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# Effect of sizes and concentration of biodegradable microplastics on bioaccumulation and reproductive characteristics of *Daphnia magna*

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## Abstract

The increasing use of biodegradable microplastics (BMPs) as an alternative to conventional plastics underscores the need for comprehensive ecotoxicity evaluations. Therefore, this study investigated the size and density dependent toxicity of small-, medium-, and large-sized biodegradable cellulose acetate microplastics (CA-MPs) at concentrations of 0, 0.1, 1, 10, and 50 mg/L. CA-MPs were labeled with fluorescent dyes (Nile red and Fluorescein isothiocyanate; FITC) to trace their behavior inside the body of *Daphnia magna*. No significant differences were observed in the survival rate of *D. magna* exposed to all CA-MPs concentrations after 48 h. However, the accumulation of CA-Nile red in the intestine was higher than that of CA-FITC and non-stained CA, leading to a decreased heart rate and swimming activity in the CA-Nile red compared to the other groups. Interestingly, CA-MPs recovered from *D. magna* excreta at 48 h after intake showed a round shape, suggesting the potential to degrade CA in their intestinal environment. Thoracic limb activity showed no significant differences between the control and treatment groups after 48 h. Chronic exposure to CA-Nile red at 0.001, 0.01, 0.1, and 1 mg/L prolonged the time to egg production and decreased the average number of eggs in each spawning event, total egg/neonate production, and maximum egg count over the 21-day period. This study enhances our understanding of the toxic effects of BMPs on *D. magna* and present the importance of ecotoxicological data for assessing the risks associated with BMPs in aquatic organisms.

**Keywords:** Cellulose acetate, Marine Biodegradable plastic, Microplastic, Toxicity test, Zooplankton

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