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Synthesis of Mesoporous In_2O_3-TiO_2 Nanocomposites as Efficient Photocatalyst for Treatment Industrial Wastewater under Visible Light and UV Illumination

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Abstract : Advanced oxidation technologies are an environment friendly approach for the remediation of industrial wastewaters. Here, one pot synthesis of mesoporous In_2O_3-TiO_2 nanocomposites at different In_2O_3 contents (0-3 wt%) have been synthesized through a facile sol-gel method to evaluate their photocatalytic performance for the degradation of the imazapyr herbicide and phenol under visible light and UV illumination compared with commercially available either Degussa P-25 or UV-100 Hombikat. The prepared mesoporous In_2O_3-TiO_2 nanocomposites were characterized by TEM, STEM, XRD, Raman FT-IR, Raman spectra and diffuse reflectance UV-visible. The bandgap energy of the prepared photocatalysts was derived from the diffuse reflectance spectra. XRD Raman's spectra confirmed that highly crystalline anatase TiO_2 phase was formed. TEM images show TiO_2 particles are quite uniform with 10±2 nm sizes with mesoporous structure. The mesoporous TiO_2 exhibits large pore volumes of 0.267 cm^3g^{-1} and high surface areas of 178 m^2g^{-1}, but they become reduced to 0.211 cm^3g^{-1} and 112 m^2g^{-1}, respectively upon In_2O_3 incorporation, with tunable mesopore diameter in the range of 5 - 7 nm. The 0.5% In_2O_3-TiO_2 nanocomposite is considered to be the optimum photocatalyst which is able to degrade 90% of imazapyr herbicide and phenol along 180 min and 60 min respectively. The proposed mechanism of this system and the role of In_2O_3 are explained by details.

Keywords : In_2O_3-TiO_2 nanocomposites, sol-gel method, visible light illumination, UV illumination, herbicide and phenol wastewater, removal
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