Abstract

Microplastics, defined as plastic particles from 1 to 1000 µm in size, are currently one of the most widespread pollutants. Despite numerous studies, not much is known about the interactions between microplastics and aquatic organisms, especially plants. Therefore, the aim of the thesis was to investigate the interactions between different types of environmentally relevant microplastics and the model aquatic plant, duckweed *Lemna minor* L., to develop a phytoremediation method to remove microplastics from the aquatic environment.

We investigated the short-term (7-day) effects of different types of microplastics, including pristine microplastics, aged microplastics (i.e., microplastics previously exposed to simulated environmental conditions), and microplastics with previously adsorbed pollutants (metal nanoparticles $nTiO_2$ and nZnO), as such types of microplastics are common in the environment. Pristine microplastics had minimal effects on duckweed, as only microplastics in the form of fragments and microplastics from which additives leached affected root growth. Aging significantly changed the physico-chemical properties of the microplastics, but the effects on the plant did not change compared to the pristine microplastics. The study of the adsorption process of $nTiO_2$ and nZnO on microplastics showed that the amount of nanoparticles bound and the binding strength depended on the type of nanoparticles, as the interactions between microplastics and $nTiO_2$ were stronger than between microplastics and nZnO. Despite the differences in the amount and strength of binding, the effects of microplastics with adsorbed $nTiO_2$ and nZnO on duckweed did not differ from the effects of pristine microplastics.

In the second part, we focused only on one type of microplastics and studied long-term interactions (12 weeks) with duckweed. During the exposure, microplastics did not have significant effects on the plant, as the effect was only seen in root growth, which was absent after the eighth week of exposure, indicating acclimation of the plant. Furthermore, an average of 25% of the microplastics adhered to the plant per week. Finally, a phytoremediation experiment was conducted, and we concluded that the environmentally relevant concentrations of microplastics in the aquatic environment can be removed within two months under the given conditions. Based on the minimal impact of microplastics and the ability to bind to the plant, we can conclude that the phytoremediation of microplastics from the aquatic environment is possible and it is also a low-cost, simple, and environmentally friendly *in situ* method.