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Anthocyanin (Natural dye) sensitizing TiO_2 in photodegradation Processes

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Abstract:

Widely spread chemically industry produces many types of water pollutants (e.g dyes, herbicides, pesticides, insecticides, drugs, and others). Most of such pollutants reach our drinking water resources. Different strategies have been followed to purify contaminated water, one low-cost technology involves semiconductors as catalysts for photo-degradation of organic contaminants. TiO_2 is widely studied for water treatment. However, the wide band gab TiO_2 limits its use in the UV range, which is less than 4% of our reaching-in solar spectrum. Therefore, sensitization of TiO_2 has been studied in order to activate the photo-degradation processes by the visible light.

In earlier work we used CdS (~2.3 eV) to sensitize TiO_2. The prepared TiO_2/CdS catalyst showed relatively high catalytic efficiency in visible light in photo-degradation of organic water contaminants (Methyl Orange & Phenazopyridine). During the photo-degradation process the CdS decomposed producing Cd^{+2} ions in the treated water.

In this work, a safe, economic, nontoxic natural dye (anthocyanin) is being used to sensitize TiO_2 nano-particles, the produced catalysts TiO_2/anth and AC/TiO_2/anth were tested for photo-degradation of both methyl orange and phenazopyridine. Under visible light, the prepared catalysts showed observable efficiencies. The efficient degradation was observed in photo-degradation methyl orange using AC/TiO_2/anth under acidic condition. Complete mineralization of contaminants was confirmed by the potential increasing of menial ions like NO^{-3}, SO_4^{-2} and $S_2O_3^{-2}$. Effect of different reaction parameters, together with reaction kinetics, will be presented.