IMPACTS OF MICROWAVE PRETREATMENTS ON THE ANAEROBIC DIGESTION OF DAIRY WASTE ACTIVATED SLUDGE

Mahmood Al Ramahi[1], Sándor Beszédes[2], Gábor Keszthelyi-Szabó[2]

[1]Department of Environmental Sciences, University of Szeged, Szeged, Hungary
[2]Department of Process Engineering, Faculty of Engineering, University of Szeged, Szeged, Hungary
m7mod-rm7i@hotmail.com

Abstract

Microwave (MW) irradiation is one of the new and possible methods used for pretreating sludge before biological treatment. Following its use in different fields, MW irradiation has proved to be appropriate in the field of environmental research. In this study, we focused on the effects of MW irradiation on solubilization, biodegradation and biogas production during anaerobic digestion of dairy sludge. We have collected results from different published papers and examined the changes in the soluble fractions of the organic matter and the biogas yield to evaluate the efficiency of MW pretreatment. Additionally, the energetic efficiency was also examined theoretically. For batch reactors and in terms of an energetic aspect, the most economical pretreatment of sludge was at 630 W for 12 min irradiation time (1 kg of sludge, 1:10 solid: water). At this, COD solubilization, SS reduction and biogas production were found to be 18.6%, 14% and 35% higher than the control, respectively. While in semi continuous anaerobic digesters, combining microwave pretreatment with anaerobic digestion led to 67%, 64% and 57% of SS reduction, VS reduction and biogas production higher than the control, respectively. Therefore, energy output will increase for same amount of sludge and the same retention time as was observed here. Therefore, the energy per unit weight of dairy sludge is significantly higher after MW pretreatment, making the quality of the sludge better suited for anaerobic digestion. The theoretical calculations demonstrated that the energy input required to carry out the microwave treatment is lower than what obtained from biogas combustion, demanding use of 60% of produced energy as input. This amount does not include losses in energy transformations, nor account for heat losses during the pretreatment process. However, with an optimized design and operational procedure, these amounts can be kept to minimum.

Key words: microwave, sludge, biodegradability, biogas

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