Sub-lethal Effects of Nanoplastics upon Chronic Exposure to Daphnia magna

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Abstract

Plastic pollution in natural waters and the continuous breakdown of plastic debris under environmental conditions has resulted in increased numbers of micro- and nano-sized plastic particles in the aquatic environment. Moreso, plastics are persistent in nature and could stay in the environment for thousands of years without completely degrading. Hence, researchers believe that the smaller sized particles will continue to break down to even smaller nano-sized plastics (i.e., nanoplastics). While many of the previous studies have focused on their short-time impacts, the long-term impacts of nanoplastics is not yet well understood. This study investigated the sublethal effects of dialyzed 20 nm and 200 nm carboxylated polystyrene nanoplastics to *Daphnia magna*. The study followed the OECD 211 protocol for 21-day chronic exposures. Separate groups of *D. magna* were exposed to 50 mg/L of both particle sizes and 0.1 mg/L of the 20 nm particles. Comparison of the results between the 50 mg/L for both particle sizes allows the use of particle mass concentration as a dose metric. Also, the particle numbers in the 50 mg/L 200 nm and 0.1 mg/L 20 nm treatments were comparable. Hence, comparison of their results allows the use of particle number as a dose metric. Overall, chronic exposure to both sizes of polystyrene nanoplastics showed sublethal effects such as growth, molting and reproduction of *Daphnia magna*, including at the 0.1 mg/L concentration of the 20 nm nanoplastics. The results of the comparison showed similar trends in most of the measured endpoints regardless of whether the results were compared using the mass concentration or particle counts as dose metrics. Also, the change in mass concentration did not cause any significant change in the observed toxicity impacts for the 20 nm nanoplastics.

Keywords: size effect, nanomaterials, plastic pollution, nanosafety, sustainability, plastic waste

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