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Back to results | 1 of 1

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Process optimization of biogas production from palm oil mill effluent : A case study of a crude palm oil factory in Muaro Jambi, Indonesia (Article)

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Abstract

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Palm Oil Mill Effluent (POME) is a liquid waste of oil palm factory that pollutes the environment but is very useful as a raw material for producing biogas. POME processing has advantages to meet environmental requirements and to produce commercialized products. Although there are already enough biogas systems installed in oil palm factories, they are not designed optimally because it involves many parameters and quite complicated process. The purpose of this study is to obtain an anaerobic system utilizing POME at an oil palm plant in Muaro Jambi, Indonesia. The optimization is based on simulation results of some process parameters to produce maximum bio-methane gas discharged at the highest CH_4 concentration. The processes occurring in the digester are stoichiometrically modelled for several variations of TSS (2-4%), temperature (30-60°C), operating pressure (1-2 bar), as well as digesting stages (1 and 2 stages). Pressure in the scrubber was varied between 9 and 12 bar, while the water flow was 1,000-15,000 kg/hour and had 3-12 stages. Calculations were performed using Aspen Plus Software. Based on this research finding, the optimum design and condition is found for 2-stages digestion where TSS = 4% and 1 bar, with temperature at first and second digester is 60°C and 42°C, respectively, which produces 7,725 kg/day biogas. The optimum methane purification is found in 5-stage scrubber at 10 bar, with water discharge of 11,000 kg/hr, which produces 7,627 kg/hour CH_4 with 97.24% methane content. © 2018 Penerbit Akademia Baru.

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