RINGKASAN

Pengaruh laju alir gas terhadap *capture* CO_2 oleh biochar dari cangkang kelapa sawit yang dimodifikasi KOH dan Melamin Sianurat pada *packed column* telah berhasil dilakukan dengan menggunakan rangkaian alat capture CO_2 pada *fixed-bed N-Doped Modified Biochar* dan NaOH *absorber purging bubble column*. Adapun tujuan dilakukan penelitian ini adalah menganalisis pengaruh laju alir gas N_2 terhadap capture CO_2 dengan campuran *biochar* yang diaktivasi dan di-*doping* nitrogen pada *packed column* dalam larutan NaOH, menentukan kapasitas adsorpsi *biochar* dari cangkang kelapa sawit dan menentukan karakteristik *modified biochar* menggunakan FTIR dan SEM-EDX.

Penyerapan gas CO_2 oleh adsorben *biochar* non aktivasi dan *N-Doped Modified Biochar* sama-sama meningkat seiring bertambahnya laju alir gas CO_2. Variasi laju alir gas CO_2 yang digunakan pada adsorben *biochar* non aktivasi dan *N-Doped Modified Biochar* adalah 1;3;5;7 dan 10 L/Menit dan pada penggunaan adsorben *biochar* non aktivasi didapatkan bobot penyerapan gas CO_2 berturut-turut sebesar 2.733 mg/L; 3.117,418 mg/L; 3.818,991 mg/L; 4.864,518 mg/L dan 5.910,635 mg/L, sedangkan penyerapan gas CO_2 oleh adsorben *n-doped modified biochar* berturut-turut yaitu sebesar 2.740,155 mg/L; 3.119,233 mg/L; 3.819,86 mg/L; 4.865,017 mg/L dan 5.910,85 mg/L. Kapasitas adsorpsi *biochar* non aktivasi terendah didapatkan sebesar 911,166 mg/g pada laju alir gas 1 L/menit dan kapasitas adsorpsi tertinggi yaitu 19.702,12 mg/g pada laju alir gas CO_2 10 L/Menit. Sedangkan kapasitas adsorpsi *N-Doped Modified Biochar* terendah yaitu 913,385 mg/g pada laju alir gas CO_2 1 L/Menit dan kapasitas adsorpsi tertinggi yaitu 19.702,833 mg/g.

Hasil analisis FTIR pada sampel *N-Doped Modified Biochar* didapatkan gugus OH, serapan vibrasi C=O (gugus karbonil), serapan vibrasi C=N, serapan vibrasi C=C yang menandakan adanya gugus aromatic, serapan vibrasi C-H yang menandakan adanya gugus alkana, serapan vibrasi C-H yang menandakan adanya gugus alken, serapan vibrasi C-N (terdeteksi gugus amina), serapan vibrasi C-O (terdeteksi gugus karbonil), serapan vibrasi N-H yang menandakan adanya gugus amina. Hasil SEM *N-Doped Modified Biochar* pada perbesaran 5000 dan 10.000 kali terlihat pori yang lebih besar dikarenakan telah melalui proses aktivasi. Tetapi pada pori *biochar* mengalami penyumbatan pori-pori karena proses pendopingan. Penyumbatan pori tersebut karena interaksi molekul atau atom yang masuk ke dalam struktur *biochar* saat di-*doping* dapat mengubah ikatan atau berinteraksi dengan komponen *biochar*, sehingga mempengaruhi permukaan dan struktur material.

Kata Kunci : *Capture* CO_2, *Biochar* Non Aktivasi, *N-Doped Modified Biochar* dan Laju Alir Gas

SUMMARY

The effect of gas flow rate on CO_2 capture by biochar from palm kernel shells modified with KOH and Melamine Cyanurate on a packed column has been successfully carried out using a series of CO_2 capture devices on a fixed-bed N-Doped Modified Biochar and NaOH absorber purging bubble column. The aim of this research is to analyze the effect of N_2 gas flow rate on CO_2 capture with a mixture of activated and nitrogen-doped biochar in a packed column in NaOH solution, determine the adsorption capacity of biochar from palm oil shells and determine the characteristics of modified biochar using FTIR and SEM- EDX.

The absorption of CO_2 gas by non-activated biochar adsorbent and N-Doped Modified Biochar both increased as the CO_2 gas flow rate increased. Variations in the flow rate of CO_2 gas used in non-activated biochar adsorbents and N-Doped Modified Biochar were 1;3;5;7 and 10 L/Minute and when using non-activated biochar adsorbents the weight of CO_2 gas absorption was 2,733 mg/minute respectively. L; 3,117.418 mg/L; 3,818.991 mg/L; 4,864.518 mg/L and 5,910.635 mg/L, while the absorption of CO_2 gas by the n-doped modified biochar adsorbent respectively was 2,740.155 mg/L; 3,119.233 mg/L; 3,819.86 mg/L; 4,865.017 mg/L and 5,910.85 mg/L. The lowest adsorption capacity of non-activated biochar was found to be 911.166 mg/g at a gas flow rate of 1 L/minute and the highest adsorption capacity was 19,702.12 mg/g at a CO_2 gas flow rate of 10 L/minute. Meanwhile, the lowest adsorption capacity of N-Doped Modified Biochar was 913.385 mg/g at a CO_2 gas flow rate of 1 L/Minute and the highest adsorption capacity was 19,702.833 mg/g.

The results of FTIR analysis on the N-Doped Modified Biochar sample showed OH groups, C=O vibration absorption (carbonyl group), C=N vibration absorption, C=C vibration absorption which indicates the presence of aromatic groups, C-H vibration absorption which indicates the presence of alkane groups, C-H vibrational absorption which indicates the presence of an alkene group, C-N vibrational absorption (amine group detected), C-O vibrational absorption (carbonyl group detected), N-H vibrational absorption which indicates the presence of an amine group. SEM results of N-Doped Modified Biochar at 5000 and 10,000 times magnification show larger pores because it has gone through an activation process. However, the pores in biochar experience blockage due to the doping process. This pore blockage is due to the interaction of molecules or atoms that enter the biochar structure when it is doped, which can change the bonds or interact with the biochar components, thus affecting the surface and structure of the material.

Keywords: CO_2 Capture, Non-Activated Biochar, N-Doped Modified Biochar and Gas Flow Rate