SO$_2$体积分数对ZL50活性炭吸附脱硫行为的影响和动力学分析

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中文摘要

　　通过动态吸附烟气脱硫实验，考察了烟气中不同SO$_2$体积分数对ZL50脱硫脱硝活性炭脱硫行为的影响，并进行了动力学分析. 随着烟气中SO$_2$体积分数增大，脱硫率和ZL50脱硫脱硝活性炭的活性度下降；SO$_2$吸附量和吸附速率增大. 模拟结果表明，Bangham模型模拟效果最优，SO$_2$的催化氧化反应对化学吸附有重要影响；Lagergren准一级吸附速率常数随SO$_2$进口体积分数的增加而增大，表明SO$_2$的催化氧化反应在吸附前期可能为速控步骤. 推导和定义了Lagergren模型和Bangham模型的初始吸附速率；推导了文献上的Ho模型和Elovich模型的初始速率式。定义的Bangham初始吸附速率与初始吸附速率实验值吻合最好；建立的Bangham吸附反应动力学模型能较好地描述SO$_2$动态吸附速率. 结果表明，SO$_2$的初始反应速率分级数为1或接近1，而O$_2$和水蒸气的初始速率分级数分别为0.15～0.20和0.45～0.50之间的常数.

英文摘要

　　The influence of SO$_2$ dynamic adsorption behaviors using ZL50 activated carbon for flue gas desulphurization and denitrification under different SO$_2$ volume fraction was investigated experimentally, and the kinetic analysis was conducted by kinetic models. With the increase of SO$_2$ volume fraction in flue gas, the SO$_2$ removal ratio and the activity ratio of ZL50 activated carbon decreased, respectively, and SO$_2$ adsorption rate and capacity increased correspondingly. The calculated results indicate that Bangham model has the best prediction effect, the chemisorption processes of SO$_2$ was significantly affected by catalytic oxidative reaction. The adsorption rate constant of Lagergren's pseudo first order model increased with the increase of inlet SO$_2$ volume fraction, which indicated that catalytic oxidative reaction of SO$_2$ adsorbed by ZL50 activated carbon may be the rate controlling step in earlier adsorption stage. The Lagergren's and Bangham's initial adsorption rate were deduced and defined, respectively. The Ho's and Elovich's initial adsorption rate were also deduced in this paper. The Bangham's initial adsorption rate values were defined in good agreement with those of experiments. The defined Bangham's adsorptive reaction kinetic model can describe the SO$_2$ dynamic adsorption rate well. The studied results indicated that the SO$_2$ partial order of initial reaction rate was one or adjacent to one, while the O$_2$ and water vapor partial order of initial reaction rate were constants ranging from 0.15-0.20 and 0.45-0.50, respectively.