SONOCHEMICAL SYNTHESIS OF POROUS NiTiO$_3$ NANORODS FOR PHOTOCATALYTIC DEGRADATION OF ENVIRONMENTALLY PERSISTENT PHARMACEUTICAL POLLUTANT

N. Pugazhenthiran$^{1,2}$, K. Kaviyarasan$^2$, R.V. Mangalaraja$^1$, S. Anandan$^2$.
$^1$Advanced Ceramics and Nanotechnology Laboratory, Department of Materials Engineering, Faculty of Engineering, University of Concepcion, Concepcion 407-0409, Chile. $^2$Nanomaterials & Solar Energy Conversion Lab, Department of Chemistry, National Institute of Technology, Tiruchirappalli 620 015, India.

Porous NiTiO$_3$ nanorods were synthesized through the sonochemical route followed by calcination at various temperature conditions. Surface morphology of the samples was tuned by varying the heat treatment temperature from 100 to 800 °C. The synthesized NiTiO$_3$ nanorods were characterized by transmission electron microscopy, X-ray photoelectron spectroscopy, X-ray diffraction, diffused reflectance spectroscopy, photoluminescence spectroscopy and Brunauer–Emmett–Teller (BET) analyses. The characterization studies revealed that the NiTiO$_3$ nanomaterial tuned during the heat treatment at 600 °C was more porous and perfectly rod shaped. The porous NiTiO$_3$ nanorods showed visible optical response and thus can be utilized as a photocatalyst under direct sunlight for the degradation process. The photoluminescence intensity of porous NiTiO$_3$ nanorods obtained while heating at 600 °C was lower than that of the as-synthesized NiTiO$_3$ sample due to the delocalization of the photogenerated electrons along the one dimensional nanorods which reduces the rate of charge recombination. The photocatalytic degradation of ceftiofur sodium (CFS) was carried out using NiTiO$_3$ nanorods under the direct sunlight irradiation. This degradation was followed using UV-vis spectroscopy and in addition, the intermediate formed during the CFS degradation was analyzed through HPLC to deduce the possible degradation mechanism. The porous NiTiO$_3$ nanorods formed in the heat treatment of 600 °C exhibited excellent photocatalytic activity towards the degradation of CFS and further, this photocatalytic activity was increased by the addition of peroxomonosulfate owing to the simultaneous generation of both OH and SO$_4^{2-}$.

Acknowledgments: The authors gratefully acknowledge the FONDECYT Project No.: 3160134, Government of Chile, Santiago, for the financial assistance.

Keywords: NiTiO$_3$ nanorods, Photocatalysis, Ceftiofur sodium

References:

Presenting author's email: npugazhmku@gmail.com