

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this research, the mesoporous-assembled TiO_2 and $\text{TiO}_2\text{-SiO}_2$ mixed oxide nanocrystal photocatalysts were synthesized by the sol-gel process with the aid of a structure-directing surfactant porosity and were comparatively used for sensitized photocatalytic H_2 production under visible light irradiation from aqueous diethanolamine (DEA) solution containing dissolved Eosin Y (E.Y.) sensitizer. The Pt and bimetallic Pt-Au loadings on a $\text{TiO}_2\text{-SiO}_2$ mixed oxide photocatalyst were also performed by the photochemical deposition (PCD) method with the aim of photocatalytic activity enhancement. The incorporation of TiO_2 by SiO_2 with a suitable content had a positive effect on the physicochemical properties and photocatalytic activity of the $\text{TiO}_2\text{-SiO}_2$ mixed oxide as compared to the pure TiO_2 . The incorporation of the secondary SiO_2 phase could effectively stabilize the mesoporous structure of the TiO_2 , increase the specific surface area of pure TiO_2 and reduce the TiO_2 crystallite size, which could enhance the photocatalytic hydrogen production efficiency. The experimental results revealed that without Pt and/or Au loading, the mesoporous-assembled $\text{TiO}_2\text{-SiO}_2$ mixed oxide photocatalyst with a TiO_2 -to- SiO_2 molar ratio of 97:3 calcined at 500 °C possessed the highest photocatalytic hydrogen production activity as compared to the other mixed oxides. Moreover, both the 1.25 wt.% Pt and bimetallic 0.75 wt.% Pt-0.75 wt.% Au loadings on the mesoporous-assembled $0.97\text{TiO}_2\text{-}0.03\text{SiO}_2$ mixed oxide photocatalyst significantly enhanced the photocatalytic hydrogen production activity, which was approximately 6 times higher than that without metal loading.

5.2 Recommendations

In order to obtain higher activity of photocatalyst, other types of bimetallic loading, e.g. Pt-Ag, can also be interestingly used to load on the synthesized mesoporous-assembled $0.97\text{TiO}_2\text{-}0.03\text{SiO}_2$ mixed oxide for this photocatalytic H_2 production application. The immobilization of the mixed oxide photocatalysts is also interesting to be studied for this application in order to imitate the real application.