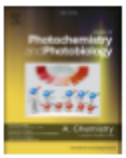
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Photocatalytic degradation of methylene blue using sunlight-powered coordination polymers constructed from a tetracarboxylate linker

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ABSTRACT

Here, we report the preparation of three coordination polymers - $[Mn_2(btec)]_n$, **1**; $[Ce_2(H_2btec)(btec)(H_2O)_2]_n$, **2**; and $[Fe(Hbtec)(H_2O)_2]_n$ **3** from 1,2,4,5-benzenetetracarboxylic acid (H_4btec). Physicochemical characterization of the coordination polymers were undertaken using microanalysis, X-ray crystallography, FTIR, PXRD, TGA/DSC, and UV/visible spectrophotometry to confirm the identities of the compounds. The Mn(II) centres in **1** exhibit octahedral geometry coordinated by six oxygen atoms and crystallizes in the monoclinic space group *I*2/*m*. In **2**, Ce(III) centres adopt tricapped trigonal prism geometry, coordinated by three $btec^{4-}$, three from H_2btec^{2-} and the oxygen from one coordinated water molecule. It crystallizes in the triclinic space group *P* $\bar{1}$. **3** is composed of an Hbtec ion and two water molecules coordinated to the Fe (III) ion. The band gaps of **1**, **2**, and **3** are 2.87, 3.10, and 3.61 eV, respectively, while their hydrogen peroxide-assisted efficiencies for the photodegradation of methylene blue are 91, 94, and 100 % respectively. An active species trapping experiment showed that an increase in hydroxy radicals (•OH) explains the enhanced efficiencies and provide an insight into the mechanism of the photodegradation of methylene blue by the photocatalysts. Efficiencies of mixtures of **2**/H_2O_2 and **3**/H_2O_2 reduced only slightly over five cycles of use and PXRD data revealed that **2** and **3** were chemically stable over the three cycles. Overall, the coordination polymers could serve as potential candidates for industrial-scale methylene blue degradation in the aqueous phase.