ISBN 978-85-63274-02-4

International Conference on Food and Agriculture Applications of Nanotechnologies

Editors:
Caue Ribeiro
Odílio Benedito Garrido de Assis
Luiz Henrique Capparelli Mattoso
Sergio Mascarenhas

São Pedro, SP
2010

1st Edition
1st print: 500 copies

Anais da 1. International Conference of Food and Agriculture Applications of Nanotechnologies – São Pedro: Aptor Software, 2010.
284 p.

ISBN 978-85-63273-02-4

1. Nanotechnologies – Events. 2. Ribeiro, Caue. 3. Assis, Odílio Benedito Garrido de. 4. Mattoso, Luiz Henrique Capparelli. 5. Mascarenhas, Sergio

International Conference on Food and Agriculture Applications of Nanotechnologies

NanoAgri 2010

Photocatalytic degradation of diuron in aqueous solution by nano-TiO_2 films.

G.B.Soares[(1,3)*], A. R. Malagutti[(2)], C.M.P. Vaz[(3)], W.T.L. da Silva[(3)] and C. Ribeiro[(3)]

(1) Universidade Federal de São Carlos, Departamento de Química, São Carlos, SP, Brazil. *email: gabi.byzynski@gmail.com
(2) Universidade Federal dos Vales do Jequitinhonha e Mucuri, UFVJM. Departamento de Farmácia e Bioquímica - Diamantina, MG.
(3) Embrapa Instrumentação Agropecuária, São Carlos, SP.

Abstract – The degradation of diuron in water on a nano-TiO_2 coated film was investigated using Differential Pulse Voltammetry (DPV) and UV-visible Spectroscopy (UV-vis). The photocatalytic efficiency and the kinetic parameters were evaluated. The influence of the increase in the pH value for the photodegradation reaction of diuron was investigated by UV-vis measurements. The rate constant for diuron degradation in presence of the photocatalyst nano-TiO_2 coated film was higher than that one measured in the direct photolysis test. The results also show that the photodegradation of the diuron is highly influenced by the pH.

The degradation of diuron in water on a nano-TiO_2 coated film was investigated using Differential Pulse Voltammetry (DPV) and UV-visible Spectroscopy (UV-vis). The photocatalytic efficiency and the kinetic parameters were evaluated. The influence of the increase in the pH value for the photodegradation reaction of diuron was investigated by UV-vis measurements. Diuron (99%) was purchased from Sigma-Aldrich Riedel-deHäen and a stock solution with 500 µg mL^{-1} was prepared and dissolved in methanol/water (50/50% v/v). Ti^{4+} resins were prepared by the polymeric precursor method in accordance with described in Malagutti et al. [1]. The photocatalytic activity of the film for the oxidation of diuron was tested under UVC illumination. The nano-TiO_2 coated films were placed in beakers, immersed in 20 mL of an aqueous solution of diuron under pH 1 and 5.7, respectively. The beakers were placed in a photo-reactor at 25ºC and illuminated using four UVC lamps (TUV Philips, 15W, maximum intensity at 254nm). The photocatalytic oxidation of diuron was monitored by taking UV-vis measurements (Shimadzu-UV-1601 PC spectrophomoter) and DPV (AUTOLAB PGSTAT 30) in various times of UVC light exposure.

The differential pulse voltammograms of diuron are presented in Figure 1. In this Figure, it can be seen that diuron shows an oxidation peak at 1.12 V (*vs.* SCE). The UV-visible spectra of diuron degradation in the presence of the nano-TiO_2 film in pH 1.0 and pH 5.7 are presented in Figure 2 and 3, respectively. As shown in these Figures, diuron presents an absorption band with a maximum at 250 nm in both pH. The decrease in the oxidation peak and in the absorption band of diuron was used to evaluate the photocatalytic efficiency of the nano-TiO_2 film. The presence of the nano-TiO_2 film increase the efficiency of the photodegration of diuron in both pH studied. From the exponential profiles observed in Figure 4, the reaction should be first-order with respect to diuron. Table 1 shows the rate constants (k´) (in h^{-1}) obtained from the photodegradation curves with the nano-TiO_2 films. It was found that the rate constant for diuron degradation was higher with the photocatalyst film than in the direct photolysis test. The pH also influenced in the photodegradation, and it can be seen that the rate constant is higher at pH 5.7 than in pH 1, when we compare the UV-Vis results in the presence of the nano-TiO_2 coated film. This study demonstrated that the nano-TiO_2 coated film is an effective and efficient photocalyst for the photodegradation reaction of diuron.

Table 1: Rate constants (k´) in h^{-1} from the photodegradation of diuron.

Analysis	DPV	DPV	UV-vis	UV-vis	UV-vis
pH	1.00	1.00	1.00	1.00	5.70
Nano-TiO_2 films	No	Yes	No	Yes	Yes
k´	0.02745	0.03046	0.01144	0.01174	0.01223

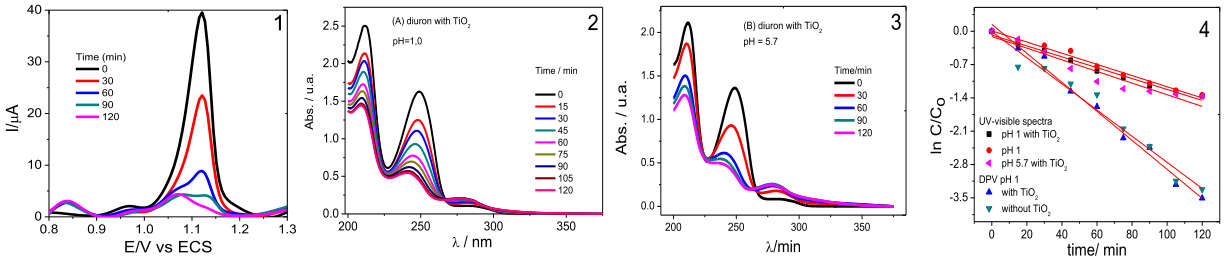

Figure 1: Differential pulse voltammograms of diuron, pulse amplitude: 80 mV, step increment: 6 mV, pH 1, graphite polyurethane electrode. **Figure 2**: Absorption spectrum of diuron in pH 1.0 **Figure 3**: and pH 5.7 in the presence of nano- TiO_2 film. (Initial diuron concentration: 8.42 10^{-5} mol L^{-1}). **Figure 4**: The exponential profile of diuron degradation.

Reference

[1] A.R. Malagutti, H.A.J.L. Mourão, J.R. Garbin, C. Ribeiro. Applied Catalysis B: Environmental, 90 (2009) 205-212.