

**PHENOL DEGRADATION OVER MESOPOROUS-ASSEMBLED
SrTi_xZn_{1-x}O₃ NANOCRYSTAL PHOTOCATALYSTS**


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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University and Institut Français du Pétrole
2012


I 28374198

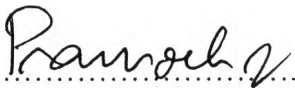
Thesis Title: Phenol Degradation over Mesoporous-Assembled $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$
Nanocrystal Photocatalysts
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Accepted by the Petroleum and Petrochemical College, Chulalongkorn University, in partial fulfillment of the requirements for the Degree of Master of Science.



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ABSTRACT

5373023063: Petroleum Technology Program

Supachai Tiyawaraku: Phenol Degradation over Mesoporous-Assembled $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$ Nanocrystal Photocatalysts

Thesis Advisors: Prof. Sumaeth Chavadej and Assoc. Prof. Pramoch Rangsunvigit 75 pp.

Keywords: Mesoporous-assembled $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$ / Photocatalysis/ Phenol/ Degradation

Advanced oxidation processes (AOPs) are effective techniques used to efficiently degrade non-biodegradable organic contaminants present in wastewater. Photocatalysis is an AOP that is very promising in the use of solar energy to initiate degradation reactions. The most interesting photocatalyst is SrTiO_3 since it is chemically stable, non-toxic, and highly active in hydrogen production. In this work, mesoporous-assembled $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$ nanostructure photocatalysts were synthesized by a sol-gel method with the aid of a structure-directing surfactant. The Ag, Cu, and Pt loadings on $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$ were carried out by the photochemical deposition method. The synthesized photocatalysts without and with different metal loadings were tested for the degradation of phenol, which was used as a model contaminant in water. The effects of various synthesis parameters, such as the ratio of Ti:Zn, calcination temperature, and metal loading content, on photocatalytic phenol degradation performance were investigated. The mesoporous-assemble photocatalyst $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$ nanostructure photocatalyst with a Ti-to-Zn molar ratio of 0.97:0.03 calcined at 700 °C provided the highest phenol degradation rate constant (k) of 0.80 h^{-1} . Among the studied loaded metals, Pt provided the highest photocatalytic activity toward phenol degradation. Therefore, O_2 gas could enhance the reaction rate constant of 0.5wt.% Pt on $\text{SrTi}_{0.97}\text{Zn}_{0.03}\text{O}_3$ photocatalysts from 0.94 to 0.97 h^{-1} .

บทคัดย่อ

ศุภชัย ดิยะวรากุล : การสลายตัวของฟีนอลโดยใช้ตัวเร่งปฏิกิริยาแบบใช้แสงร่วมประเภทสะตรอนเทียมซิงค์ไททาเนตที่มีขนาดรูพรุนในระดับเมโซพอร์ (Phenol Degradation over Mesoporous-Assembled $\text{SrTi}_x\text{Zn}_{1-x}\text{O}_3$ Photocatalysts) อ. ที่ปรึกษา : ศ. ดร. สุเมธ ชวเดช และ รศ. ดร. ปราโมช รังสรรค์วิจิตร 75 หน้า

การพัฒนากระบวนการออกซิเดชันเป็นเทคนิคที่มีประสิทธิภาพสำหรับการกำจัดสารออกซิไดซ์ที่อยู่ในน้ำเสียซึ่งตัวเร่งปฏิกิริยาแบบใช้แสงร่วมที่น่าสนใจคือสะตรอนเทียมไททาเนต เพราะมีความเสถียรต่อสารเคมี, ไม่เป็นพิษ, และมีความว่องไว โดยในงานวิจัยนี้ใช้ตัวเร่งปฏิกิริยาแบบใช้แสงร่วมประเภทสะตรอนเทียมซิงค์ไททาเนตที่มีขนาดรูพรุนในระดับเมโซพอร์ โดยการเปลี่ยนแปลงตัวแปรต่างๆ ได้แก่ อัตราส่วนโดยโมลของไททาเนตต่อซิงค์, อุณหภูมิที่ใช้ในการเผา, และชนิดกับปริมาณโลหะที่เติมลงบนตัวเร่งปฏิกิริยาแบบใช้แสงร่วมดังกล่าว ในการทดลองนี้ตัวเร่งปฏิกิริยาแบบใช้แสงร่วมถูกสังเคราะห์โดยกระบวนการโซล-เจลร่วมกับการใช้สารลดแรงตึงผิวเป็นตัวกำหนดโครงสร้าง จากการทดลองพบว่าตัวเร่งปฏิกิริยาแบบใช้แสงร่วมที่ประกอบด้วยอัตราส่วนโดยโมลของไททาเนตต่อซิงค์เท่ากับ 0.97:0.03 ซึ่งถูกเผาที่อุณหภูมิ 700 องศาเซลเซียส ให้ค่าอัตราการสลายฟีนอลดีที่สุดในที่เท่ากับ 0.80 ต่อชั่วโมง นอกจากนี้การเติมโลหะแพลตทินัมในปริมาณที่เหมาะสมร้อยละ 0.5 โดยน้ำหนักบนตัวเร่งปฏิกิริยาดังกล่าวพบว่าอัตราการย่อยสลายเพิ่มเป็น 0.94 ต่อชั่วโมง และเมื่อมีการใช้แก๊สออกซิเจนในการร่วมทำปฏิกิริยาพบว่าอัตราการย่อยสลายเพิ่มเป็น 0.97 ต่อชั่วโมง

ACKNOWLEDGEMENTS

The author was grateful for the scholarship and funding of the thesis work provided by the Petroleum and Petrochemical College; and the Center for Excellence on Petrochemicals, and Materials Technology, Chulalongkorn University, Thailand.

The author would like to express her sincere gratitude to Prof. Sumaeth Chavadej and Assoc. Prof. Pramoch Rangsunvigit for their invaluable guidance, understanding, and constant encouragement throughout the course of this research.

She would like to express special thanks to Assoc. Prof. Apanee Luengnaruemitchai and Dr. Tarawipa Puangpetch for kindly serving on her thesis committee. Their sincere suggestions are definitely imperative for accomplishing her thesis.

Her gratitude is absolutely extended to all staffs of the Petroleum and Petrochemical College, Chulalongkorn University, for all their kind assistance and cooperation.

Furthermore, she would like to take this important opportunity to thank all of her graduate friends for their unforgettable friendship.

Finally, she really would like to express her sincere gratitude to her parents and family for the love, understanding, and cheering.

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