

**Study the Photocatalytic Degradation of Apocarotenoid,
Crocein, on Surface of TiO₂ Semiconductor
Nanoparticles under Visible Light Irradiation**

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ABSTRACT

This study highlights the role of TiO₂ semiconductor nanoparticles as a photocatalyst in accelerating the degradation of apocarotenoids, such as crocetin, under visible light irradiation. The findings confirm that crocetin degrades in the presence of TiO₂ due to its molecular structure, which enables easy adsorption onto the TiO₂ nanoparticles and exhibits superior light absorption properties. This enhanced interaction between the crocetin dye and the semiconductor surface demonstrates the potential of crocetin as a promising natural dye for photosensitizer applications. Furthermore, the study establishes that increasing the concentration of crocetin improves the efficiency of crocetin based dye-sensitized solar cells (DSSCs) by enhancing light absorption and electron transfer. These results provide valuable insights into optimizing the performance of natural dyes for sustainable energy applications. The combination of crocetin and TiO₂ presents a viable approach to improving DSSC efficiency while promoting environmentally friendly solar energy solutions. However, the efficiency of DSSCs decreases due to the rapid degradation of crocetin. Future research can focus on further optimizing dye concentration, enhancing semiconductor interactions, and exploring the stability of crocetin based DSSCs for long-term energy conversion applications.