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Assessment of Metal and Nano-Metal Doped TiO_2 Nanoparticles for Photocatalytic Degradation of Methylene Blue in Almeda Textile Industry, Tigray, Ethiopia

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Abstract : Nowadays, the photocatalytic mechanism of water purification using nanoparticles has gained wider acceptance. For this purpose, the Crystal form of N- TiO_2 and Ag-TiO_2 was prepared from $TiCl_4$, Urea, NH_4OH and $AgNO_3$ by sol-gel method and simple solid phase reaction followed by calcination at a temperature of 400 °C for 4h at each. The synthesized photocatalysts were characterized using XRD, SEM and UV-visible diffuse reflectance spectra. In the experiment, it was found that the absorption edge of N-TiO_2 was a well efficient shift to visible light as compared to Ag-TiO_2. The XRD diffraction makes the particle size of N-TiO_2 smaller than Ag-TiO_2. The effect of catalyst loading and the effect of temperature on the photocatalytic efficiency of the prepared samples was tested using methylene blue as a target pollutant. The photocatalytic degradation efficiency of the catalysts for methylene blue was increased from 57.05 to 96.02% under solar radiation as the amount of the catalyst increased from 0.15 to 0.45 gram for N-TiO_2. Similarly, photocatalytic degradation of methylene blue was increased from 40.32 to 81.21% as the amount of Ag-TiO_2 increased from 0.05g to 0.1g. In addition, the photocatalytic degradation efficiency of the catalysts for the removal of methylene blue was increased from 58.00 to 98.00 and 47.00 to 81.21 % under solar radiation as the calcination temperature of the catalyst increased from 300 to 500 for N-TiO_2 for Ag-TiO_2 300 to 4000C. However, a further increase in catalyst loading and calcination temperature was found to decrease the degradation efficiency.

Keywords : photocatalysis, degradation, nanoparticles, catalyst loading, calcination and methylene blue
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