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Nitrogen/Platinum Co-Doped TiO_2 for Enhanced Visible Light Photocatalytic Degradation of Brilliant Black

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Abstract : Elimination of toxic organic compounds from wastewater is currently one of the most important subjects in water pollution control. The discharge of azo dyes such as Brilliant black (BB) into the water bodies has carcinogenic and mutagenic effects on humankind and the ecosystem. Conventional water treatment techniques fail to degrade these dyes completely thereby posing more problems. Advanced oxidation processes (AOPs) are promising technologies in solving the problem. Anatase type nitrogen-platinum (N,Pt) co-doped TiO_2 photocatalyts were prepared by a modified sol-gel method using amine terminated polyamidoamine generation 1 (PG1) as a template and source of nitrogen. SEM/ EDX, TEM, XRD, XPS, TGA, FTIR, RS, PL and UV-Vis were used to characterize the prepared nanomaterials. The synthesized photocatalysts exhibited lower band gap energies as compared to the commercial TiO_2 revealing a shift in band gap towards the visible light absorption region. Photocatalytic activity of N,Pt co-doped TiO_2 was measured by the reaction of photocatalytic degradation of BB dye. Enhanced photodegradation efficiency of BB was achieved after 180 min reaction time with initial concentration of 50 ppm BB solution. This was attributed to the rod-like shape of the materials, larger surface area, and enhanced absorption of visible light induced by N,Pt co-doping. The co-doped N,Pt also exhibited pseudo-first order kinetic behaviour with half-life and rate constant of 0.37 min 0.1984 min^{-1} and respectively. N doped TiO_2 and N,Pt co-doped TiO_2 exhibited enhanced photocatalytic performances for the removal of BB from water.

Keywords : N,Pt co-doped TiO_2, dendrimer, photodegradation, visible-light
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