

郑森鸿,叶盛英,黄 迅,沈生文.利用60Co- $\gamma$ 射线辐照使TiO<sub>2</sub>改性后对乙烯的催化降解效果[J].农业工程学报,2013,29(20):286-292

## 利用60Co- $\gamma$ 射线辐照使TiO<sub>2</sub>改性后对乙烯的催化降解效果

### Photoelectrocatalytic degradation of ethylene with TiO<sub>2</sub> modified by 60Co $\gamma$ -ray irradiation

投稿时间: 2013-07-22 最后修改时间: 2013-09-23

中文关键词: [TiO<sub>2</sub>辐照](#), [乙烯](#), [60Co- \$\gamma\$ 射线](#)

英文关键词: [titanium dioxide irradiation](#) [ethylene](#) [60Co  \$\gamma\$ -ray](#)

基金项目:国家自然科学基金资助项目 (31171449)

作者	单位
<a href="#">郑森鸿</a>	<a href="#">华南农业大学食品学院, 广州 510642</a>
<a href="#">叶盛英</a>	<a href="#">华南农业大学食品学院, 广州 510642</a>
<a href="#">黄 迅</a>	<a href="#">华南农业大学食品学院, 广州 510642</a>
<a href="#">沈生文</a>	<a href="#">华南农业大学食品学院, 广州 510642</a>

摘要点击次数: 189

全文下载次数: 148

中文摘要:

为了解60Co- $\gamma$ 射线辐照且以活性炭纤维(activated carbon fiber, ACF)为载体所负载Ag沉积的TiO<sub>2</sub>的半导体材料(Ag-TiO<sub>2</sub>/ACF)对光催化降解冷藏环境中乙烯的影响,在模拟园艺产品的冷藏环境中,研究了不同辐照剂量下的TiO<sub>2</sub>对乙烯的降解,并利用X射线衍射仪(XRD)及X-射线光电子能谱(XPS)对所制备的光催化材料进行相关的表征分析。表征结果表明:随着辐照剂量的增加,总体上锐钛矿的含量及尺寸减小, Ti<sup>3+</sup>及羟基氧含量提高,这些变化能使TiO<sub>2</sub>的催化活性增强。乙烯降解试验结果表明,当辐照剂量小于25 kGy时,乙烯降解速率随辐照剂量的提升而提高;当辐照剂量大于25 kGy时,乙烯降解速率随辐照剂量的提升而下降,可能是辐照能量过高导致TiO<sub>2</sub>粒子聚集沉淀,催化能力下降。研究结果为 TiO<sub>2</sub>光催化技术的进一步应用提供了参考。

英文摘要:

Abstract: Horticultural products are abundant in China. However, a large amount of them were deteriorated due to the lack of appropriate storage and transport technology, resulting in a huge waste. Ethylene gas is one of the main reasons which cause the deterioration of horticultural products in storage. Nanometer TiO<sub>2</sub> photoelectrocatalysis technology is a new technique developed in recently. TiO<sub>2</sub>, under UV light, can degrade organics such as ethylene, so it provides a potentially effective method for keeping free products. However, in practical applications, the mutual composite happens easily, which shorts the lives of the carriers and limits the application of TiO<sub>2</sub>. The only solution for this problem is to decrease the recombination rate of photoinduced electrons and the holes by modifying the nanometer-sized TiO<sub>2</sub>. Developing modified method is also a hot topic of researchers here in China and abroad. 60Co- $\gamma$  ray irradiation reduction technique can modify TiO<sub>2</sub> and make it more activity for the catalytic degradation of organics. In order to investigate the effect of TiO<sub>2</sub>, irradiated by 60Co- $\gamma$  ray and loaded with activated carbon fibers (ACF), on photoelectrocatalytic degradation of ethylene in the environment of cold storage, the TiO<sub>2</sub>/ACF photoelectrocatalysis materials was deposited with nano-Ag (Ag-TiO<sub>2</sub>/ACF) and irradiated by 60Co- $\gamma$  ray. The effects of 60Co- $\gamma$  ray irradiation modified TiO<sub>2</sub> (10, 15, 20, 25, 30, 40 kGy) on the photoelectrocatalytic degradation rate of ethylene were investigated in a simulated cold storage environment for horticultural product. X-ray diffractometer and X-ray photoelectron spectroscopy were used to characterize the prepared TiO<sub>2</sub>. Results from X-ray diffraction showed that: the crystal size has reduced. The percent of anatase decreased from 84.97% in pure TiO<sub>2</sub> to 82.98% in TiO<sub>2</sub> treated with a 40 kGy irradiation dose. Result of X-ray photoelectron spectroscopy indicated that the amount of Ti<sup>3+</sup>, hydroxyl oxygen which have better catalytic activity increased after irradiation. The percentage of Ti<sup>3+</sup> in total Ti element rose from barely detected to 3.1%. The hydroxyl oxygen increased from 18.83% to 35.8%. Both X-ray diffraction and X-ray photoelectron spectroscopy results favored the separation rate of electron-hole, the redox ability and catalytic activity of TiO<sub>2</sub>. The apparent rate constant for photoelectrocatalysis degradation of ethylene was increased as irradiation dose increased up to 25 kGy due to the promotion of catalytic activity of TiO<sub>2</sub>. However, when the irradiation dose reached 30 kGy, the solution of TiO<sub>2</sub> formed precipitate which reduced the specific surface of TiO<sub>2</sub> and decreased the apparent rate constant.

[查看全文](#) [下载PDF阅读器](#)

关闭

您是第6726865位访问者

主办单位: 中国农业工程学会 单位地址: 北京朝阳区麦子店街41号

服务热线: 010-65929451 传真: 010-65929451 邮编: 100125 Email: [tcsae@tcsae.org](mailto:tcsae@tcsae.org)

本系统由北京勤云科技发展有限公司设计