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Microwave assisted hybridization of Ternary selenides with TiO_2 for enhancement in Phtocatalytic degradation efficiency against Methylene Blue (MB)

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I-III/V-VI2 family ternary chalcogenides e.g. CuInSe2 (CISe), $AgInSe_2$ (AISe), CuSbSe2 (CSbSe) etc. have attracted attention because of properties such as, high absorption coefficient, high photo stability and high solar cell conversion efficiency. Ternary selenides have extensively studied for various important energy applications such as, solar cells, photonics and other electronic devices. However, there is need to explore some other areas where such semiconductors can be effectively employed. The NIR absorption and small band gap of ternary selenides has potential as photocatalyst thus making them technologically more important.Ternary chalcogenides are not so much explored as photocatalyst for degradation of dyes. Present study therefore heighlights the use of hybridized ternary selenide/TiO_2 nanostructured materials as photocatalyst against Methylene blue (MB) under long UV light (365 nm). Microwave method was used for effective coupling between spherical CISe/AISe/CSSe nanoparticles (NPs) and anatase TiO_2 NPs. The hybrid photocatalysts were characterized by various advanced analytical tools such as, UV-Visible spectroscopy, XRD, TEM etc. The X-ray diffractions of hybrid nanomaterials revealed effective hybridization while TEM showed surface modification due to accumulation of TiO2 NPs over ternary selenide NPs. The degradation of MB revealed maximum efficiency of about ~89% for AISe/TiO_2. The degradation efficiency as well as degradation rate constant were found to be significantly enhanced as compared to TiO_2 and parent ternary selenides alone. The different intermediates were identified by HPLC/MS which suggests formation of environmental friendly oxidized products.

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