

Anaerobic digestion is a widespread method of wastes treatment aimed at a reduction of the amount of organic waste and energy recovery in the form of methane (biogas). The conversion of organic matter into biogas is a complex anaerobic process that involves four main steps: hydrolysis, acidogenesis, acetogenesis, and methanogenesis. The first three steps can be carried out by wide spectrum of bacterial species, while methanogenesis is exclusively associated with a group of Archaea called methanogens. As the methane fermentation is a very complex process, the efficiency of biogas production depends on activity of microorganisms conducting this process, which is determined not only by environmental factors, but also by the availability of nutrients and supplements. Between supplements that enhance biogas production are zeolites. Zeolites are microporous, aluminosilicate minerals of different chemical composition. Positive influence of zeolites on methane fermentation process is, due to the following main features: (i) high capacity to immobilization of microorganisms, (ii) the possibility to reduce the concentration of toxic elements, (iii) the ability to release various microelements. However, knowledge about the influence of zeolites on microbial community structure during anaerobic digestion of sludge is insufficient in the literature.

The objectives of this project are to investigate the effect of addition of zeolites on changes in the structure of microbial community composition during anaerobic digestion of sewage sludge and to track the process of zeolite colonization by biogas-community. Various types of natural and synthetic zeolites will be added and tested in anaerobic digestion process conducted in laboratory reactor. The effect of different type zeolites on kinetic of anaerobic digestion of sewage sludge process and will be estimated, basing on the comprehensive analyzes of biogas yield and physico-chemical parameters. Analysis of community composition will be done at the metagenomic DNA level by the sequencing of marker gene 16S rRNA of Bacteria and Archaea. The rate of zeolite's colonization will be also searched with the use of scanning electron microscopy analyzes. Research conducted during this project allow to:

- estimate and compare impact of different types of zeolites on the rate and efficiency of anaerobic digestion of sewage sludge;
- correlate the physiological effect of zeolites addition with changes in the structure of microbial community;
- explain the interaction between zeolites and microorganisms, especially in the context of zeolite's colonization by microorganisms.

The proposed project will broaden our knowledge about zeolites effects on biogas-community and allow to assessing the real impact of the minerals on the processes efficiency. The knowledge gained during this project will be important for further research focused on the use of zeolites in methane fermentation and in environmental protection.