Photocatalytic hydrogen production using Pt/TiO_2 as catalyst

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Techniques aimed at the production of hydrogen gas (H_2) are increasingly encouraged, especially in the field of renewable energies and in the field of green chemistry[1]. In this work, the TiO_2/Pt photocatalyst was produced using the platinum photodeposition method on commercial titanium dioxide (P25, Degussa). The photocatalytic activities of this catalyst were tested in the hydrogen production with the presence of different alcohols as sacrificial agents: methanol, ethylene glycol and glycerol. Xenon lamp was used as a light source. The hydrogen production was analyzed in 6 hours of reaction, in an alcoholic solution of 3% and catalyst concentration of 0.5 $g.L^{-1}$. The best result was obtained using glycerol as a sacrificial reagent at the concentration, producing a rate of 2510 $\mu mol.h^{-1}.g^{-1}$. In terms of hydrogen production, the ordering of the sacrificial agents was: glycerol > ethylene glycol > methanol. Furthermore, different percentages of platinum were tested (0.1, 0.27, 0.45 and 0.57%), in which the H_2 production rate (HPR) was higher using 0.1% of platinum. Using glycerol as substrate and Pt/TiO_2 (0.1%) as catalyst, the rate of hydrogen production kinetic was quantified. It is possible to observe that in 3,5 hours of reaction the HPR stabilizes. Furthermore, its photonic efficiency was determined using the actnometric method, reaching 0.42%.

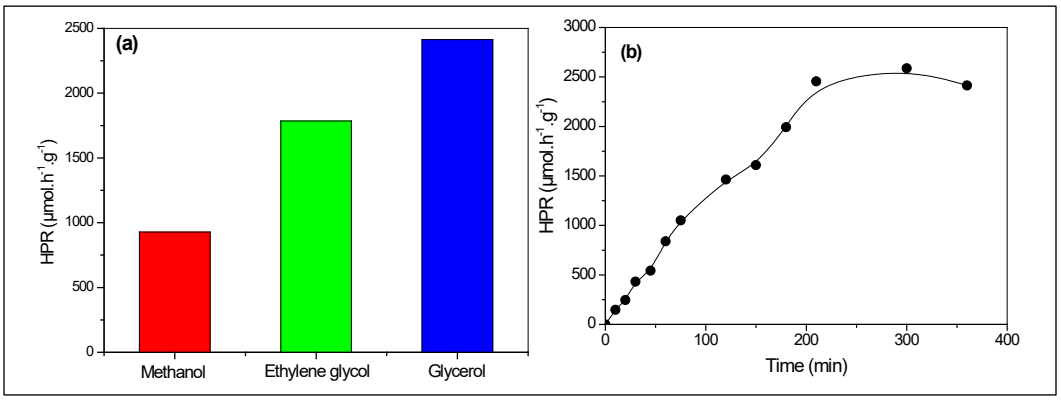

Figure 1. Hydrogen Production Rate: study of different alcohols as sacrificial agentes (a), and glycerol photoreforming kinetics (b). $C_{glycerol}$ = 3%, TiO_2/Pt (0.1%) = 0.5 $g.L^{-1}$.

[1]PUGA, A. V. Photocatalytic production of hydrogen from biomass-derived feedstocks. Coordination Chemistry Reviews, v. 315, p. 1–66, 2016.