GRAPHITIC CARBON NITRIDE (g-C_3N_4) BASED PHOTOCATALYSTS FOR H_2 PRODUCTION VIA PHOTOREFORMING OF ORGANIC COMPOUNDS

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ABSTRACT

During the last decades, the energy crisis and environmental pollution have emerged as primary concerns mainly due to the excessive consumption of fossil fuels; thus, the transition to renewable energy sources is essential. Among a variety of renewable energy processes, semiconductor-based photocatalysis has attracted considerable attention for its wide-ranging potential in both energy and environment. Applications of this advanced technology have been implemented in numerous areas such as water/air purification, disinfection, CO_2 reduction and H_2 production. H_2 is a storable, clean and environmental friendly fuel that can be sustainably generated via photocatalytic water splitting and photoreforming of organic compounds [1]. Graphitic carbon nitride (g-C_3N_4) has been widely used for photocatalytic applications because of its attractive electronic band structure, excellent stability and facile synthesis. However, it suffers from low utilization of solar light and high photogenerated charge-carrier recombination rate [2]. Therefore, a series of strategies have been developed to overcome these drawbacks, for instance, heteroatom doping, nano-structuring and combination with other semiconductors (e.g. TiO_2). Heterostructures of g-C_3N_4 and nanosized TiO_2 have demonstrated enhanced photocatalytic performance; however, their application in photocatalytic H_2 evolution with the use of organic compounds as sacrificial agents needs to be further investigated [3]. Furthermore, it has been proven that surface modification with Ag nanoparticles contributes to significant enhancement of the photocatalytic activity due to the surface plasmon resonance effect and the efficient e^-/h^+ separation induced by Ag^+ [4].

In this work, g-C_3N_4/TiO_2 and Ag/g-C_3N_4/TiO_2 nanocomposites were synthesized and used as photocatalysts for hydrogen production associated with the oxidation of organic compounds. For this purpose, alcohols and sugars have been used as target substances and the amount of generated hydrogen under solar light illumination was measured via gas chromatography. The obtained results confirm that the photocatalytic hydrogen production is strongly related to the synthesis method and the selection of the organic substrate.

KEYWORDS: photocatalysis, hydrogen production, graphitic carbon nitride, photoreforming of organic substances, g-C_3N_4/ TiO_2 heterostructures.

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