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Development of photocatalytic semiconductors and nanocomposites with excellent optoelectronic and electrochemical properties for dye effluent remediation -A review

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Development of photocatalytic semiconductors and nanocomposites with excellent optoelectronic and electrochemical properties for dye effluent remediation -A review

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Abstract

Myriads of photocatalytic semiconductors and their corresponding nanocomposites have been investigated for the remediation of toxic dye molecules in textile effluent however, notable challenges are reported of their performance. These challenges are based on the optoelectronic and electrochemical features that precede their photocatalytic performance in dye effluent remediation. Thus, the need arises to investigate the development of state-of-the-art photocatalytic semiconductors and their composites fabricated with excellent optoelectronic and electrochemical features having proficient activities under visible photon irradiation. The study focused on vital optoelectronic and electrochemical features needful for the development of high-performance photocatalysts under a green photon source. It also provides concise synthetic and composite fabrication approaches aimed at developing photocatalytic semiconductors with these properties. The report presents various doping processes and introduction of elements into the structural lattices of the semiconductors while equally offering a recent approach to developing nanocomposites with heterostructures. The review evaluated bandgap modification, separation of charge carries, structural defects and mobility concerning the investigated process. The study was able to present an inorganic doping technique with intercalated nitrogen, codoping and nanocomposite fabrication as the versatile and industrially scalable approach for the development of high-performance photocatalytic semiconductors.