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Integration of membrane filtration in two-stage AD-system: Specific methane yield potentials of permeate and hydrolysate

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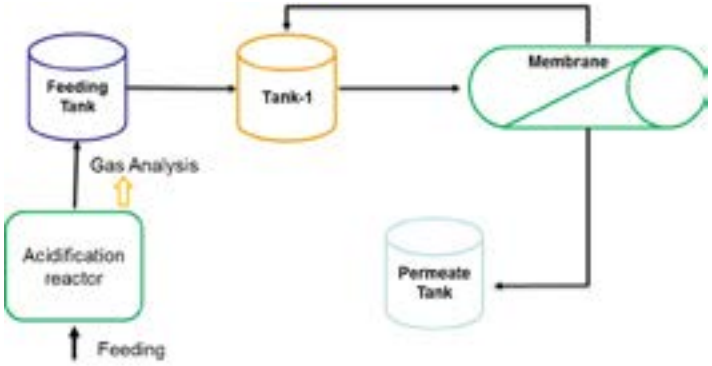
Two-stage biogas systems consisting of a CSTR-acidification reactor and a subsequent anaerobic filter for methane production were frequently described in the newer literature for the microbial conversion of food and agricultural wastes to biogas. To use the hydrolysate from acidification step in the anaerobic filter, the solids particles have to be removed to prevent blockage. The purpose of this study is to integrate a membrane filtration process in a two-stage AD system to remove particles and inert COD-components from the hydrolysate. The hypothesis is that the removal of the inert COD leads to a more effective performance of anaerobic filter and higher degradation rates there so that the volume of the AF is used more efficiently. A cross flow ceramic membrane filtration plant with 0.2 µm pore size in membrane was used to treat the hydrolysate produced in acidification reactor, which was maintained at target pH-value 5.75. For this experiment, two different substrates (grass-maize silage and vegetable waste) were investigated. For the determination of organic acids, sugars and alcohols of hydrolysate, permeate and concentrate during filtration process, HPLC and GC analysis were performed. Additionally, the COD concentrations were detected. For the carbon balance, TC, TOC and IC and the gases produced in acidification reactor were measured quantitatively and qualitatively. Furthermore, the permeability of the ceramic membrane was determined. To evaluate the specific methane yield the Hohenheim Biogas Yield Test (HBT) was conducted for permeate, hydrolysate and concentrate. The preliminary results show that there were no significant differences in organic acid concentration of the hydrolysate permeate and concentrate, even though the COD concentrations had significant differences. During the experiment, the permeability of the membrane was stable, although there was no physical or chemical cleaning. The organic dry matter (ODM) degradation rate in acidification reactor was 36.01%.



Biography

Padma Priya Ravi has completed her Bachelor of Engineering in Biotechnology from VMKV University, India and obtained her Master's degree in the field of environmental protection and agricultural food production from University of Hohenheim, Stuttgart, Germany. Presently she is pursuing PhD at State Institute of Agricultural Engineering and Bioenergy, University of Hohenheim, Stuttgart, Germany.

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