

Analytical Studies on the Formation of Biofilms on Plastic Surfaces in Freshwater

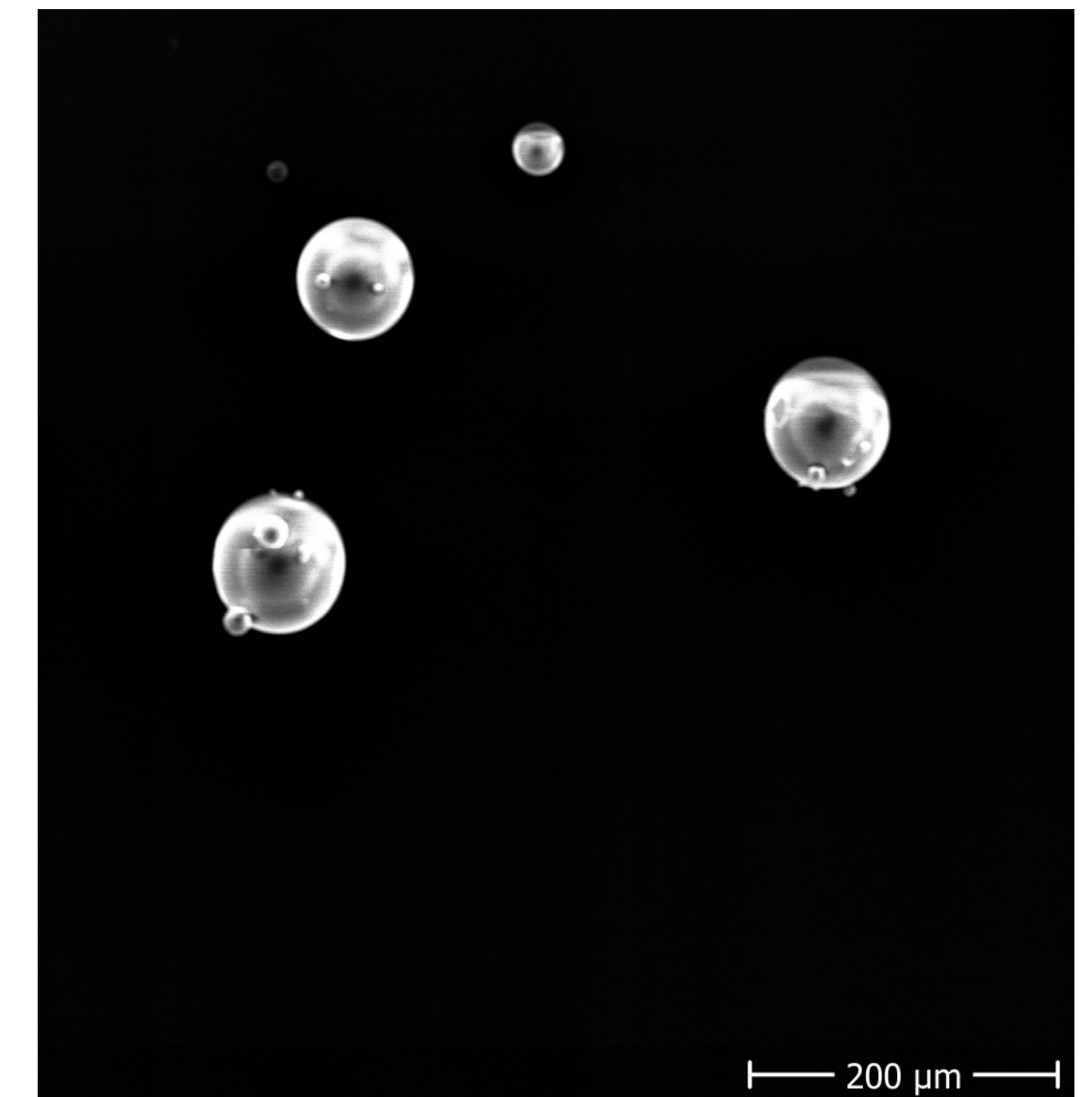
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Background

Littering of plastics in the environment is a serious problem. While the research on marine litter advances more and more, there are immense gaps of knowledge regarding the freshwater systems and the terrestrial environment. But, plastic litter in freshwater systems has become a new topic of interest attracting the attention of the public. There are some important gaps that need to be filled, e.g. the lack of standardized sampling and analytical methods. The relevant sources and the environmental effects also have to be investigated. There is also a lack on the biological effects of micro particles on freshwater species, too.

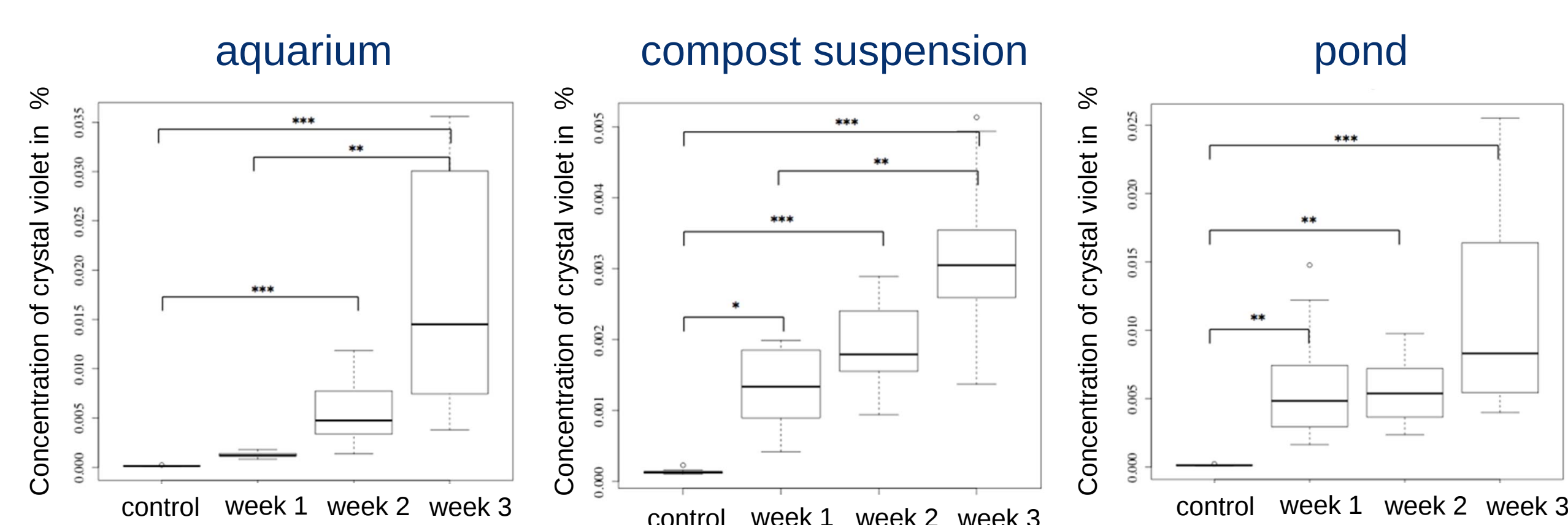


Peelings from the supermarket containing a high amount of microscopic small plastic particles



PLA-microparticles under a scanning electron microscope, produced with a emulsion-solvent-evaporation process

Quantitative Biofilm-Assay



The amount of biofilm increases during the exposure time leading to a changed sinking / floating behavior already after one week.

Aim of the work

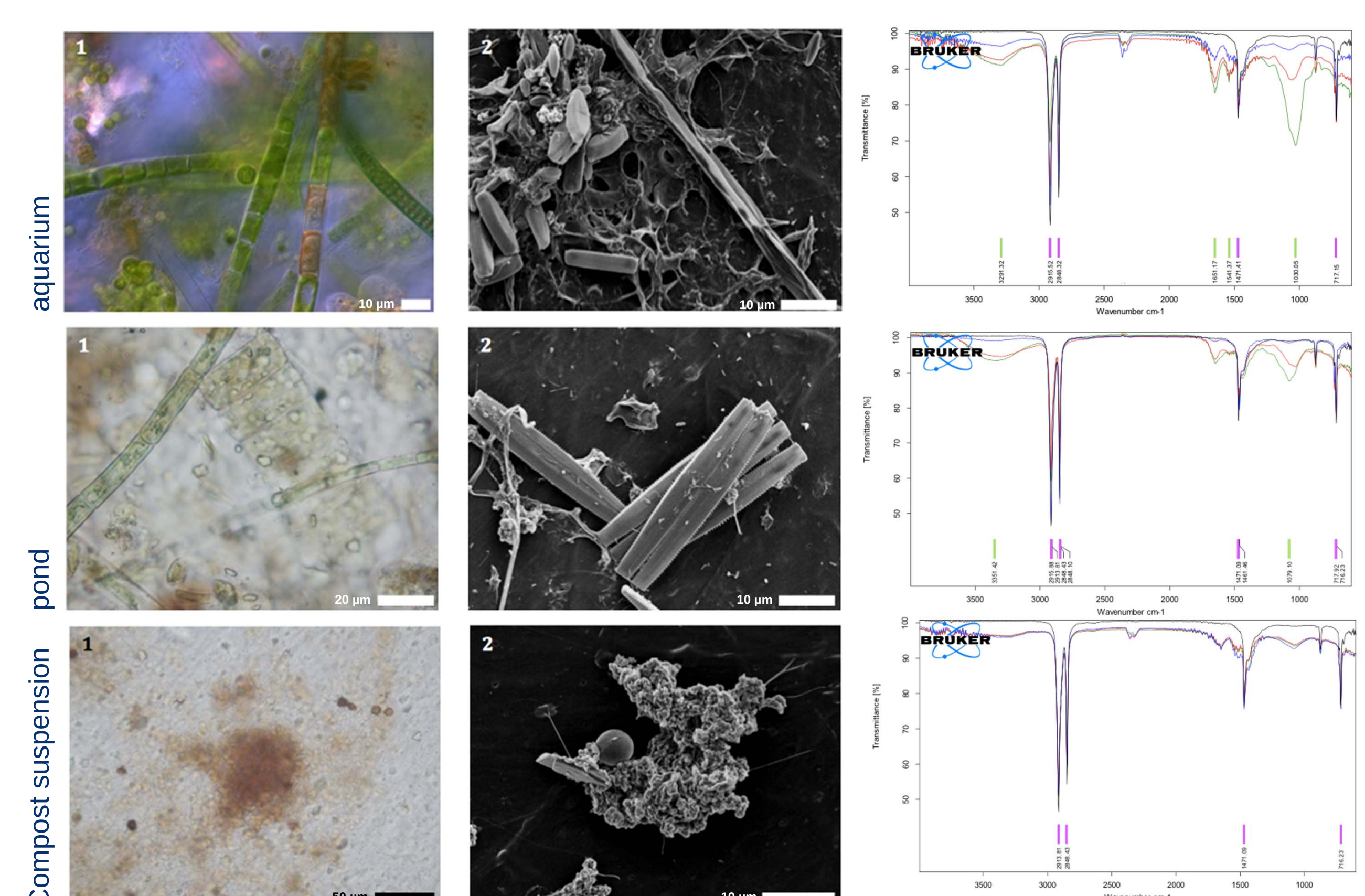
The aim of this work is to investigate the formation of biofilms on plastic films in fresh water systems. To investigate the biofilm formation on PE films three different freshwater media (aquarium, pond and compost suspension) were used. The samples were exposed to the different media for three weeks. During this time the biofilm formation on the plastic films was investigated by means of quantitative biofilm-assay, sinking / floating behavior, scanning electron microscopy and infrared spectroscopy. Furthermore, the DNA of the biofilms were isolated and sequenced to qualify the dominating microorganism in the produced biofilms.

Conclusion and Future Work

In order to estimate the impact of plastic waste on freshwater systems, a reliable and standardized separation of the particles from the environment is necessary. At the moment, this is done predominantly on density separation techniques followed by a qualitative analysis of the plastic particles by means of IR spectroscopy.

This procedure works without any problems on the starting materials. But, in case of samples that were exposed to aging processes in nature and having a biofilm this procedure does not work anymore.

Biofilms consist of many different types of microorganism and form on very different surfaces. The sinking and floating behavior and qualitative detection of the plastics is influenced leading to complications during the analyzes. Techniques to remove the biofilm by digestion with acids, bases or enzymes are required. Further studies on biofilm formation and their influence on aging and degradation processes are needed.



- Biofilm consist mainly of green algae and diatoms
- Biofilm interfere with the infrared light
- Characterization of the polymer through the biofilm hardly possible

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