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The facile synthesis of Fe_3O_4@SiO_2@Ho_2TiO_5 core-shell nanostructures in mild circumstance and their photocatalytic activity analysis

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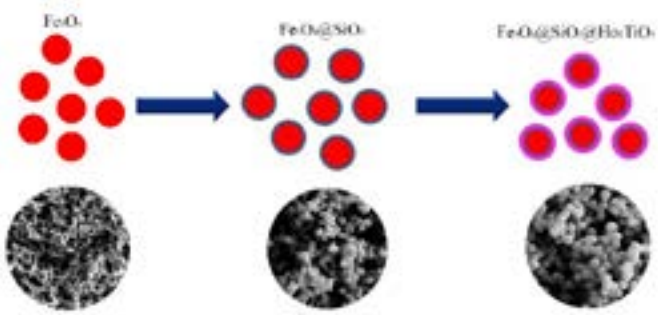
In this work, we have successfully fabricated Fe_3O_4@SiO_2@Ho_2TiO_5 magnetic core-shell nanostructures with different weight percentages of holmium by sol-gel method. The achieved magnetic nanostructures characterized by several techniques such as X-ray diffraction (XRD), field emission-scanning electron microscopy (FE-SEM), transmission electron microscopy (TEM), UV-vis diffuse reflectance spectroscopy (DRS), vibrating sample magnetometer (VSM) and photoluminescence (PL) spectroscopy. The photocatalytic activity of the magnetic nanostructures was then evaluated by the degradation of methylene orange (MO). Additionally, the weight percentage of cerium oxides on magnetic photocatalyst was evaluated indicating that the photocatalyst including 10 wt% of holmium revealed the best photocatalytic activity and after a maximum of 40 min, about 99% of MO were eliminated from the water samples in the presence of Fe_3O_4@SiO_2@Ho_2TiO_5 (10%wt Ho) nanostructure. Also, results shows the kinetics of the reaction in the presence of Fe_3O_4@SiO_2@Ho_2TiO_5 (10%wt Ho) nanostructure to be pseudo first order. Furthermore, the photodegradation of MO was executed under visible light. The photodegradation of MO required hydrogen proxide (H_2O_2) as an external oxidant to accelerate photodegradation. In the case of applying 2.5cc of H_2O_2, 94% of the dye was degraded after 45 minutes.



Recent Publications

1. H.R Naderi, A. Sobhani-Nasab, M. Rahimi-Nasrabadi*, M.R. Ganjali, Decoration of Nitrogen-doped Reduced Graphene Oxide with Cobalt Tungstate Nanoparticles for Use in High-Performance Supercapacitors, Applied Surface Science 423 (2017) 1025–1034.
2. A. Sobhani-Nasab, M. Rahimi-Nasrabadi*, H. Reza Naderi, V. Pourmohamadian, F. Ahmadi, M.R. Ganjali, H. Ehrlich, Sonochemical synthesis of terbium tungstate for developing high power supercapacitors with enhanced energy densities, Ultrasonics - Sonochemistry 45 (2018) 189–196
3. J. Amani, A. Khoshroo, M. Rahimi-Nasrabadi*, Electrochemical immunosensor for the breast cancer marker

CA 15–3 based on the catalytic activity of a CuS/reduced graphene oxide nanocomposite towards the electrooxidation of catechol, Microchimica Acta 185 (2018) 79.

4. H. Kooshki, A. Sobhani-Nasab, M. Eghbali-Arani, F. Ahmadi, M. Rahimi-Nasrabadi*, Eco-friendly synthesis of PbTiO3 nanoparticles and PbTiO3/carbon quantum dots binary nano-hybrids for enhanced photocatalytic performance under visible light, Separation and Purification Technology, 211 (2019) 873-881
5. A. Sobhani-Nasab, S. Pourmasoud, F. Ahmadi, M. Wysokowski, T. Jesionowski, H. Ehrlich, M. Rahimi-Nasrabadi*, Synthesis and characterization of MnWO4/TmVO4 ternary nano-hybrids by an ultrasonic method for enhanced photocatalytic activity in the degradation of organic dyes, Materials Letters 238 (2019) 159–162.

Biography

Mehdi Rahimi-Nasrabadi has received his PhD degree in 2010 in Analytical Chemistry at Razi University, Kermanshah, Iran. Dr. Rahimi is now an Associate Professor at Baqiyatallah University of Medical Sciences (from 2012), Tehran, Iran, He has published over than 90 scientific articles in various chemistry and nanoscience disciplines

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