Evaluation of Hydrogen Photocatalytic Production Parameters using TiO_2 doped with platinum under low-intensity radiation

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The energy issue is essential to ensure human development in the next generations, in recent decades the exponential loss of fossil fuel reserves due to overexploitation, aggravating subsequent pollution and accelerating global warming.[1] Which makes it essential to find a balance between energy development and the environment. Hydrogen (H_2) is a promising fuel, which is carbon-free and has a high energy density, and has been increasingly focused on investments.[2] In this context, heterogeneous photocatalysis emerges as one of the most promising ways of harnessing solar energy in the form of usable chemical energy. However, the influence of reactional parameters requires deeping analysis for large-scale feasibility.[3] In this study, the glycerol photoreforming in aqueous medium was carried out through the activation of titanium dioxide doped with platinum (TiO_2@Pt), using a halogen lamp as a radiant source. A two-level (2k) factorial experimental design was carried out to evaluate the variables pH, glycerol concentration, photocatalyst concentration, and photodeposited platinum concentration on the TiO_2 surface. The response surface methodology (RSM) was used to indicate the condition of highest photocatalytic performance, obtaining a hydrogen production rate (HPR) of 1005.63 µmol $H_2.g^{-1}.h^{-1}$ with catalyst, platinum, and glycerol concentrations in 0.1 $g.L^{-1}$, 1.0% (w/w), 5% (v/v), respectively, and pH 2. Additionally, the catalyst concentration was the only significant variable of the process, showing a negative correlation, that is, the lower concentration, the greater the response in terms of HPR.

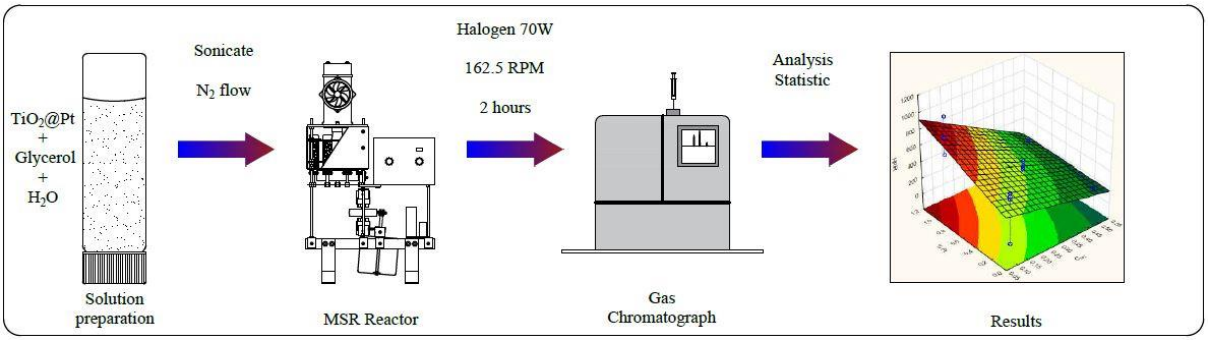

Figure 1 - Illustration of the experimental process

[1] Ahmad, K.; Ghatak, H. R.; Ahuja, S. M. Environ. Technol. Innov. **2020**, 19, 100893.

[2] Yu, S.; Han, B.; Lou, Y.; Liu, Z.; Qian, G.; Wang, Z. Int. J. Hydrogen Energy **2020**, 45 (53), 28640–28650.

[3] Zhang, J.; Hu, W.; Cao, S.; Piao, L. Nano Res. **2020**, 13 (9), 2313–2322.