Porous Carbon Materials from South Africa Coal Wastes for Gas Storage Applications: Synthesis and Characterization

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Availability, tuneable microstructure and large specific surface area of porous carbon materials has made it suitable for as gas storage application. In this study, activated carbons were prepared from three distinct South Africa coal wastes (run-of-mine fines, discard and flotation slurry) by KOH activation. Preliminary analysis (proximate and ultimate analysis) of the coal waste samples showed a high percentage of carbon and low ash content, a good indication of a good material for preparing porous carbon. The synthesized activated carbons were characterized by nitrogen at 77 K adsorption – desorption isotherms, SEM/EDS, FTIR, and XRD. The largest surface area of 1925.34 m2/g, 1893.41 m2/g, 1484.96 m2/g, pore volume of 1.26 cm3/g, 1.21 cm3/g, 1.03 cm3/g and pore size of 2.51 nm, 2.66 nm and 2.90 nm were obtained for activated carbons from ROM fines, discard and slurry respectively. SEM/EDS analysis showed the development of pores and presence of high carbon element, FTIR analysis confirmed the presences of carbonyls, alkenes and hydroxyls. XRD analysis reveals a broad diffraction background which is an indication of a largely amorphous structure. Based on the requirements of suitable porous materials for gas storage application, it could be stated that the produced activated carbons from South Africa coal wastes could well be applied for gas storage.