Pengaruh Konsentrasi Pelarut CuCl2 dan Laju Alir Gas Umpan terhadap Proses Penyisihan Emisi Gas Buang Mesin Diesel melalui Membran Serat Berongga Polysulfone = The Effect of CuCl2 Solvent Concentration and Feed Gas Flow Rate on Diesel Engine Exhaust Emissions Removal Process through Polysulfone Hollow Fiber Membrane

Fahra Azzahra Fitri, author

Abstrak

Sampai saat ini, sebagian besar sumber energi masih berasal dari energi tak terbarukan yang dapat memicu peningkatan emisi gas buang berbahaya, salah satunya, yaitu gas karbon monoksida (CO). Teknologi penyisihan gas berupa kontaktor membran dapat menjadi solusi alternatif karena keunggulannya yang memiliki area kontak yang luas dengan ukuran kontaktor relatif kecil, serta konsumsi energi dan biaya relatif rendah dibandingkan dengan teknologi konvensional. Penelitian ini berfokus pada proses absorpsi gas buang mesin diesel (CO) menggunakan modul membran serat berongga polysulfone sebagai perangkat perpindahan massa dengan bantuan pelarut Tembaga (II) Klorida (CuCl2) dan Trietilamina (TEA) sebagai absorben. Gas buang mesin diesel akan dialirkan pada bagian tube membran, sedangkan pelarut berada di bagian shell dan bersifat statis. Variabel bebas yang diuji pada penelitian ini adalah laju alir gas umpan dan konsentrasi pelarut CuCl2. Berdasarkan data hasil penelitian dengan laju alir gas umpan yang konstan sebesar 100 mL/menit dan konsentrasi perlarut CuCl2 tertinggi 1 M diperoleh efisiensi penyisihan gas CO dan fluks tertinggi berturut-turut senilai 70,09 % dan 2,628x10-6 mmol/cm2.s, sementara pada konsentrasi CuCl2 terendah 0,01 M diperoleh CO loading tertinggi sebesar 1,031 mmolCO/molCuCl2.s. Kemudian, dengan konsentrasi pelarut CuCl2 yang konstan 0,1 M, didapatkan efisiensi senilai 61,41% pada laju alir gas umpan terendah 100 mL/menit, sementara fluks dan CO loading tertinggi yang dapat dicapai berturut-turut sebesar 1,978x10-6 mmol/cm2.s dan 7,767x10-2 mmolCO/molCuCl2.s pada laju alir gas umpan tertinggi 200 mL/menit.

.....Until now, most energy sources still come from non-renewable energy which can lead an increase in harmful exhaust emissions, one of which is carbon monoxide (CO). The gas removal technology such as membrane contactor can be an alternative solution because of its advantages in having a large contact area with a relatively small contactor size, as well as relatively low energy consumption and low cost compared to conventional technologies. This research focuses on the absorption of diesel engine exhaust gases (CO) using polysulfone hollow fiber membrane modules as a mass transfer device and with the support of solvents Copper (II) Chloride and Triethylamine (TEA) as absorbents. Diesel engine exhaust gas will flow through the membrane tube, while the solvent is static in the shell section. The independent variables tested in this study are feed gas flow rate and CuCl2 solvent concentration. Based on research data with a constant feed gas flow rate of 100 mL/minute and the highest CuCl2 concentration of 1 M, the highest CO removal efficiency and flux were obtained respectively at 70.09% and 2.628x10-6 mmol/cm2.s, while at the lowest CuCl2 concentration of 0.01 M, the highest CO loading was obtained at 1.031 mmolCO/molCuCl2.s. In addition, with a constant CuCl2 concentration of 0.1 M, gas removal efficiency of 61.41% was obtained at the lowest feed gas flow rate of 100 mL/minute, while the highest flux and CO loading that could be

achieved were respectively 1.978x10-6 mmol /cm2.s and 7.767x102 mmolCO/molCuCl2.s at the highest feed gas flow rate of 200 mL/minute.