Comparison of separation performance of absorption column and membrane contactor system for biohydrogen upgraded from palm oil mill effluent fermentation

Rosiah Rohani[a],Izzati Izni Yusoff[a],Nur Fatinah Ainaa Amran[a],Rosmawati Naim[b],Mohd Sobri Takriff[a]

[a] Department of Chemical and Process Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, Bangi, Malaysia

[b] Faculty of Chemical and Natural Resources Engineering, Universiti Malaysia Pahang, Kuantan, Malaysia

ABSTRACT

Treatment of palm oil mill effluent (POME) via fermentation under controlled conditions can produce a high-value biohydrogen (H_2) mixture containing carbon dioxide (CO_2). This H_2 can be enriched before it can be used for renewable energy, that is, in fuel cell. In this work, H_2 was upgraded via two techniques, namely absorption column and membrane contactor system. Ammonium hydroxide (NH_4OH), potassium hydroxide (KOH), and mixed solution of NH_4OH and KOH were used as the chemical absorbents for both techniques. In the absorption column, it was found that the mixed solution provided the highest H_2 purity (99%) at 1 M concentration with a gas flow rate of 0.2 L/min. Meanwhile, the mixed solution and KOH solution showed similar separation performance with H_2 purity of up to 75% in the gas–liquid membrane contactor. On investigating the separation performance for each of the compared techniques, it was found that the absorption column has a superior ability to purify H_2 than the membrane contactor system. However, the membrane contactor is more sustainable as it has the least drop in H_2 purity at a longer separation time during the separation process. Both techniques have their own advantages in purifying H_2, and thus they can be fairly considered for gas upgrading.

KEYWORDS

Absorption; CO_2; Hydrogen; Membrane technology; Separations

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