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## Preparation of carbon quantum dots decorated $BiVO_4$ quantum tube for enhanced photocatalytic performance under visible and near-infrared light

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Photocatalysis has been regarded as a sustainable and efficient technology for removing refractory pollutants in water. However, the performance of photocatalysis is usually limited by the fast recombination of photoinduced electron-holes and the narrow range of spectrum absorption. In this work, the visible-light sensitive $BiVO_4$ quantum tube (q-$BiVO_4$) was decorated with the carbon quantum dots (CQDs) possessing unique upconversion fluorescence function for enhanced photocatalytic degradation of organic pollutants. Under visible light (λ >420 nm) and even near-infrared light (λ > 700 nm) irradiation, the CQDs/q-$BiVO_4$ composites displayed significantly enhanced performance compared with q-$BiVO_4$ alone for the degradation of RhBl. The CQDs/q-$BiVO_4$ with 2% CQDs loading exhibited the best performance, whose kinetic constants for phenol degradation were 2.4 times higher than that on q-$BiVO_4$. The outstanding photocatalytic performance of CQDs/q-$BiVO_4$ was ascribed to the quantum sized $BiVO_4$ and the dual function of CQDs, which not only served as the electron-acceptor to separate the photoinduced electron-holes in q-BiVO4, but also improve the light absorption of q-$BiVO_4$ through converting the near-infrared light into visible light. This work provides new insight into designing high-efficiency photocatalyst for enhanced environmental remediation.

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