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Removal of Methylene blue from aqueous solution with activated carbon produced from hazelnut shells by K_2CO_3 activation

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ABSTRACT

The purpose of this investigation is to produce activated carbon from hazelnut shells by using chemical activation method of potassium carbonate. For the activation, the shells were milled and sieved in range of 50–150 mesh and then impregnation ratios were selected at the ranges of 1:1, 1:2 and 1:3. The carbonisation was carried out under the N_2 gas pressure with flow rate of 100 mL min^{-1} at 873.15 K for 120 min. The characterization of carbonization of activated carbon were executed with the X-ray diffraction, Fourier-transform infrared spectroscopy and scanning electron microscopy after drying samples and also in order to determine the adsorption capacity, the iodine and Methylene blue numbers were used. In this research, the microporous character of series of activated carbons has been analyzed using of the Brunauer–Emmett–Teller (BET) equation. N_2(BET) surface area was found to have the maximum BET area as 644 m^2 g^{-1}, the absorbants of iodine and Methylene blue numbers were determined 1,974 mg/I_2 and 489 mg g^{-1}, respectively for 70 mesh in the impregnation ratio of 1:2. In the addition to that the kinetic of Methylene blue adsorption were determined by the pseudo-second-order kinetic model and also the thermodynamic parameters were calculated to see whether the adsorption was spontaneous or not. The experimental data indicated that the adsorption isotherms were well matched by the Langmuir equilibrium isotherm equation given as 454.5 mg g^{-1} at 293 K.

Keywords: Activated carbon; Potassium carbonate; Hazelnut shell; Brunauer–Emmett–Teller; Iodine number; Kinetic; Adsorption; Methylene blue

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