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Sun-Light Driven Photocatalytic Degradation of Tetracycline Antibiotics Employing Hydrothermally Synthesized sno_2/mnv_2o_6 Heterojunction

Authors : Sandeep Kaushal

Abstract : Tetracycline (TC) is a widespread antibiotic that is utilised in a multitude of countries, particularly China, India, and the United States of America, due to its low cost and potency in boosting livestock production. Unfortunately, certain antibiotics can be hazardous to living beings due to metal complexation and aggregation, which can lead to teratogenicity and carcinogenicity. Heterojunction photocatalysts are promising for the effective removal of pollutants like antibiotics. Herein, a simple, economical, and pollution-less hydrothermal technique was used to construct SnO_2/MnV_2O_6heterojunction with varying amounts of tin dioxide (SO_2). Various sophisticated techniques like XRD, FTIR, XPS, FESEM, HRTEM, and PLand Raman spectroscopy demonstrated the successful synthesis of SnO_2/MnV_2O_6 heterojunction photocatalysts.BET surface area analysis revealed that the as-synthesized heterojunction has a favorable surface area and surface properties for efficacious degradation of tetracycline. Under the direct sunlight exposure, the SnO_2/MnV_2O_6 heterojunction possessed superior photodegradation activity toward TC than the pristine SnO_2 and MnV2O6owing to their excellent adsorption abilities suitable band positions, large surface areas along with the effective charge-transfer ability of the heterojunction. The SnO_2/MnV_2O_6 heterojunction possessed extraordinary efficiency for the photocatalytic degradation of TC antibiotic (98% in 60 min) with an apparent rate constant of 0.092 min–1. In the degradation experiments, photocatalytic activities of as-synthesized heterojunction were studied by varying different factors such as time contact, catalyst dose, and solution pH. The role of reactive species in antibiotics was validated by radical scavenging studies, which indicated that.OH, radical has a critical role in photocatalytic degradation. Moreover, liquid chromatography-mass spectrometry (LC-MS) investigations were employed to anticipate a plausible mechanism for TC degradation.

Keywords : photocatalytic degradation, tetracycline, heterojunction, LC-MS
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