https://doi.org/10.7250/CONECT.2024.056

PH-OPTIMIZED BIOMETHANE PRODUCTION: EVALUATING CARRIER MATERIALS FOR EX-SITU BIOMETHANATION

Zane KUSNERE[1*], Lauma LAIPNIECE[2], Kriss SPALVINS[3]

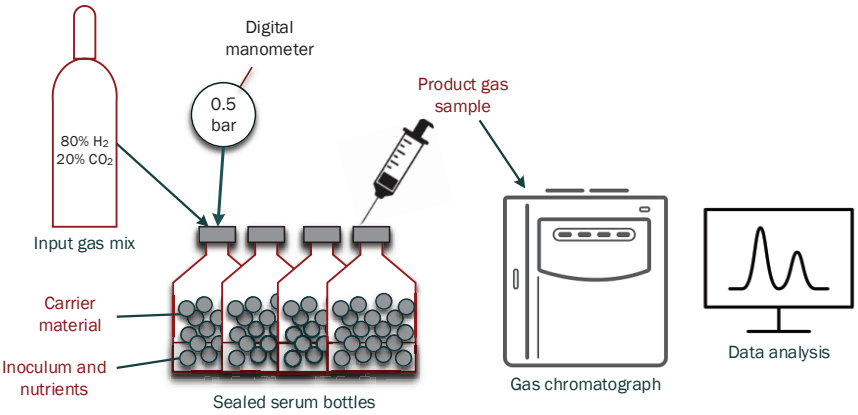
[1, 3] *Institute of Energy Systems and Environment, Riga Technical University, Āzenes iela 12/1, Riga, LV-1048, Latvia*

[2] *Institute of Chemistry and Chemical Technology, Riga Technical University, Paula Valdena iela 3, Riga, LV-1048, Latvia*

[*] ***Corresponding author.*** *Email address: Zane.Kusnere@rtu.lv*

Abstract – Choosing the appropriate carrier material for ex-situ biomethanation is a critical factor to consider when developing biogas upgrading technologies. The chosen material for biomethanation in a biotrickling filter reactor functions as a substrate that immobilises microorganisms, which act as catalysts in the reaction for producing biomethane. This study conducted experiments on waste-derived materials, including glass foam and vulcanised wood ash material, in addition to polyurethane foam and expanded clay pellets. Pretreratment of wood ash was done to lower the pH level of material. The manometric test measured the rate of CH_4 generation by quantifying pressure fluctuations. The validity of these results was confirmed by analysing product gas samples using a Shimadzu Nexis GC-2030 gas chromatograph, which was equipped with two parallel lines, a flame ionisation detector (FID) and a thermal conductivity detector (TCD). In order to enhance the biomethane concentration in the end product, two strains of methanobacterium alcaliphilum were evaluated alongside biogas sludge as the inoculum. These strains of microorganisms are methanogens that utilise hydrogen and can thrive in a high pH environment. Thus, they have the potential to demonstrate improved biomethane production outcomes when a vulcanised wood ash filter is used as the carrier material.

Keywords – Biomethanation; biogas upgrading; carrier material; gas chromatography; methanobacterium alcaliphilum; vulcanized wood ash



Methodology for biomethanation experiment.

ACKNOWLEDGEMENT

This work was supported by the European Social Fund within the Project No. 8.2.2.0/20/I/008, "Strengthening of PhD students and academic personnel of Riga Technical University and BA School of Business and Finance in the strategic fields of specialization".