Using microstructured yeast as biotemplate for TiO_2 deposition applied on amoxicillin solar photodecomposition.

N. Ortiz. Institute of Nuclear and Energy Research – IPEN, São Paulo –Brazil*
presenting author
F. Maichin., M.V. Macedo Institute of Nuclear and Energy Research – IPEN, São Paulo –Brazil

Abstract: The indication of amoxicillin (AMOX) is the most frequent by the public health assistance in Brazil. After the body metabolization, the antibiotic is discharged by excretes in the sewage system; also acting as secondary pollution sources for surface water resources. The microstructured yeast culture (biotemplate) enhances the TiO_2 surface area before the amoxicillin solar photodecomposition. The maximum removal percentage was 56% of AMOX with pseudo-second-order kinetics. The use of the low-frequency ultrasonic source in the TiO_2 slurry dispersion after the yeast culture enhanced the TiO_2 surface area and its effectiveness during the antibiotics solar photodecomposition

Keywords: ultrasonic source, titanium dioxide, solar/TiO_2, amoxicillin and yeast biotemplate.

Introduction

The antibiotics discovery and their use in medicine enhanced the human quality of life and worldwide public health. In spite of those medicine improvements, the prescription of such pharmaceuticals is extense for bacterial infections in humans and animals. The massive release of these compounds in the environment is the collateral effect for pharmaceuticals industries, hospitals, domestic sewage, and livestock excretion. The presence in the environment of such compounds accelerate the bacteria resistance and the conventional water treatment methods remove only small portion due to their non-biodegradable nature, and thus the remaining part of it runs off to surface water resources.

Methods

The antibiotics standard solutions were prepared and diluted in different initial concentrations. The ultrasound application in time interval of 2 minutes applied at TiO_2 anatase suspensions followed by its addition on the yeast culture. The

Saccharomyces cerevisiae was reproduced and evaluated at its best condition using an optical microscope. After that, the culture was filtered, dried and added the ultrasonic TiO_2 to the yeast suspension. The final suspension was heated and calcined at 100°C for overnight to obtain TiO_2 molded microstructures. After the addition of the AMOX solution, the system was installed at a solar radiation chamber (solar lamp) with the collection of the suspension aliquots for every 20 minutes in a falcon tube. After shaking the tubes, became the centrifugation at 1500 rpm for 15 minutes. The measurements of the supernatants were at UV – Visible Spectrophotometer

Results and conclusions

The results of the photodecomposition kinetics studies provide valuable insights into the kinetics models: The pseudo-second-order equation (1) best fit the experimental results:

$$\frac{t}{q_t} = \frac{1}{K_2} + \frac{1}{q_e}t \quad (1)$$

Where: K_2 is the kinetics decomposition rate, the plottering the t/qt for t (min) (Figure 1), and the calculation predicted decomposition capacity qe.

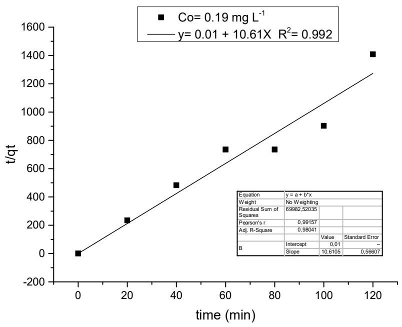

Figure 1: The pseudo-second-order kinetics

All results indicate the use of biotemplate increases the TiO_2 surface area and showed promising results for amoxicillin solar photodecomposition with the removal percentage of 56%, the decomposition rate K_2 =100 $g.mg^{-1}.min^{-1}$ and qe= 0.094 mg g^{-1}

Acknowledgments

The National Council for Scientific and Technological Development (CNPq) by PIBIC program and São Paulo Research Foundation (Fapesp).