Desalination and Water Treatment
www.deswater.com

13 (2010) 437–440
January

1944-3994/1944-3986
doi: 10.5004/dwt.2010.1002

Ti/Cr-pillared clay as photocatalysts for 4-chlorophenol removal in water

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Received 1 August 2009; accepted 5 November 2009

ABSTRACT

Ti-pillared and Ti/Cr-pillared montmorillonite have been prepared from natural bentonite and characterized by UV-Vis DRS and X-ray diffraction. The photocatalytic activities have been tested for the removal of 4-chlorophenol in water. The influence of the Ti/Cr ratio and the calcinations method on these activities has been investigated. It was found that the photocatalytic activities increase with increasing the Cr/Ti ratio up to 0.1 after which it becomes almost constant.

Keywords: Photocatalysis; Pillared clays; Chlorophenols; Water reuse

1. Introduction

Many regions in the world are confronting constraints of water supply shortage and the imbalance between natural water availability and demands. This imbalance is continuously exacerbating with time, mainly because of insufficient sanitation services, increased industrial activities with inadequate means for treatment of liquid disposal and increasing use of fertilisers and pesticides. At the same time, these wastewaters could represent an important resource of water. In this regard, technologies of wastewater treatment are essential not only in terms of environmental impact, but also for provision of economically sound and sanitarily safe water which could be used for agriculture, industrial cooling, etc.

One technology, which is expected to develop in the future, is heterogeneous photocatalysis, since: (i) it does not need any chemicals addition; (ii) it is suitable for treating water with low concentrations of organic pollutants, (iii) it is non-specific, and (iv) it can lead to the total mineralization of organic compounds. This technology can use solar energy, which can be of particular interest for Southern countries.

Some TiO_2 samples are by far the most active photocatalysts for degrading organic pollutants in gaseous or aqueous phases [1].

4-Chlorophenol is considered as a priority pollutant in water stream. It is used as an intermediate in organic synthesis and furthermore it can be generated as a by-product during chlorine disinfection of water containing phenolic compounds. Because of its toxic and carcinogenic properties and its resistance to biological treatment, this compound has been taken as a model molecule in this investigation.

Currently many research projects are designed to improve the performance of TiO_2 photocatalyst. That can be achieved by decreasing the particle size of the photocatalyst down to nanoparticles, by coupling semiconductors or adding another adsorbent to the

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