SIMULTANEOUS TREATMENT OF SOLID AND LIQUID ORGANIC WASTE VIA SPATIAL SUCCESSION OF MICROBIAL COMMUNITIES

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The microbial treatment of organic waste is one of the most promising as well as challenging approaches. Existing technologies do not provide effective degradation of solid organic waste that causes the increase in the amount of landfills and toxic filtrate. The goal was to investigate spatial microbial succession during the degradation of solid and liquid organics with fuel obtaining.

The process was carried out consistently in the direct flow system consisting of anaerobic bioreactor, aeration tank and aquarium. For solid waste degradation, 240 L anaerobic bioreactor was used. Liquid organics removal was conducted in the 10 L aeration tank. The aquarium was used for purification of the filtrate. Spatial succession, i.e. gradual change of the physiological groups of microorganisms in space functioning simultaneously was applied to accelerate the process.

The accelerated fermentation of solid waste took place in the 240 L anaerobic bioreactor due to the spatial stratification of the redox zones. Aerobic microorganisms provided first stage of waste degradation in the high potential surface zone. After decrease in the oxygen concentration and redox potential anaerobic microorganisms provided effective synthesis of hydrogen in low potential zone up to 50 - 60 L/kg of waste during 3 days. Anaerobic degradation provided 80-90 fold reduction of solid waste weight. However, it produced filtrate with the concentration of soluble organics up to 500 mg/L. Its removal was carried out in the direct flow 10 L aeration tank during 24 hrs. Here, spatial succession of microorganisms was observed. Among 10 sections of the installation, 4 were anaerobic with the domination of copiotrophic microorganisms. The following 6 sections contained less organics and demonstrated the decrease in the amount of copiotrophs increasing the number of oligotrophic ones. The purified filtrate was removed to the aquarium evidencing complete purification of the solution.

Thus, the approach based on the spatial succession of microbial communities is promising for the further optimization and industrial implementation to accelerate the process of solid and liquid organic waste degradation and hydrogen production.