A Comparative Assessment of Membrane Bioscrubber and Classical Bioscrubber for Biogas Purification

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Abstract : Raw biogas is a valuable renewable energy source however it usually needs removal of the impurities. The presence of hydrogen sulfide (H2S) in the biogas has detrimental corrosion effects on the cogeneration units. Removal of H2S from the biogas can therefore significantly improve the biogas quality. In this work, a conventional bioscrubber (CBS), and a dense membrane bioscrubber (DMBS) were comparatively evaluated in terms of H2S removal efficiency (RE), CH4 enrichment and alkaline consumption at gas residence times ranging from 5 to 20 min. Both bioscrubbers were fed with a synthetic biogas containing H2S (1%), CO2 (39%) and CH4 (60%). The results show that high RE (98%) was obtained in the DMBS when gas residence time was 20 min, whereas slightly lower CO2 RE was observed. While in CBS system the outlet H2S concentration was always lower than 250 ppmv, and its H2S RE remained higher than 98% regardless of the gas residence time, although the high alkaline consumption and frequent absorbent replacement limited its cost-effectiveness. The result also indicates that in DMBS when the gas residence time increased to 20 min, the CH4 content in the treated biogas enriched upto 80%. However, while operating the CBS unit the CH4 content of the raw biogas (60%) decreased by three fold. The lower CH4 content in CBS was probably caused by extreme dilution of biogas with air (N2 and O2). According to the results obtained here the DMBS system is a robust and effective biotechnology in comparison with CBS. Hence, DMBS has a better potential for real scale applications.

Keywords : biogas, bioscrubber, desulfurization, PDMS membrane

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