

Intisari

Perkembangan industri kelapa sawit di Indonesia menyebabkan peningkatan produksi limbah pabrik kelapa sawit (PKS), seperti *Palm Oil Mill Effluent* (POME). POME mengandung bahan organik tinggi, sehingga dapat dimanfaatkan menjadi biogas. Produksi biogas dari POME melibatkan banyak tahapan mikrobiologis, yang setiap tahapannya memiliki perbedaan kondisi optimum. Dalam penelitian ini dilakukan penambahan inokulum pada fermentasi 2 tahap terhadap produksi biogas dari POME yang dilakukan dalam digester *batch*. Inokulum yang digunakan adalah kotoran sapi (PoCo) dan cairan kolam anaerob PKS (PoAp). Pengujian pada penelitian ini adalah fermentasi tahap pertama dengan penambahan sumber aerasi pada proses hidrolisis hingga asetogenesis dengan waktu pengamatan 4 hari dengan interval 12 jam, serta fermentasi tahap kedua pada proses metanogenesis secara anaerobik dengan waktu pengamatan 6 hari dengan interval 24 jam. Pada fermentasi tahap pertama dilakukan pengujian total asam dengan metode titrasi, pengujian produksi asam asetat dilakukan dengan menggunakan test kit asetat. Pada fermentasi tahap kedua dilakukan pengujian total gas dengan metode *liquid displacement gas measurement*, pengujian produksi gas metana dengan gas kromatografi, dan nilai pH.

Berdasarkan hasil penelitian, penambahan aerasi pada proses hidrolisis hingga asetogenesis menunjukkan hasil produksi total asam dan asetat lebih tinggi dibandingkan tanpa penambahan sumber aerasi. Sementara itu, perlakuan fermentasi satu tahap (anaerob) menunjukkan produksi total gas lebih baik dibandingkan perlakuan fermentasi dua tahap (aerob-anaerob). Perlakuan penambahan inokulum tidak mempengaruhi produksi total gas yang dihasilkan, namun penambahan inokulum kolam anaerob PKS dengan fermentasi satu tahap menunjukkan produksi gas metana paling baik pada jam ke-48 dan ke-96 yakni sebesar 0,0533 mL dan 0,0435 mL.

Kata kunci: *Palm Oil Mill Effluent*, Biogas, Gas Metana, Fermentasi Dua Tahap.

Abstract

The development of palm oil industries in Indonesia have caused the increment of industrial liquid waste product, such as Palm Oil Mill Effluent (POME). POME contained high organic matter, so it can be used as biogas. The biogas production from POME involves many microbiological stages, which have different optimum conditions. This research aimed to know the effect of inoculum addition and two-stage fermentation on biogas production from POME. In this research, the addition of inoculum in the two-stage fermentation of biogas from POME was tried in a batch digester. The inoculum used in this research were cow dung (PoCo) and Palm Oil Mill (POM) anaerobic pond (PoAp). This research was evaluated by the effect of aeration introduction on the first stage of fermentation in the hydrolysis to acetogenesis process which was observed for 4 days with 12 hours intervals, and the effect of anaerobic condition on the second stage of fermentation for biogas production in methanogenesis process, which observed for 6 days with 24 hours intervals. The total acid was tested by titration method, the acetic acid production was tested by an acetate test kit, and pH value were observed on the first stage of fermentation. The total gas was tested by the liquid displacement gas measurement method, methane gas production testing using gas chromatography and the pH value were observed on the second stage of fermentation

Based on the results, the addition of aeration in the hydrolysis process for acetogenesis showed that the production of total acid and the acetate were higher than without aeration. Meanwhile, the one-stage (anaerobic) fermentation showed better total gas production than the two-stage (aerobic-anaerobic) fermentation. The addition of inoculum did not affect the total gas production, but the addition of inoculum anaerobic pond with one stage fermentation showed the highest methane gas production, which was 0.0553 mL and 0.0435 mL in 48 and 96 hours.

Keywords: Palm Oil Mill Waste, Biogas, Methane Gas, Two-Stage Fermentation.