CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The overall results revealed that TiO_2 thin film properties are strongly influenced by the preparation conditions. The amount of ethanol, chemical additives, calcinations temperature and coating cycle were the main parameters that need to be controlled, as summarized below:

(a) Regarding the roles of ethanol in preparation of TiO_2 thin film, it was found that concentration of ethanol had an effect on mass of TiO_2 deposited on stainless steel. The lowest amount of ethanol gave the highest amount of TiO_2 as well as the highest amount of anatase. The optimum ratio of TTiP to ethanol was 1:40.

(b) Regarding the roles of PEG600 in preparation of TiO_2 thin film, it was found that the obtained film was smooth with high surface area. Besides, the film adherence and corrosive resistant was also improved for the film prepared with low ethanol ratio (TTiP:ethanol = 1:20). With amount of PEG600 increased, the anatase intensity was slightly decreased. The optimum ratio of TTiP to ethanol toPEG600 was 1:20:0.5 since the obtained film had higher anatase intensity than the film obtained from TTiP:ethanol at 1:40. Photocatalytic activity of the TiO_2 thin film was 26.28% of chromium(VI) removal.

(c) Regarding the roles of DEG in preparation of TiO_2 thin film, it was found that the obtained film from low ethanol concentration with small amount of DEG was substantially improved in adherence property and corrosive resistance. The amount of DEG had less effect on amount of anatase phase. The optimum ratio of TTiP to ethanol to DEG was 1:20:0.5. At this ratio, it has higher amount of anatase than the film prepared with higher ethanol concentration (TTiP:ethanol = 1:40). The obtained film had efficiency in chromium(VI) removal of 25.72%.

(d) In the solution contained both PEG600 and DEG, the obtained film showed good adherence, corrosive resistance as well as high surface areas with high anatase content. The co-effect of both substances provided the film with high efficiency in photocatalytic activity of 28.52% chromium(VI) removal. The optimum ratio of TTiP to ethanol to PEG600 to DEG was 1:20:0.5:0.5.

(e) Regarding the effects of calcination temperature, it was found that calcined temperature had an influence on anatase intensity. With increasing temperature, amount of anatase was also increased, resulting in high photoactivity. The optimum calcined temperature was 500°C as it was the temperature before stainless steel plates changed their structure.

(g) Regarding the effects of coating cycle, it was found that increasing of cycle times resulted in the increased amount of TiO_2 attached on substrate. The anatase intensity was increased as cycle times increased. The film obtained from 5-coating cycles had highest efficiency of 36.04% in chromium(VI) removal.

Furthermore, the obtained results can be used as the fundamental data for immobilized TiO_2 as a film that practically used in industrial work.

5.2 Recommendations

In application of TiO_2 thin film in the real situations, the conditions for the film preparation should be carefully selected in order to produce the film that is suitable for industrial process. The recommendations for further research were shown as follows:

1. There are other parameters which affect film properties and need to be investigated such as types of substrate, titanium precursors, solvents and chemical additives, withdrawal speed, and calcination time.

2. The photoreactor for lab scale have to modified as the UV light cannot provide enough intensity for chromium(VI) removal.

3. The photacatalytic removal of other pollutants, organics and organic species, should be investigated as they also presented in real wastewater.