Description for the general public (*in English*)

Until recently, landfilling was the main way of disposing of municipal solid waste, negatively influencing the environment. Currently, the waste is treated as a source of materials for recycling and recovery, including recovery of energy form organic substrates. Changing in waste management resulted in the need for technologies of recovery/recycling of material fractions (paper, textiles, plastics, metals and biodegradable fraction) of municipal waste. Methane fermentation is one of the recovery processes of energy, in the form of biogas, from organic substrates.

Recovery of energy from organic substrates requires preparation and intensification of anaerobic treatment of biodegradable fraction of municipal waste. One of the methods for preparation for fermentation is elution of soluble organic substances to leachate. The next step is intensive methane fermentation of this leachate in the expanded granular sludge bed reactor.

The aim of the project is to determine the effectiveness of elution and removal of organic compounds and the production of biogas from municipal waste in an integrated system, percolation-methane fermentation in expanded reactor with anaerobic granules.

Physico-chemical composition of leachate after waste percolation and efficiency of the process depending on the intensity and the elution time will be determined. The results of physico-chemical analyzes in the leachate before and after methane fermentation, the amount and composition of the biogas in the reactor with anaerobic granules, will be the basis for determination of biogas yields and effectiveness of organic compounds degradation by anaerobic granules.

Microbial structure of anaerobic granules using high-throughput sequencing, real-time PCR and FISH, as well as morphological properties of the granules will be determined. Technological research, supplemented by molecular techniques to determine the relationships between groups of methanogenic microorganisms in the reactor with anaerobic granules will provide novelty and interdisciplinary aspects, which give wide scope for the interpretation of the results. The results of the research will complement the knowledge of the technologies for organic recovery from biodegradable fraction of waste, and of ecology of microorganisms in the anaerobic wastewater treatment system with biogas production.