Environmental Engineering and Management Journal

August 2017, Vol.16, No. 8, 1827-1835
http://omicron.ch.tuiasi.ro/EEMJ/

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BIOGAS PRODUCTION FROM WHEAT STRAW PRE-TREATED WITH HYDROLYTIC ENZYMES OR SODIUM HYDROXIDE

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Abstract

Lignocellulosic residues are relatively recalcitrant to bioconversion during anaerobic digestion (AD) for biogas production. Pre-treatments with cellulolytic enzymes or diluted alkali can facilitate biomass hydrolysis and enhance the process. Both pre-treatments require low energy and chemical inputs, without accumulation of inhibitor. Milled wheat straw was pre-treated with hydrolytic enzymes or with diluted NaOH before AD. The pre-treatments were performed on sterilized, stabilized with formic acid or not sterilized wheat straw to evaluate the effect of straw indigenous microorganisms on the sugar concentration before AD. Anaerobic digestion was carried out in batch reactors, at 35 °C, for 3 months. The maximum cumulated methane production (Mmax) and the daily rate of methane accumulation (R) were estimated by a modified Gompertz equation. The NaOH pre-treatment was the most effective, with average increases of 23 and 85 % for Mmax and R, respectively, in comparison with no pre-treatment. The enzymatic pre-treatment only increased Mmax by 14 %. However, the same increase was observed with heat-inactivated enzymes, thus it was merely caused by the bioconversion into methane of the organic compounds contained in the enzymatic preparations. Moreover, all the pre-treatments determined a holocellulose conversion into reducing sugars lower than 4 %. In particular, the sugar concentration from not sterilized or stabilized with formic acid straw was lower than from sterilized straw, probably due to straw indigenous microorganisms activity. In conclusion, hydrolytic enzyme addition does not seem to provide a real advantage in terms of methane yield from wheat straw, differently from alkali pre-treatment.

Key words: alkaline pre-treatment, cellulose, enzymatic hydrolysis, formic acid, lignocellulosic biomass, methane

Received: February, 2017; Revised final: July, 2017; Accepted: August, 2017

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