Topic: Conversion of sugar to fuels and chemicals via catalytic photo-oxidation process

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ABSTRACT

Glucose was successfully converted to high-value products, including xylitol, gluconic acid, and formic acid, via photocatalytic reaction with TiO_2, which is an alternative route for high-value chemical production. In detail, TiO_2 synthesized by the sol-microwave method resulted in small particles (Ø=400 nm), relatively high BET surface area (24.3 m^2/g), and a mixed-crystalline structure of anatase and rutile phases (86:14) that enables to promote high photocatalytic activity. The effects of catalyst calcination temperature and calcination time were investigated, which the highest photocatalytic activity was obtained from TiO_2 calcined at 500 °C for 5 h. Moreover, it was observed that increasing of calcination temperature promoted phase transformation from anatase to rutile. The effect of several metal loadings over TiO_2 on its photocatalytic activity was later determined. In detail, Ag-TiO_2, Cu-TiO_2, and Ag-Cu-TiO_2 photocatalysts were synthesized by a sol-microwave method with a doping content of 1, 3, and 10 wt.%. It was found that 1wt.%Ag provided the highest photocatalytic activity due to small crystallite size, high BET surface area, small band gap, and suitable anatase-rutile ratio, which is efficiently promoted high photocatalytic activity. Lastly, the effect of microwave assisted wet impregnation was studied. It was found that microwave-assisted wet impregnation provided low BET surface area and resulted in low photocatalytic activity.

Keywords: Sugar, Titanium dioxide, Sol-gel synthesis, Photocatalytic oxidation, Ag, Cu.