**Abstract**

Bismuth and Boron co-doped TiO2 nanoparticles were successfully prepared by a modified sol–gel method. The products were characterized with various spectroscopic and analytical techniques to determine their structural, morphological, light absorption and photocatalytic properties. The results reveal that all the samples consist of highly crystalline anatase with mesoporous structures. The experimental results further indicate that Bi and B species have been doped into the crystal lattice of TiO2 with Bi substituting Ti in the form of Bi3+ and B doped in the form of substitutional and interstitial B. The presence of Bi species facilitated the incorporation of B into the crystal lattice of TiO2. XRD and TEM analysis show that all the dopants (B and Bi) have the ability to inhibit particle growth of anatase TiO2 with more inhibition exhibited by Bi. Compared to pure TiO2, B and Bi singly doped TiO2; Bi–B co-doped samples showed better activities for degradation of Acid Orange 7 (AO7) and 2, 4-dichlorophenol under visible light irradiation. The highest activity is observed for 3% Bi–B–TiO2 calcined at 450 °C. The superior performance of this sample is ascribed to the high surface area, ability to absorb in visible light, efficient charge separation as well as improved e− transfer associated with the cooperate effects of appropriate amounts of B and Bi in co-doped sample. Bi species are found to play a pivotal role in the co-doped samples. Superoxide radicals are the most reactive species in degradation of AO7 over 3% Bi–B–TiO2 under visible light irradiation.