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# 論文 / 著書情報
# Article / Book Information

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# Thesis Outline

## Chapter 1: Introduction

This chapter provides a background on colored wastewater problem and the advantages of using advanced oxidation processes (AOPs), particularly $TiO_2$ photocatalysis, over the conventional treatment methods. Limitations and potential improvements of $TiO_2$ and its synthesis, and the objectives of the study are presented in this chapter.

## Chapter 2: Literature Review

A thorough review of literatures regarding $TiO_2$ photocatalysis, recent developments in the design and applications of $TiO_2$ materials with different dimensionalities, various synthesis techniques of high-dimensional materials, and enhancement of photocatalytic activity by rare-earth metal doping is presented in this chapter.

## Chapter 3: Synthesis of 3D Sea Urchin-like $TiO_2$ (SUT)

The facile synthesis procedure, which made use of ethylene glycol-assisted hydrothermal method, to produce $TiO_2$ with micrometer-sized 3D sea urchin-like structure is presented. The growth and formation mechanism of the $TiO_2$ structure was investigated by varying the hydrothermal reaction time. The roles of both sodium hydroxide and ethylene glycol were explained in detail in this chapter.

## Chapter 4: Effect of Calcination Temperature on 3D SUT

The influence of calcination temperature on the characteristics and solar photocatalytic activity of the as-synthesized 3D SUT is elucidated, and the outcome of the sedimentation test using the best performing SUT sample in comparison with the commercially available $TiO_2$ is included in this chapter.

## Chapter 5: Effect of Dopant Amount and Calcination Temperature on 3D Holmium-doped Sea Urchin-like $TiO_2$ (Ho-SUT)

The synthesis, characterization, and solar photocatalytic activity of Ho-SUT samples, together with the influences of dopant content and calcination temperature are discussed. The result of the sedimentation test using the best performing Ho-SUT sample compared with commercially available $TiO_2$ is presented in this chapter.

## Chapter 6: General Conclusions

This chapter presents the general conclusions derived from this research.