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橘子皮化学改性及其对Cu(II) 离子的吸附性能

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摘 要: 以橘子皮为基体, 经环氧氯丙烷交联后, 以Ce⁴⁺为引发剂将丙烯酸甲酯单体接枝到橘子皮上, 再经过皂化制备改性橘子皮生物吸附剂。研究溶液pH、吸附时间和Cu²⁺初始浓度对生物吸附剂吸附性能的影响。结果表明, 在pH值为5.5, Cu²⁺初始质量浓度为50 mg/L, 吸附时间为3 h的条件下, 该生物吸附剂对Cu²⁺去除率为94.6%, 吸附容量为24.41 mg/g。Cu²⁺在该生物吸附剂上的吸附过程可以用准二级动力学方程很好地描述。吸附等温线结果表明, 该生物吸附剂对Cu²⁺的吸附用Freundlich方程拟合效果优于用Langmuir方程拟合效果。将该生物吸附剂用于含Cu²⁺ 5.8 mg/L的电镀废水, Cu²⁺去除率可达97%。通过红外光谱表征该生物吸附剂的结构, 说明羧基和羟基与金属离子的结合引起该生物吸附剂对Cu²⁺的吸附。该生物吸附剂可以再生重复使用4次以上。

关键字: 橘子皮; 化学改性; Cu(II)离子; 生物吸附

Biosorption of Cu(II) ion on modified orange peel

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Abstract: The chemically modified orange peel was prepared from hydrolysis of the grafted copolymer, which was synthesized by interacting methyl acrylate with cross-linking orange peel. Various factors were investigated by batch experiments, including pH value, adsorption time and initial concentration of Cu²⁺, to study their effects on adsorption characteristics of the biosorbent on Cu²⁺. The results show that when pH value is 5.5 and the initial concentration of Cu²⁺ is 50 mg/L, the removal rate achieves 94.6% after 3 h adsorption, and the adsorption capacity is 24.41mg/g. The kinetic characteristics of Cu²⁺ biosorption were investigated and the adsorption processes were found to follow pseudo-second order type adsorption kinetics. The adsorption isotherms results indicate that Freundlich model fits the adsorption process much better than the Langmuir model. The removal rate of 5.8 mg/L Cu²⁺ in 50 mL of electroplating wastewater is 97%

when 1 g of the biosorbent is used at pH value of 5.5. The biosorbent was characterized by using infrared spectroscopy. The analysis of IR spectrum indicates that the adsorption of Cu^{2+} by the biosorbent caused the combination of carboxyl and hydroxyl groups with heavy metal. The biosorbent is suitable for repeated use more than four cycles.

Key words: orange peel; chemical modification; Cu(II) ion; biosorption

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