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# How hazardous can polymethyl methacrylate nanoparticles be to marine polychaetes?

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## Abstract

The low production costs of plastics have led to their increased use and, ultimately, to their release into the environment, raising concerns about their impact on marine organisms. Polymethyl methacrylate (PMMA) has been used in a wide range of applications, from touch screens to drug delivery systems. Like other plastic polymers, PMMA is expected to break down into small particle sizes, becoming available to a wide range of biota. Since this polymer may gradually sink into the sediments, it may also threaten benthic organisms. Polychaetes are often the most abundant group in estuarine ecosystems, being key species in coastal food webs. Due to their intimate contact with sediments, these marine worms are exposed to harmful materials both in the sediments and pore water. Thus, this study aimed to understand the effects of waterborne PMMA nanoplastics (NPs) on behavioural and biochemical endpoints associated with oxidative status and damage, neurotransmission, and energy metabolism of the polychaete *Hediste diversicolor*.

*H. diversicolor* specimens collected at a reference site were allowed to grow under laboratory conditions. Organisms then were exposed, for 7 days, to 50 nm PMMA NPs (0; 0.5; 5; 50; 500 µg/L).

Overall, data demonstrated the ability of PMMA NPs to alter, at lower concentrations, the activities of important antioxidant enzymes, such as superoxide dismutase (0.5-50 µg/L) and glutathione peroxidase (0.5 µg/L), as well as the biotransformation enzymes glutathione S-transferases (0.5 and 50 µg/L). Exposure to these NPs also induced lipid peroxidation (50 µg/L). Energy reserves and cholinesterase activity decreased only at the highest concentration (500 µg/L). However, behaviour showed a concentration-dependent decrease in the time organisms took to burrow into clean sediments.

The obtained results highlighted the potential consequences of PMMA NPs to benthic organisms, particularly at low concentrations.

**Keywords:** PMMA NPs, Polychaetes, Behaviour, Biochemical parameters

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