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ABSTRACTS

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PHOTOCATALYTIC GLUCOSE CONVERSION TO PRODUCE HYDROGEN IN THE PRESENCE OF TiO_2 BASED MATERIALS

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The search of alternative resources for synthesis of chemicals currently produced from non-renewable sources has directed the activities of researchers towards the use of different raw materials such as biomass [1]. Glucose, obtained from cellulose, can be used for the sustainable production of high value chemicals for instance ethanol by fermentation, sorbitol and mannitol by hydrogenation, 5-hydroxymethyl furfural by dehydrocyclization, gluconic and glucaric acids by oxidation and also to produce hydrogen [2]. Chong et al. have photocatalyticaly converted glucose to arabinose and erythrose and simultaneously obtained H_2 in the presence of Rh-TiO_2 materials [3]. The advantages of these hydrogen production approach are the use of biomass to obtain also added-value chemicals at low reaction temperature and pressure and in aqueous medium.

In the present research commercial anatase (BDH) and anatase/rutile (P25) and home prepared anatase (HPA), rutile (HPR) and brookite (HPB) TiO_2 polymorphs and have been used as supports for the deposition of metallic Pt. The Pt-TiO_2 samples have been tested in the glucose conversion under anaerobic conditions. The photoreactivity runs were carried out at room temperature in a 800 mL tightly closed N_2 saturated photoreactor irradiated in the UV region with an immersed 125 W medium pressure Hg lamp. The initial aqueous glucose concentration was 1 mM. The quantitative determination and identification of glucose and its degradation products were performed by HPLC whereas the CO_2 and H_2 evolution was followed by GC-TDC analyses.

The presence of Pt resulted essential for the production of H_2 as no hydrogen was detected by using naked TiO_2 photocatalysts. In Figure 1 are reported the concentrations of glucose, CO_2 and H_2 during the photocatalytic degradation of glucose in the presence of commercial Pt-P25 and Pt-HPR TiO_2 powders. The home prepared samples resulted more active than the commercial ones. The rutile polymorph was the most active sample both for H_2 formation and glucose conversion. The amount of H_2 formed after 420 minutes of irradiation was of 475 μmol for Pt-P25 and 1575 μmol for Pt-HPR.

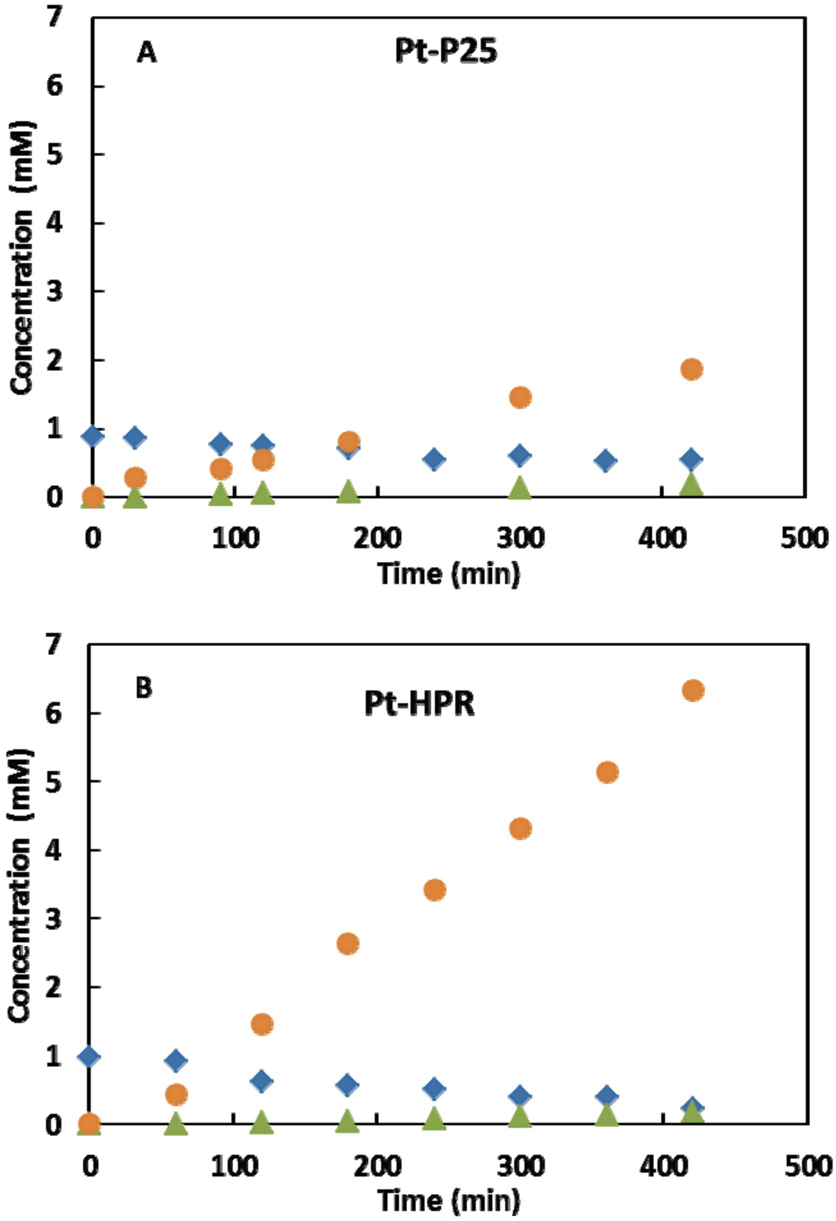

Figure 1. Evolution of concentration of glucose (◆), hydrogen (●) and carbon dioxide (▲) versus irradiation time in the presence of Pt-P25 (A) and Pt-HPR (B) samples.

References

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