



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In this research, the mesoporous-assembled $\text{TiO}_2\text{-SiO}_2$, $\text{TiO}_2\text{-ZrO}_2$, and $\text{SrTi}_x\text{Zr}_{1-x}\text{O}_3$ nanocrystal photocatalysts were synthesized by the sol-gel process with the aid of a structure-directing surfactant at the Ti-to-Si molar ratio of 97:3 and Ti-to-Zr molar ratio of 93:7 and were comparatively tested for sensitized photocatalytic H_2 production under visible light irradiation from an aqueous diethanolamine (DEA) solution containing dissolved Eosin Y (E.Y.) sensitizer. The bimetallic Pt-Ag loadings on the $0.97\text{TiO}_2\text{-}0.03\text{SiO}_2$, $0.93\text{TiO}_2\text{-}0.07\text{ZrO}_2$, and $\text{SrTi}_{0.93}\text{Zr}_{0.07}\text{O}_3$ photocatalysts were prepared by the photochemical deposition (PCD) method with the aim of photocatalytic activity enhancement. The experimental results revealed that the bimetallic 1.25 wt.% Pt-0.25 wt.% Ag loaded on the mesoporous-assembled $0.97\text{TiO}_2\text{-}0.03\text{SiO}_2$ photocatalyst significantly enhanced the photocatalytic hydrogen production activity with the hydrogen production rate of $3.21 \text{ cm}^3/\text{h}\cdot\text{g}_{\text{cat}}$, whereas the bimetallic 1.25 wt.% Pt-0.25 wt.% Ag loaded on the $0.93\text{TiO}_2\text{-}0.07\text{ZrO}_2$ photocatalyst exhibited the hydrogen production rate of $2.11 \text{ cm}^3/\text{h}\cdot\text{g}_{\text{cat}}$. Interestingly, among the investigated photocatalysts, the $\text{SrTi}_{0.93}\text{Zr}_{0.07}\text{O}_3$ photocatalyst with bimetallic 1.25 wt.% Pt-0.25 wt.% Ag loading showed the highest hydrogen production rate of $5.37 \text{ cm}^3/\text{h}\cdot\text{g}_{\text{cat}}$.

5.2 Recommendations

In order to obtain higher photocatalytic activity, other types of bimetallic loading, e.g. Pt-Ni, can also be potentially used to load on the synthesized mesoporous-assembled $0.93\text{TiO}_2\text{-}0.07\text{SiO}_2$, $0.93\text{TiO}_2\text{-}0.07\text{ZrO}_2$, and $\text{SrTi}_{0.93}\text{Zr}_{0.07}\text{O}_3$ photocatalysts for the H_2 production application. The incorporation of SiO_2 into SrTiO_3 is also interesting to be studied for visible light irradiation system.