Semiconductor Cells for Photocatalytic Decomposition of Industrial Dyes under Visible Light

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Textile manufacturing is one of major industries in developing countries feeding the society with jobs and legitimate income. However, the release of improperly treated waste water, contaminated with non-degraded dyes, has led to some environmental problems. Traditional treatment processes consist of either biological or chemical degradation of the dyes which are relatively costly. This research aims to develop semiconductor cells made from metal oxides or mixed-metal oxides to be used as catalysts in the degradation process of such dyes utilizing visible light irradiation. The model compound used as representative textile dyes was methylene blue. In the semiconductor fabrication processes, spin coating and electrodeposition techniques were used to deposit a thin film of the semiconductor on electrodes. Bismuth vanadate ($BiVO_4$) was coated on fluorine-doped tin oxide (FTO) glass substrate by sol-gel spin coating technique. Cuprous oxide (Cu_2O) was deposited on FTO glass by electrodeposition technique. Various parameters of the coating processes have been studied to evaluate their effects on the efficiency of these semiconducting photocatalysts. The band gap energy of the semiconductors were determined using UV spectrophotometric technique. Subsequently, these semiconductor cells had been tested for efficiency of methylene blue degradation through photocatalytic irradiation by visible light. In some experiments, electricity has also been applied and efficiency evaluated for comparison. The results will be presented where detailed experimental procedures and evaluation of semiconducting photocatalysts will be elaborated.

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