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Physical and chemical characteristics of activated carbon prepared by pyrolysis of chemically treated date stones and its ability to adsorb organics

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Abstract

Preparation of activated carbons from date stones by activation with ferric chloride (FAC) and commonly used zinc chloride (ZAC) has been investigated. The characteristics of such carbons were evaluated and found to have surface areas of 780.06 and 1045.61 m^2/g, respectively. Effects of activation time, activation temperature, and impregnation ratio on the yield and iodine number of FAC and ZAC were studied. At best conditions, 761.40 mg/g maximum iodine number and 47.08 % yield for FAC were obtained compared to 1008.86 mg/g maximum iodine number and 40.46 % yield for ZAC. The experimental equilibrium data for methylene blue (MB) and phenol (Ph) adsorption on prepared carbons were well fitted to the Langmuir isotherm model, showing maximum MB and Ph capacities of 381.79 and 169.55 mg/g for ZAC; and 255.32 and 181.03 mg/g for FAC, respectively. The kinetic data were found to follow closely the pseudo-second order model for both adsorbates. The calculated thermodynamic parameters, namely ΔG, ΔH, and ΔS showed that adsorption of MB and Ph on prepared carbons was spontaneous and endothermic under examined conditions.