CO_2 capture using amine-impregnated activated carbon from Jatropha curcas shell

Abstract

This study is aimed at the synthesis and amine functionalization of *Jatropha curcas* activated carbon. Waste *Jatropha curcas* shell was used to produce the Jatropha Activated Carbon (JAC) via chemical activation with Potasium hydroxide (KOH). The JAC was modified with triethanolamine (TEA) to produce (JAC-TEA). The performance of both adsorbents in CO_2 capture study was evaluated in a cylindrical glass column equipped with a digital mass balance. The effect of adsorbent dosage (0.5-1.5 g) and temperature (30-60°C) as a function of time was investigated. The results showed that CO_2 adsorption capacities of the adsorbents increase on amine loading and adsorbent dosage (bed height), while the adsorption capacity decreases with increase in temperature. Adsorption capacity of JAC and JAC-TEA were 66 and 78 mg/g respectively. Crystallinity, morphological structure and surface functional groups of adsorbents were characterized using X-ray diffraction, Scanning electron microscopy and Fourier Transformed Infra red spectrophotometer respectively, while the surface areas and porosity were determined by Brunauer-Emmett-Teller. Both adsorbents had good crystallinity with a well-developed pore structures. The mechanism of CO_2 adsorption onto JAC and JAC-TEA is physisorption and that the adsorbent (JAC-TEA) can be used upto 7 cycles. The results of this study have revealed that a cost-effective high quality porous activated carbon can be prepared from a cheap carbonaceous material like *Jatropha curcas* shell and modified to improve its CO_2adsorption capacity.