Topic: Development of TiO_2-based photocatalysis by hydrothermal process converting xylose to chemicals

Name of student: Ms. Nuch Puttipat **Student ID:** 55300700525

Name of supervisor: Assoc. Prof. Dr. Navadol Laosiripojana

Name of co-supervisor: Dr. Surawut Chuangchote

ABSTRACT

Photo-conversion of xylose into expensive sugar and acidic compounds, mainly arabitol, xylitol and formic acid was carried out under UV light (λ_{max}=365nm) with TiO_2 photocatalysts. The photocatalysts were synthesized by hydrothermal method with several impregnated metals (i.e. 3%Cr, 3%Fe, 3%Ag, 3%Cu, and bimetallic 1.5%Ag1.5%Cu). From the characterizations, the synthesized materials showed average particle size of 22.49-33.73 nm with mainly anatase phase. Composite powder induced an evident in absorption peak 408-575 nm in UV-vis absorption spectrum. From the reaction test, the photo-conversion of xylose in the presence of hydrothermally synthesized TiO_2 (at 120^{o}C for 8 h) resulted in xylose conversion of 53.19% at illumination time of 120 min. The main products from the reaction were 6.31% arabitol, 8.57% xylitol and 33.99% formic acid respectively. As the next step, TiO_2 impregnated with 3%Cr, 3%Fe, 3%Ag, 3%Cu, and bimetallic 1.5%Ag1.5%Cu were consequently tested toward the xylose reaction. Among all impregnated catalysts, 3% Cu-TiO_2 enhanced the highest xylose conversion of 87.15% after 120 min of illumination time. The main products from the reaction in the presence of 3%Cu-TiO_2 included 9.01% arabitol, 15.16% xylitol and 53.21% formic acid. The reaction promotion by Cu impregnation could be due to facilitated small crystallite size (22.53nm) with pure anatase phase, and optimum band gap (2.82 eV). Finally, the effects of microwave-assisted wet impregnation was also studied. It was revealed that microwave-assisted wet impregnation did not enhance promotion of the photocatalytic activity compared with the conventional heating, because the use of microwave can cause the agglomeration of metal over TiO_2 surface, which results in the increase of catalyst crystalline size and low surface area.

Keywords: Xylose, Titanium dioxide, Hydrothermal, Photocatalysis.