The Effect of Nanobubble Treated [TEA][CuCl2] Absorbent Concentration and Feed Gas Flow Rate Towards the Removal of Exhaust Gas From A Diesel Engine Through A Polysulfone Hollow Fiber Membrane = Pengaruh Konsentrasi Absorben Nanobubble-Treated [TEA][CuCl2] Dan Laju Alir Gas Umpan Terhadap Proses Penyisihan Emisi Gas Buang Mesin Diesel Melalui Kontaktor Membran Serat Berongga Polysulfone

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Abstrak

Konsumsi energi di Indonesia sebagian besar masih didominasi oleh sumber energi tak terbarukan seperti diesel. Saat dibakar, bahan bakar diesel dapat mengeluarkan gas buang beracun ke udara, salah satunya adalah karbon monoksida (CO). Teknologi pemisahan membran merupakan metode efisien yang dapat digunakan untuk menangkap gas buang dari atmosfer secara selektif. Dibandingkan dengan metode konvensional lainnya, teknologi pemisahan membran memiliki beberapa keunggulan antara lain, efisiensi pemisahan yang tinggi karena rasio volume terhadap luas permukaan yang tinggi, serta konsumsi energi dan biaya pengoperasian yang relatif rendah. Penelitian ini akan fokus pada penyerapan gas karbon monoksida dari gas buang mesin diesel menggunakan alat kontaktor membran serat berongga polysulfone. Pada percobaannya, akan digunakan dua absorben untuk membantu proses penyerapan pada kontaktor membran, yaitu tembaga (II) klorida (CuCl2) dan trietilamina (TEA). Selain itu, absorben tersebut akan menjalani perawatan nanobubble untuk meningkatkan efisiensi penyerapan. Variabel bebas yang akan diteliti dalam penelitian ini adalah laju alir gas umpan dan konsentrasi absorben nanobubble-treated [TEA][CuCl2]. Berdasarkan hasil penelitian, dengan laju alir gas umpan 100 mL/menit dan konsentrasi pelarut nanobubble-treated [TEA][CuCl2] 1 M, diperoleh efisiensi penyisihan gas CO dan fluks tertinggi berturut-turut 51,94% dan 1,203 x 10-8 mmol/cm2.s. CO loading tertinggi terdapat dengan laju alir gas umpan 100 mL/menit dan konsentrasi nanobubble-treated [TEA][CuCl2] 0,01 M; CO loading tertinggi yang dapat dicapai adalah 2,294 x 10-3 mmol CO/mol [TEA][CuCl2].s.
.....Energy consumption in Indonesia is still largely dominated by non-renewable energy sources such as diesel fuel. When burned, diesel fuel will release toxic exhaust gasses into the air, one of which is Carbon Monoxide (CO). Membrane separation technology represents an efficient method that can be used to selectively capture exhaust gas from the atmosphere. Compared to other conventional methods, membrane separation technology has several advantages including high separation efficiency due to a high surface area to volume ratio, as well as relatively low energy consumption and low operating costs. This research will focus on the absorption of carbon monoxide gas from the exhaust of a diesel engine using a polysulfone hollow fiber membrane contactor. In this experiment, two absorbents will be used to assist the absorption process in the membrane contactor, namely copper (II) chloride (CuCl2) and triethylamine (TEA). In addition to that, these absorbents will undergo nanobubble treatment to potentially improve absorption efficiency. The independent variables that will be examined in this research are the feed gas flow rate and concentration of the nanobubble-treated [TEA][CuCl2] absorbent. The results showed that the highest CO removal efficiency (%R) and mass transfer flux (J) was achieved by utilizing a feed gas flow rate of 100

mL/minute and nanobubble-treated [TEA][CuCl2] concentration of 1 M, where the results obtained are 51.94% and 1.203 x 10-8 mmol/cm2.s, respectively. The highest CO loading was achieved by utilizing a feed gas flow rate of 100 mL/minute and nanobubble-treated [TEA][CuCl2] concentration of 0.01 M; CO loading was measured to be 2.294 x 10-3 mmol CO/mol [TEA][CuCl2].s.