Furthering the dynamic uptake model for virgin microplastics: application to the blue mussel (Mytilus edulis)

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Microplastic pollution of the marine environment has been established worldwide as a major issue: microplastic particles have been detected in almost every aquatic habitat on the planet. Due to their small size, and conspicuous presence in the water column, microplastics are of- ten mistaken for food and ingested by marine organisms. Nonetheless, the mechanisms ruling microplastic ingestion and accumulation in biota are still largely unknown, thus hindering the implementation of a proper microplastic exposure risk assessment. In this study, our previously developed dynamic model of microplastic uptake and excretion for the Mediterranean mussel (M. galloprovincialis) was further applied to blue mussels (M. edulis), and the results obtained from the two studies were compared, to highlight any specie-specific influence. Blue mussels were individually exposed to virgin polyethylene (PE) microplastics (3-12 µm). Two treatments were tested at two different microplastic concentrations, both equal or below the pseudofaeces threshold to encourage particle ingestion and avoid saturation. After the particles were spiked in the test vessels, ingestion was monitored for three hours, and samples were taken at 12 time- points (0, 5, 10, 15, 20, 25, 30, 45, 60, 90, 120, 180 min); furthermore, excretion was assessed for six days after the end of the ingestion phase, with a total of six sampling timepoints (12, 24, 36, 48, 80, 120 h). When compared to the previous model, the increased number of timepoints and the longer duration of the excretion phase in this study improved the fitting of data, thus increasing the accuracy of the calculated uptake and excretion constants. Moreover, the juxta- position of results from the two mussel species (M. edulis and M. galloprovincialis) underlines potential differences in the risk posed by microplastic pollution between two important Euro- pean marine ecosystems, the North Sea and the Mediterranean basin, hence providing a useful risk assessment tool.

Keywords: uptake, excretion, model, mussel

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