a very large surface to volume ratio which leads to high leaching rate. Hence, once MNPs accumulate in living organisms, their additives and monomer residues can easily penetrate into tissues and organs leading to a localized toxicity by inducing or enhancing an immune response. Recently, many research groups reported the presence of monomers and constituents of MNPs in human tissues such as the liver, stomach, kidney, spleen, lungs *etc*.

Direct evidence of the role of MNPs in carcinogenesis has not been reported to date. However, recently, MNPs have been detected in human cancer tissue, suggesting (https://doi.org/10.21203/rs.3.rs-1315103/v1) its role in causing cancer. It has been observed that oxidative stress and chronic irritation due to MNPs (https://doi.org/10.1016/j.scitotenv.2020.143872) leads to the production of pro-inflammatory mediators that may induce angiogenesis. Angiogenesis is a well-established attribute of cancer progression. Likewise, endocrine disruptive chemicals (EDCs) present in the MNPs can mimic oestrogen, which may lead to DNA damage and promote breast cancer. There are also reports that EDCs can affect intestinal microorganisms influencing cancer risk. EDCs with recognized estrogenic activity have also been found to increase the risk of extrahepatic biliary tract cancer. Furthermore, organochlorine compounds present in some MNPs modulate K-RAS activation (K-RAS is an oncogene which when mutated leads a normal cell to transform to cancerous state) leading to exocrine pancreatic cancer (https://doi.org/10.3390/cancers14194637). In latest research, (https://doi.org/10.1016/j.scitotenv.2022.159306) molecular mechanism of MNPs in the induction of cancer signalling pathways in the kidney and testis has been reported using a microfluidic platform for the first time.

Despite this, risk posed by MNPs is uncertain and the evidence is weak. Discrepancies in the physical characteristics of the MNPs studied, bias introduced

*Corresponding author, e-mail: prashantha.k@gmail.com

by the additives and pollutants carried by MNPs, as well as the robustness of the study designs, renders the generalization of study results to humans ambiguous. Demonstration of the actual potential of MNPs on carcinogenesis requires extensive and trans-disciplinary research with robust study design to establish a cause-effect relationship. This demands for further research on the exact molecular mechanism deciphering signalling pathways to be elucidated in order to provide the evidence on the carcinogenic potential of micro(nano)plastics.

Dr. Kalappa Prashantha
Member of the International Advisory Board

Dr. Krishnappa Amita