Institute: Institute of Environmental Sciences

Topic: The use of aquatic microorganisms to remove microplastics from aquatic environment.

Opportunities and limitations.

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Background information:
Plastic pollution is one of the most pressing problems of the modern world. More than 300 million tons of plastic waste are produced each year. About 90% of the plastics produced worldwide are not recyclable. Biological, chemical and physical factors lead to the breakdown of plastic into smaller particles. The smallest fraction (<5 mm) is called microplastic (MP). The most troublesome are plastic microparticles with a size of one to several micrometers, which are dispersed in water and can penetrate plant and animal tissues. To date, there is no efficient way to microplastics and nanoplastics removal from water. In the frame of the PhD project, the ability of aquatic microorganisms to cope with microplastics will be investigated. The unique ability of some rotifers to ingest biofilm with embedded microplastic particles will be tested as a biological tool to extract dispersed MP from water.

The main question to be addressed in the project:
Can aquatic microorganisms be applied as a tool for the separation of microplastics dispersed in the water?

Information on the methods/description of work:
The research will be based mainly on laboratory experiments with the usage of a range of high-quality microscopes equipped with fluorescence, digital camera and image analysis systems. In the first stage, the effect of fluorescently labeled different types of microplastics of different sizes on a few species of aquatic microorganisms in an environment enriched with biofilm will be examined. The results will be compared to the control without biofilm. In the next stage, the ability to reduce the amount of microplastic particles by different activated sludge microorganisms' communities with and without the addition of *Lecane inermis* rotifers will be tested. The tests will be carried out using activated sludge from municipal sewage treatment plants. At the end of the experiments, the concentration of microplastic particles in the supernatant (effluent) will be compared between the treatment and the control. The ability of the microplastics to aggregate, biosorb and adsorb onto the flocks and particles of the activated sludge will also be investigated. During the experiment, sludge samples will also be taken, and photos of the flocs will be taken using fluorescence, which will help in the interpretation of the results and visualization of the "fate" of microplastic particles in the activated sludge wastewater treatment process.

Additional information (e.g Special requirements from the student)**:**
Msc in biology (or related), experience in laboratory experiments with aquatic microorganisms, experience in data analysis (Statistics), high proficiency in spoken and written English

Place/name of potential foreign collaborator:
University of Potsdam/Claudia Drago

References (max.3**):**
[1]Barros, J., & Seena, S. (2021). Plastisphere in freshwaters: An emerging concern. Environmental Pollution, 290, 118123.
[2]Bellasi, A., Binda, G., Pozzi, A., Galafassi, S., Volta, P., & Bettinetti, R. (2020). Microplastic contamination in freshwater environments: A review, focusing on interactions with sediments and benthic organisms. Environments, 7(4), 30.