PREPARATION AND CHARACTERIZATION OF ACTIVATED CARBON FROM TAMARIND SEED BY USING $ZnCl_2$ SINGLE STEP CHEMICAL ACTIVATION

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ABSTRACT

PREPARATION AND CHARACTERIZATION OF ACTIVATED CARBON FROM TAMARIND SEED BY USING $ZnCl_2$ SINGLE STEP CHEMICAL ACTIVATION

In this study, high-quality activated carbon (AC) was effectively synthesized from waste tamarind seed (TS) using single-step chemical activation with $ZnCl_2$ as the chemical activator under different synthesizing parameter such as, the effect of impregnation ratio of raw/activating agent (1:0.5, 1:1, 1:1.5 and 1:2), activation time (10, 20, 30, 40 min), and activation temperature (600 °C, 700 °C, 800 °C and 900 °C). The raw TS, char and the synthesized AC were characterized by Fourier Transform Infrared Spectroscopy (FTIR), sodium thiosulfate ($Na_2S_2O_3$) volumetric method, CHNS elemental analysis and Scanning Electron Microscopy (SEM) analysis (SEM). In addition, the proximate analysis was done to determine the percentage of moisture, ash, volatile matter and fixed carbon content in raw TS and AC. The optimal condition for maximizing the surface area of AC was identified based on highest iodine number (IN) from sodium thiosulfate ($Na_2S_2O_3$) volumetric titration results. The maximum IN value of 905.03 mg/g was obtained at impregnation ratio of 1:1.5, activation temperature of 800°C and activation time of 30 min. The maximum percentage yield under the optimum synthesizing condition was 21.9%. FTIR showed the presence of -OH vibration at 3378 cm^{-1}, 3398 cm^{-1} and 3381 cm^{-1} for the raw TS, char and AC spectrum respectively. However, disappearance of peaks were observed in the IR spectra of char and AC due to the elimination of volatile components during the activation process. Proximate analysis proved that TS was the best choice of raw material in the production of AC with low moisture content (8.00%), low ash content (1.86 %), high volatile content (68.24%) and high fixed carbon content (21.9%). Moreover, the decrease in volatile matter content for AC (20.05%) and increase in fixed carbon content (58.9%) indicates the effectiveness of the activation process. A significant increase in Carbon % of 48.52% was recorded for AC in comparison to the raw TS, that registered only 41.40 %. SEM analysis proved the development of porous networks occurred on the surface of synthesized ACs compared to raw TS and char. To conclude, low-cost agricultural waste of TS has been successfully converted into high value AC under the studied parameter condition.