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Removal of EDTA From Photovoltaic Industry Wastewater By Ag-TiO2 Photocatalyst

Salaheddine Aoudj[a,b]*, Nadjet Taoualit[a], Abdellah Khelifa[a] , Nadjib Drouiche[b], Isma Berkache[a],Roumaissa Bendjiara Dalila Ikermoud [b],Fadila Belkad [a,b], Wahiba Bouchelaghem[b]

[a] Laboratoire de génie chimique, Département de Chimie Industrielle, Université Saad Dahlab, B.P. 270, Route de Soumaa 09000, Blida, Algeria
[b]CRTSE-Division CCSM- N°2, Bd Dr. Frantz FANON- p.o.box 140, Alger sept merveilles, 16038,Algeria
aoudjsalah@yahoo.fr

The presence of EDTA in wastewaters originating from photovoltaic (PV) process may cause significant environmental impacts. The aim of this work was the treatment of the effluents, resulting from the baths of the PV process, by a photocatalytic process based on TiO_2 silver doped (Ag-TiO_2) and using synthetic solutions containing EDTA.The influence of the various parameters such as the quality and quantity of the photocatalyst, initial concentration of the pollutant, the initial pH was studied. XRD characterizations were also done. Results mainly showed that with doping TiO_2 with Ag, it possible to obtain higher yields in the photocatalytic degradation of EDTA than in absence of dopant. The optimal Ag-TiO_2 catalyst dose was found to be 1.5 g/L, whereas, the optimal initial pH value was found to be 2.5.
Keywords : Photovoltaic wastewater, EDTA, Doped Ag-TiO_2 photocatalyst

1. Introduction

The fabrication of photovoltaic (PV) cells includes the use of more than 200 organic and inorganic compounds (Doble and Kumar, 2005). Consequently, effluents from PV industry may contain harmful agents, such as acids, nanoparticles, organics, etc. Among organic contaminants, complexing agents such as EDTA may consist a threat for environment (Kunz et al. 2002). Biologic degradation of EDTA is very slow and only occurs in abiotic medium in presence of sun light. In order to reduce negative effects of complexing agents, many treatment processes were studied including chemical oxidation (with oxidants such as ozone and chlorine, etc), physico-chemical (adsorption on activated carbon, etc). Electrochemical methods were also used in EDTA degradation (Khelifa et al.,2009). Recently, advanced oxidation processes (AOP's) such as photocatalysis, had known remarkable success in organic pollutants removal (Hoffmann et al., 1995, Aoudj et al., 2018). Photocatalysis was used in removal of phenol, dyes, pharmaceuticals, etc (Chatterjee et al. 1994). In photocalysis, TiO_2 is undoubtedly the most used semiconductor. Besides, catalyst modification such as doping may result in increasing the photoactivity. Several works reported that doping sensitively improves the TiO_2 photocatalytic efficiency (Hoffmann et al., 1995). Most recently, some research teams focued their studies on silver based photocatalysts owing to their interesting properties (Harikisbor et al., 2014, Asai et al., 2002). In this work, a silver doped photocatalyst Ag-TiO_2 was synthesized and then used in the degradation of EDTA which is an ubiquitous pollutant in PV industry wastewater. The effect of some influencing parameters such as initial pH, initial pollutant concentration and Ag-TiO_2 dose were studied.

2. Experimental

2.1 Experimental setup

The experimental setup comprises a photoreactor which is a glass thermostated cell which is irradiated by a UV lamp (PHILIPS, UVA, 20 W).

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