

Currently, the challenge in wastewater treatment is to remove pollutants found in wastewater in very low concentrations such as microplastic (plastic with a particle diameter less than 5 µm), which has been qualified by many researchers as a compound with toxic, carcinogenic or endocrine-disrupting properties. In the study, possibility of effective removal of microplastic from wastewater will be tested in a system with aerobic granular sludge exhibiting high biological activity and efficiency in micropollutant removal.

The varied chemical structure of microplastics determines the effectiveness of removal and the structure, activity, and composition of biomass in wastewater treatment systems. Two types of microplastic (polyethylene terephthalate, polyethylene) most commonly found in wastewater will be used in the experiments. The research will be carried out in four stages. In the first stage, different doses of two microplastic will be introduced with wastewater to two aerobic granular sludge reactors (GSBR). Physico-chemical analyzes will be carried out in raw and treated wastewater and during the GSBR cycle to determine the effectiveness and kinetics of pollutant removal. Also, the concentration and morphology of microplastic in treated wastewater and aerobic granular sludge (sieve analysis, determination of extracellular polymer content, microscopic observations) will be examined. In the next stages of the experiment, the impact of microplastic on the activity and species composition of microorganisms in aerobic granules will be determined using real-time PCR and next-generation sequencing. In the last stage, bioinformatical and statistical analyzes will be conducted to determine the relationship between technological parameters and molecular results.

The project will expand knowledge in the field of environmental biotechnology, in particular, it will allow us to illustrate the impact of type and dose of microplastic on the efficiency of wastewater treatment and species structure and activity of microorganisms responsible for nitrogen and phosphorus transformation in the aerobic granule structure. The potential of using aerobic granules as an effective technology for microplastic removal from wastewater will be determined. The obtained results will allow selecting microorganisms highly resistant to microplastic exposure and potentially responsible for its degradation.