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研究论文

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## 柴胡药渣对锌离子的吸附动力学特性

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### Biosorption Kinetics Characteristics of Bupleurum Dreg to Zinc Ions

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**摘要** 为了探讨柴胡药渣对含锌废水的吸附特性和液相pH值、电导率变化特性,以柴胡药渣为生物吸附剂,进行了Zn<sup>2+</sup>批量吸附实验研究。分析了液相pH值、Zn<sup>2+</sup>初始浓度(C<sub>0</sub>)、柴胡药渣加入质量浓度(ρ<sub>m</sub>)、粒度(M<sub>Z</sub>)等因素对吸附效果的影响,并进行等温吸附模拟及吸附动力学相关分析。结果表明,实验室环境下的最佳的吸附条件为:pH值为4.0~6.0,ρ<sub>m</sub>为4.0~8.0 g/L,M<sub>Z</sub>为40~100目,C<sub>0</sub>为0.1~2.0 mmol/L。柴胡药渣对Zn<sup>2+</sup>的等温吸附结果很好符合了Langmuir和Freunlich吸附模型,R<sup>2</sup>分别为0.978和0.989;计算所得最大吸附量(q<sub>max</sub>)达到19.96 mg/g,说明柴胡药渣对Zn<sup>2+</sup>有很好的吸附能力。动力学吸附分析表明,柴胡药渣对Zn<sup>2+</sup>的吸附是一个快速进行的反应过程,二级吸附速率方程拟合结果中R<sup>2</sup>均在0.997以上,由此认为其吸附反应过程中限速步骤是化学吸附过程。柴胡药渣对Zn<sup>2+</sup>吸附过程中液相pH值分析表明,pH值呈现初始阶段迅速升高后进入缓慢变化的趋势。

**关键词**: 柴胡药渣, 锌离子, 生物吸附, 动力学

**Abstract**: In order to explore the adsorption characteristics, liquid pH, and electrical conductivity variation characteristics of bupleurum dreg to the waste water containing zinc, the bupleurum dreg was utilized as biosorbent to remove Zn<sup>2+</sup> with batch experiments. The effect factors on biosorption were analyzed, which included pH values, initial Zn<sup>2+</sup> concentration (C<sub>0</sub>), biosorbent concentration (ρ<sub>m</sub>), and mesh size (M<sub>Z</sub>). Meanwhile, the isotherm biosorption and kinetics was analyzed. The results showed that the optimum condition for biosorption was as follows: pH was 4.5~6.0, ρ<sub>m</sub> was 4.0~8.0 g/L, C<sub>0</sub> was 0.1~2.0mmol/L, M<sub>Z</sub> was 40~100 mesh. The isotherm adsorption curve of Zn<sup>2+</sup> on bupleurum dreg accorded well with Langmuir and Freunlich model, and the R<sup>2</sup> value was 0.978 and 0.989 while the value of q<sub>max</sub> was 19.96 mg/g. This shows that a bupleurum dreg has excellent adsorption capacity to zinc ions. The kinetics analysis showed that the biosorption of Zn<sup>2+</sup> on bupleurum dreg was a rapid process, and the R<sup>2</sup> values were all above 0.997. These indicated that its limit step was chemical adsorption process. The variation trend of pH values in liquid was increasing rapidly at initial adsorption phase and then changed slowly in the succedent phases.

**Key words**: bupleurum dreg zinc ions biosorption kinetics

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