

研究报告

## 榕树叶-活性污泥协同曝气吸附铀的热动力学

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**摘要** 通过吸附动力学实验及等温吸附实验, 研究了20~50 °C榕树叶-活性污泥协同曝气吸附铀的热动力学性质。结果表明, 调节pH=3.0, 吸附时间60 min, 榕树叶-活性污泥体系对初始质量浓度为100 mg/L的UO<sub>2</sub><sup>2+</sup>的吸附率超过99%, 室温20 °C下最大吸附量达到13.055 mg/g。吸附动力学过程可用准二级吸附速率方程来描述, 计算值与实测值吻合良好, 相关系数达0.99以上。吸附平衡符合Langmuir和Freundlich等温吸附方程, 相关系数都大于0.98, 体现了单层吸附与多层覆盖相结合的吸附模式; 求得反应的 $\Delta H=-45.2$  kJ/mol,  $\Delta S=-46.2$  J/(mol·K),  $\Delta G$ 分别为-31.7 (20 °C), -31.2(30 °C), -30.7 (40 °C), -30.3(50 °C) kJ/mol。根据 $\Delta G<0$ ,  $\Delta H<0$ 及平均吸附能大小判断, 榕树叶-活性污泥协同曝气体系吸附铀是自发、放热的物理吸附反应。

**关键词** [榕树叶](#); [活性污泥](#); [铀](#); [动力学](#); [热力学](#)

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## Thermodynamic and Kinetics for Synergistic Aeration Adsorption Uranium(VI) on Banyan Leaves-Activated Sludge

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**Abstract** Synergistic aeration adsorption of uranium from aqueous solution using banyan leaves (BL) and activated sludge(AS) was investigated by thermodynamic and kinetics batch experiments in the temperature range of 20- 50 °C. The results show that the adsorption ratio of U(VI) with the initial concentration of 100 mg/L on BL- AS is more than 99%, and the maximal adsorption capacity is 13.055 mg/g for 60 min, at pH=3.0 and 20 °C. Pseudo 2nd- order model best describes the reaction kinetics; the adsorption capacity calculated by the model is consistent with that actual measured ( $r^2>0.99$ ). The experimental data better follow Freundlich isotherm model and Langmuir isotherm model at 20 °C ( $r^2>0.98$ ). For the whole adsorption process, the enthalpy change is -45.2 kJ/mol, the entropy change is -46.2 J/(mol·K), and the Gibbs free energy change is -31.7 (20 °C), -31.2 (30 °C), -30.7 (40 °C), -30.3 (50 °C)kJ/mol respectively, which indicates that the process is spontaneous, radiative, irreversible and physical adsorption process.

**Key words** [banyan leaves](#) \_ [activated sludge](#) \_ [uranium](#) \_ [kinetics](#) \_ [thermodynamic](#)

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