Photocatalytic Reduction of CO_2 into Methanol over $CuFe_2O_4/TiO_2$ under Visible Light Irradiation

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ABSTRACT
The present study aims to focus the photocatalytic reduction of carbon dioxide (CO_2) into methanol on TiO_2 loaded copper ferrite ($CuFe_2O_4$) photocatalyst under visible light (500 W xenon lamp) irradiation. In this perspective, $CuFe_2O_4$ and $CuFe_2O_4/TiO_2$ photocatalysts were synthesized following the sol–gel method from copper(II) nitrate, $Cu(NO_3)_2{\cdot}3H_2O$ (99 %) and iron(III) nitrate, $Fe(NO_3)_3{\cdot}9H_2O$ (99 %) as precursors. The phases and crystallite size of the photocatalysts were characterized by X-ray diffraction (XRD), morphology by scanning electron microscopy (SEM), absorption spectrum by ultraviolet–visible spectroscopy (UV–Vis), electron–hole (e^-/h^+) recombination process by photoluminescence spectrophotometer, and elemental compositions by energy dispersive X-ray spectroscopy (EDX) instruments. The loading of TiO_2 on $CuFe_2O_4$ enhanced the photocatalytic activity in the visible light range. The enhanced photoactivity in $CuFe_2O_4/TiO_2$ semiconductor catalyst can be attributed to interfacial transfer of photogenerated charges, which led to effective charge separation and inhibited the recombination of photogenerated electron–hole (e^-/h^+) pairs. Methanol was observed as the main product over $CuFe_2O_4/TiO_2$ and the photocatalytic activity of $CuFe_2O_4/TiO_2$ for CO_2 reduction was found to be about three times higher (651 μmol/g_{cat} L) than that of $CuFe_2O_4$ photocatalyst which might be due to the modification of band gap through TiO_2 loading.

KEYWORDS: CO_2 reduction; Visible light irradiation; $CuFe_2O_4/TiO_2$ photocatalyst; Band gap energy; Methanol

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