Operational Conditions Affecting Hydrogen Production by the Photoreforming of Organic Compounds using Titania Nanoparticles with Gold

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Abstract

Several factors affect photocatalytic hydrogen productivity from the photoreforming of organic compounds, which makes it difficult to optimize operational conditions in photoreactors. To prioritize these factors, we focused on the quantification of the effect of five of them on hydrogen production. Photocatalytic experiments were performed on 67 mL batch photoreactors under UV■LED lamps (λ=375 nm) using a suspension of TiO2–Au nanoparticles synthesized by a sol–gel approach. The analyzed factors were: (A) presence of Au as a cocatalyst, (B) type of alcohol as the electron donor, (C) intensity of UV light, (D) electron donor concentration, and (E) nanoparticle concentration. A main and interaction effects analysis is presented with reduced fixed effect models for three responses: total hydrogen generation, catalyst productivity, and electron donor productivity. The presence of Au as a cocatalyst (A), the intensity of UV light (C), and their interaction (AC) were the factors with the highest effect. The best configuration allowed us to reach a catalyst productivity of 2925 μmol g−1 h−1..

Keywords

gold, hydrogen, nanoparticles, photocatalysis, titanium dioxide.