Green hydrogen production through seawater splitting on MS_2 (M=Ni/Co/Sn)/TiO_2 nanocomposites

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Green Hydrogen will play an important role in reducing the carbon emission in sectors like transportation, power supply and industry, but for it to become competitive technology, the costs related to hydrogen production should be reduced. Photocatalytic hydrogen production is one of the green hydrogen production methods that has potential to become cost effective. So far, photocatalytic water splitting has mainly focused on hydrogen production from pure water systems, but it is practically attractive to study methods for seawater systems, which will make better use of available natural resources. In this study, we focus on synthesis, characterization of variety of metal sulfide-embedded titanium dioxides (NiS_2/TiO_2, CoS_2/TiO_2, SnS_2/TiO_2) nanocomposite materials as photocatalysts for seawater splitting. The materials synthesized using a facile hydrothermal method was used for seawater splitting with 4 hours of simulated solar illumination. The amounts of 48.11, 24.94, 15.04, and 2.78 $mmolg^{-1}$ hydrogen were successfully produced with NiS_2/TiO_2, CoS_2/TiO_2, SnS_2/TiO_2, and pristine TiO_2 nanomaterials, respectively. Highest amount of H_2 was produced with NiS_2/TiO_2 photocatalyst. This can be attributed to the low bandgap of NiS_2, which acts as a co-catalyst. Our study clearly demonstrates that low-cost, noble-metal-free nanocomposite photocatalysts could be promising candidates for realizing efficient solar-to-hydrogen conversion from seawater splitting.

Keywords: Photocatalysts, metal sulfides, titania, water splitting

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