ABSTRACT

This study reports the development of biomass-assisted sunlight-active semiconductor-tungstate-clay photocatalytic composite for the removal of pharmaceutical contaminants (PCs): Acetaminophen (ACT), Ampicillin (AMP) and Sulfamethoxazole (SMX), from water. Materials prepared ($Cu@ZnWO_4$–K, $Fe@ZnWO_4$–K and $Cu/Fe@ZnWO_4$–K) composites, were characterized using Scanning Electron Microscopy (SEM), Fourier Transformed Infrared spectroscopy (FTIR), X-ray Photoelectron Spectroscopy (XPS), Raman Spectroscopy, High Resolution TEM and X-ray Diffraction (XRD). XRD analysis showed the presence of Scheelite ($CuWO_4$), Ferberite ($FeWO_4$) and Sanmartinite ($ZnWO_4$) crystal phases in the composites. Moreover, results showed that $Cu@ZnWO_4$–K composite gave the best efficiency for the photodegradation of AMP (100%), ACT (83%), and SMX (68%) molecules. This composite showed more preference for the photodegradation of AMP molecules (>98%) even in the presence of ACT and SMX molecules. After five reuse cycles, the composite still had ca. 90% efficiency for AMP molecules but far less for the other two molecules. The presence of anions reduced the photocatalytic efficiency of this composite but increased the photodegradation of SMX molecules. The rate of photodegradation of the PCs was comparably fast, leading to high removal capacity. The concentrations of inorganic ions released as by-products of photodegradation, were far below WHO standard limits for their presence in drinking water.