JEE Journal of Ecological Engineering
Volume 21, Issue 1, January 2020, pages 14–19
https://doi.org/10.12911/22998993/113507

Received: 2019.09.20
Revised: 2019.10.28
Accepted: 2019.11.30
Available online: 2019.12.20

Possibilities of Leachate Co-Treatment Originating from Biogas Production in the Deammonification Process

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INTRODUCTION

It is estimated that the amount of sewage sludge generated during the wastewater treatment is about 1–3% of the volume of wastewater transported to the plant. This amount depends on the composition of the wastewater, treatment technology and the reagents used in the treatment process (Kołodziejczak 2012). Due to the trends of the wastewater treatment process intensification and improvements in terms of system efficiency, it appears necessary to search for rational ways of managing them (Czekała 2012).

In previous years, sewage sludge was mainly stored in municipal landfills. However, in 2016 a ban on their storage was introduced (Regulation of the Minister of Economy 2015) and other solutions that would enable their safe disposal were started to be sought. The high content of organic matter in sewage sludge makes it a valuable fertilizer, but the biological and mineral pollutants, such as heavy metals and pathogenic microorganisms, cause restrictions in their agricultural use. This is mainly due to lower permissible concentrations of heavy metals in sediments, which directs their management by thermal methods.

Therefore, the methane fermentation process in which sewage sludge is the only substrate or serves as a co-substrate with the addition of various waste products turns out to be an important alternative. The process is carried out in separate fermentation chambers. This process allows obtaining stable digestate, which is a safer waste compared to the sewage sludge before fermentation. The content of organic substances decreases by at least 30%; the hydration of the sludge decreases as well, causing an increase in the solids mass in the sludge to 6–7% (Kołodziejczak 2012). The digestate has a black color due to the content of sulphides and humus substances.

In connection with the hydration of sludge, it is important to subject it to appropriate processes: concentration and dehydration (Sadecka 2014). This reduces the amount of water as well as the volume of sludge and thus increases the dry matter content. After the separation of digestate into solid and liquid fractions, two types of waste are generated 19 06 06 and 19 05 05 (Regulation of the Minister of the Environment on the waste catalog). The liquid fraction, called leachate, due to the high content of nutrients, must be purified before it is discharged into the environment. The leachates from excessive sludge dewatering in municipal wastewater treatment plants are characterized by high concentrations of organic substance expressed in COD (approx. 8000 mg O_2/dm^3 on average), total suspension (approx. 6000 mg/dm^3 on average) and total nitrogen (approx. 1600 mg/dm^3 on average), mainly in the form of ammonium nitrogen – NH_4-N) (Obarska-Pempkowiak 2009). In addition, these leachates contain toxic refractory compounds, such as BTEX, PAHs, PCBs and heavy metals, as well as high concentrations of iron and chloride (Wojciechowska and Obarska-Pempkowiak, 2008). However, the literature does not provide the composition of leachate from a biogas plant, for which the greatest challenge is its proper management. The amount of leachate can be up to 0.83 m^3/Mg of charge (Jędrczak 2008). Sometimes, the leachate after treatment is directed to water receivers or recycled to the wastewater treatment plant (Czekala 2012).