化工学报 2009 60 (9): 2215-2220 ISSN: 0438-1157 CN: 11-1946/TQ

催化、动力学与反应器

TiO_2纳米管/UV/O_3对腐殖酸的降解动力学

潘留明，季民，王秀朵，赵乐军，陆彬

天津大学环境科学与工程学院;天津市市政工程设计研究院

收稿日期 2009-1-12 修回日期 2009-6-8 网络版发布日期 2009-9-11 接受日期

摘要 用自制的TiO_2纳米管（TNTs）作为催化剂，对腐殖酸进行TNTs/UV/O_3工艺降解研究. 从动力学角度分析了光催化、臭氧化的协同作用及催化剂煅烧温度的影响，考察了反应温度、初始pH值、催化剂投加量和臭氧投加量对降解速率的影响，建立了新型动力学模型. 结果表明，光催化和臭氧化有很强的协同作用，催化剂最佳煅烧温度为400℃，腐殖酸的TOC降解过程符合零级反应，模型显示当原水pH值为7. 35，TNTs投加量0. 806g·L^{-1}，O_3投加量0. 49g·h^{-1}时TNTs/UV/O_3对腐殖酸TOC的降解取得最佳反应速率，当反应温度T为25℃时，最佳k为0. 8095mg·L^{-1}·min^{-1}，当反应温度T为30℃时，最佳k为0. 8231mg·L^{-1}·min^{-1}. 试验结果和模型结果对比得出试验值基本符合动力学模型.

关键词

TiO_2纳米管 腐殖酸 光催化 臭氧化 动力学

分类号

Kinetics of humic acid degradation by TiO_2 nanotubes/UV/O_3

PAN Liuming, JI Min, WANG Xiuduo, ZHAO Lejun, LU Bin

Abstract

Titanium dioxide nanotubes (TNTs) were prepared and used as catalysts for degradation of humic acid by titanium dioxide nanotubes/UV/O_3.With a view of kinetics, the effect of calcination temperature and the synergistic effect of photocatalysis and ozonation were analyzed.The influences of reaction temperature, original pH value, dosage of TNTs and dosage of ozone on the reaction kinetics were also investigated, and the reaction kinetics model was established.The result showed that photocatalysis and ozonation had a good synergistic effect and the best reaction temperature of TNTs was 400℃.The TOC removal of humic acid followed zero-order kinetics.In the model, the best reaction kinetics k was obtained under the condition with original pH value of 7.35, TNTs dosage of 0.806 g·L^{-1} and ozone dosage of 0.49 g·h^{-1}.It was 0.8095 mg·L^{-1}·min^{-1} when the reaction temperature was 25℃ while 0.8231 mg·L^{-1}·min^{-1} at 30℃.The theoretical predictions were in good agreement with the experimental data.

Key words

titanium dioxide nanotubes humic acid photocatalysis ozonation kinetics

DOI:

通讯作者 潘留明 liumingpan@126.com