World Academy of Science, Engineering and Technology
International Journal of Biological and Ecological Engineering
Vol:10, No:04, 2016

Preparation and Chemical Characterization of Eco-Friendly Activated Carbon Produced from Apricot Stones

Authors : Sabolč Pap, Srđana Kolaković, Jelena Radonić, Ivana Mihajlović, Dragan Adamović, Mirjana Vojinović Miloradov, Maja Turk Sekulić

Abstract : Activated carbon is one of the most used and tested adsorbents in the removal of industrial organic compounds, heavy metals, pharmaceuticals and dyes. Different types of lignocellulosic materials were used as potential precursors in the production of low cost activated carbon. There are, two different processes for the preparation and production of activated carbon: physical and chemical. Chemical activation includes impregnating the lignocellulosic raw materials with chemical agents (H3PO4, HNO3, H2SO4 and NaOH). After impregnation, the materials are carbonized and washed to eliminate the residues. The chemical activation, which was used in this study, has two important advantages when compared to the physical activation. The first advantage is the lower temperature at which the process is conducted, and the second is that the yield (mass efficiency of activation) of the chemical activation tends to be greater. Preparation of activated carbon included the following steps: apricot stones were crushed in a mill and washed with distilled water. Later, the fruit stones were impregnated with a solution of 50% H3PO4. After impregnation, the solution was filtered to remove the residual acid. Subsequently impregnated samples were air dried at room temperature. The samples were placed in a furnace and heated (10 °C/min) to the final carbonization temperature of 500 °C for 2 h without the use of nitrogen. After cooling, the adsorbent was washed with distilled water to achieve acid free conditions and its pH was monitored until the filtrate pH value exceeded 4. Chemical characterizations of the prepared activated carbon were analyzed by FTIR spectroscopy. FTIR spectra were recorded with a (Thermo Nicolet Nexus 670 FTIR) spectrometer, from 400 to 4000 cm-1 wavenumbers, identifying the functional groups on the surface of the activated carbon. The FTIR spectra of adsorbent showed a broad band at 3405.91 cm-1 due to O–H stretching vibration and a peak at 489.00 cm-1 due to O–H bending vibration. Peaks between the range of 3700 and 3200 cm−1 represent the overlapping peaks of stretching vibrations of O–H and N–H groups. The distinct absorption peaks at 2919.86 cm−1 and 2848.24 cm−1 could be assigned to -CH stretching vibrations of –CH2 and –CH3 functional groups. The adsorption peak at 1566.38 cm−1 could be characterized by primary and secondary amide bands. The sharp bond within 1164.76 – 987.86 cm−1 is attributed to the C–O groups, which confirms the lignin structure of the activated carbon. The present study has shown that the activated carbons prepared from apricot stone have a functional group on their surface, which can positively affect the adsorption characteristics with this material.

Keywords : activated carbon, FTIR, H3PO4, lignocellulosic raw materials
Conference Title : ICCEBE 2016 : International Conference on Chemical, Environmental and Biological Engineering
Conference Location : Lisbon, Portugal
Conference Dates : April 14-15, 2016