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BIOGAS ENRICHMENT VIA CHEMICAL ABSORPTION OF CARBON DIOXIDE AT A LABORATORY SCALE

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Abstract

Energy uses of biogas depend on its quality, which is related to its CH_4 and CO_2 content and the presence of impurities (H_2S, ammonia, siloxanes). Methane enrichment of biogas makes it suitable for use in the same applications as natural gas. Although different technologies have been developed for this purpose, their costs suppose a major drawback. Process optimization is therefore needed to improve techniques and achieve increased operational efficiency. Methane losses need to be minimized for economic and environmental reasons. The main objective of this study was to optimize a continuous absorption process to remove CO_2 from biogas obtained from anaerobic co-digestion and hence increase its heating value. Two chemical absorbents were tested in preliminary batch experiments; the best absorption capacity being obtained for monoethanolamine (MEA). Experiments were subsequently carried out with this absorbent in a packed tower. The liquid/gas (*L/G*) ratio had a marked influence as an operating parameter on the efficiency of the absorption process, modifying the required amount of MEA and the quality of the upgraded biogas. Different *L/G* ratios were tested using Raschig rings and a helical packed material, no relevant differences being found. The optimum *L/G* ratio seemed to fall within the 0.9-1.2 range for both materials when recirculating a 5% MEA solution. A quadratic correlation fitted the experimental data, giving a theoretical optimum *L/G* ratio of 1.1 for which the maximum CO_2 would be removed. As regards CO_2 content, the upgraded biogas could be injected in the gas grid or used as vehicle fuel.

Key words: biogas upgrading, biomethane, CO2 capture, packed tower, Raschig rings

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