Development of carbon dioxide adsorbent from rice husk char

Abstract

This study was mainly concerned about the development of carbon dioxide (CO_2) adsorbent from rice husk (RH). Several chemical treatments were used to produce activated rice husk char (RHAC) from RH. Initially the RH was refluxed with 3M of sodium hydroxide (NaOH) solution, activation followed by using 0.5M of zinc chloride ($ZnCl_2$) solution and finally acidic treatment by using 0.1M of hydrochloric acid (HCl). Then, the RHAC was functionalized by using 3-chloropropylamine hydrochloride (3-CPA) and noted as RHN. RHN samples were characterized with scanning electron microscopy (SEM), mercury intrusion porosimetry (MIP), fourier transform infrared spectroscopy (FTIR). Based on the SEM, the RHN sample had a large pore diameter compared to RH sample after being treated. Based on MIP data, the average pore diameter between RH and RHAC samples were increased significantly from 0.928 microns to 1.017 microns. The RHN sample also had higher total porosity (%) compared to RHAC and RH (58.45%, 47.82% and 45.57% respectively). The total specific surface area of the sample was much increasing from RHO to RHAC (29.17 m^2/g and 62.94 m^2/g respectively) and slightly being decreasing from RHAC to RHN (58.88 m^2/g). FTIR result showed the present of weak band at 1587 cm^{-1} which demonstrating of the amine group present on the sample. The CO_2 capture result showed that the decreasing of operating temperature can increase the breakthrough time of CO_2 capture. On the contrary decreasing of CO_2 gas flow rate can increase the breakthrough time of CO_2 capture. The highest total amount of CO_2 adsorbed was 25338.57 mg of CO_2/g of RHN sample by using 100 mL/min of gas flow rate at 30^oC. Based on adsorption isotherm analysis, the Freundlich isotherm was the best isotherm to describe the CO_2adsorption on the sample.