Isotherm Models for Aqueous Manganese (II) Adsorption by Bamboo Wood Based Activated Carbon

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The adsorption is considered the most effective technology for the removal of contaminants from water. The production of low cost, efficient and eco-friendly adsorbents is a growing concern, and activated carbon is considered a viable solution. In this study, bamboo which is an abundant and inexpensive material was used to prepare activated carbon, and adsorption of Mn (II) onto bamboo wood activated carbon (BAC) was investigated. BAC was prepared by chemical impregnation with KOH at a 1:1 ratio followed by pyrolysis at 800 °C for 2 hours. Adsorption isotherm of the Mn (II) onto BAC was determined and correlated with Langmuir and Freundlich isotherms. A Commercial Activated Carbon (CAC) was used as a reference. The experimental data at optimum conditions (pH=6-7, adsorbent dose = 5g/L, contact time - 5 hours) for BAC shows a better fit with Langmuir model (R^2=0.9960) than Freundlich model (R^2=0.9740), whereas CAC shows a better fit with Freundlich model (R2=0.9815) than Langmuir model (R^2 = 0.9720). The Langmuir constant (KL) and adsorption capacity (Qm) were calculated with graphical data. KL is 0.2940 mg^{-1} for BAC and 0.7740 mg^{-1} for CAC, which implies BAC has a higher affinity than CAC between adsorbent and adsorbate. Qm was 0.9620 mg g−1 for BAC and 2.259 mg g^{-1} for CAC. For Freundlich model experimental data, the Freundlich constant (KF) and adsorption intensity (1/n) was calculated and it results in KF of 0.5350 mg g−1 for BAC and 2.929 mg g^{-1} for CAC. The 1/n values are 0.4358 and 1.162 for BAC and CAC respectively which BAC indicates more favourable adsorption than CAC. Mn (II) is found to adsorb strongly on the surface of activated carbon and adsorption behavior is described by a monolayer, homogeneous Langmuir type isotherm. The present investigation showed that bamboo can be effectively used as a raw material for the preparation of activated carbon for the removal of Mn (II) from aqueous solutions.

Keywords: Bamboo, Activated Carbon, Langmuir, Freundlich, Manganese