การสังเคราะห์แผ่นฟิล์มชนิดใหม่ไทเทเนียมไดออกไซด์/ไคโตแซน และการประยุกต์ใช้ในกระบวนการโฟโตคะตะไลติกสำหรับการกำจัดโครเมียม

นางสาวปิยะพร คำเกษ

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต
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Thesis Title	PREPARATION OF NOVEL CATALYST, TITANIUMDIOXIDE/ CHITOSAN FILM AND APPLICATION AS MEDIA IN PHOTOCATALYTIC PROCESS FOR CHROMIUM(VI) REMOVAL
By	Miss Piyaporn Kumket
Field of	Environmental Management
Thesis	Assistant Professor Puangrat Kajitvichyanukul, Ph.D.

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Graduate School
(Assistant Professor M.R. Kalaya Tingsabadh, Ph.D.)

THESIS COMMITTEE

..... Chairman
(Manaskorn Rachakornkij, Ph.D.)

..... Thesis Advisor
(Assistant Professor Puangrat Kajitvichyanukul, Ph.D)

..... Member
(Assitant Professor Jarurat Voranisarakul)

..... Member
(Chantra Tongcumpou, Ph.D.)

..... Member
(Tawan Limpiyakorn, Ph.D.)

ปิยะพร คำเกษ : การสังเคราะห์แผ่นฟิล์มชนิดใหม่ไทเทเนียมไดออกไซด์/ไคโตแซน และการประยุกต์ใช้ในกระบวนการโฟโตคะตะไลติกสำหรับการกำจัดโครเมียม. (PREPARATION OF NOVEL CATALYST, TITANIUMDIOXIDE/ CHITOSAN FILM AND APPLICATION AS MEDIA IN PHOTOCATALYTIC PROCESS FOR CHROMIUM(VI) REMOVAL) อ.ที่ปรึกษา:ผศ.ดร.พวงรัตน์ ขจิตวิชยานุกูล, 134 หน้า.

ในงานวิจัยนี้ ได้ทำการศึกษาเกี่ยวกับการสังเคราะห์แผ่นฟิล์มไทเทเนียมไดออกไซด์/ไคโตแซน โดยการเตรียมแผ่นฟิล์มจากผงไทเทเนียมไดออกไซด์ร่วมกับไคโตแซนที่ได้จากเปลือกปู โดยละลายในกรดอะซิติกที่มีความเข้มข้น 20% งานวิจัยฉบับนี้ รายงานเกี่ยวกับการเตรียมแผ่นฟิล์มไทเทเนียมไดออกไซด์/ไคโตแซน ในตัวแปรที่ต่างกัน นั่นคือ ปริมาณไคโตแซน และปริมาณไทเทเนียมที่ต่างกัน นอกจากนี้ได้ศึกษาถึงผลกระทบของปริมาณไคโตแซน และปริมาณไทเทเนียมไดออกไซด์ที่ต่างกันต่อคุณลักษณะของแผ่นฟิล์ม, กระบวนการการดูดติดผิว และกระบวนการโฟโตคะตะไลติก เพื่อการกำจัดโครเมียมในน้ำเสียสังเคราะห์ ซึ่งวัตถุผสมระหว่างไทเทเนียมไดออกไซด์/ไคโตแซนสามารถเพิ่มประสิทธิภาพของกระบวนการโฟโตคะตะไลติกได้ ผลการทดลองการดูดติดผิวของโครเมียมบนแผ่นฟิล์มไทเทเนียมไดออกไซด์/ไคโตแซนสามารถอธิบายได้ด้วยไอโซเทอมการดูดติดผิวแบบแลงเมียร์ สำหรับการกำจัดน้ำเสียสังเคราะห์โคร- เมียมด้วยกระบวนการโฟโตคะตะไลติกแผ่นฟิล์มไทเทเนียมไดออกไซด์/ไคโตแซน ที่เตรียมด้วยปริมาณไคโตแซนที่มากที่สุด (2.5% ไคโตแซน, 0.4% ไทเทเนียม) และมีค่าคงที่ในการเกิดปฏิกิริยาคือ 0.0255 นาที$^{-1}$ ซึ่งมีค่าสูงกว่าค่าคงที่ในการเกิดปฏิกิริยาของผงไทเทเนียมไดออกไซด์เพียงอย่างเดียว ส่วนแผ่นฟิล์มไทเทเนียมไดออกไซด์/ไคโตแซน ที่เตรียมด้วยปริมาณไทเทเนียม ที่มากที่สุด (1.5% ไคโตแซน, 0.8% ไทเทเนียม) มีค่าคงที่ในการเกิดปฏิกิริยา คือ 0.0358 นาที$^{-1}$ ซึ่งสูงกว่า ค่าคงที่ในการเกิดปฏิกิริยาของผงไทเทเนียมไดออกไซด์ แผ่นฟิล์มไทเทเนียมไดออกไซด์/ไคโตแซนที่ได้จากงานนี้สามารถใช้เป็นแคตตาลิสที่สำคัญ ในการกำจัดโลหะหนักอื่นๆ ด้วยกระบวนการโฟโตคะตะไลติกได้ต่อไป

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In this research, TiO_2/chitosan film was prepared by using TiO_2 (Degussa P-25) and chitosan flake from crab shells dissolved in 20% acitic acid solution. From this study the preparation of TiO_2/chitosan film in different composition of the chitosan and Ti contents were investigated to produce a composite TiO_2/chitosan film. In this work, effects of chitosan and Ti content on TiO_2/chitosan film properties, adsorption and photocatalytic activity for chromium (IV) removal were investigated. The adsorption and photocatalytic activity of the composite material were tested by the reduction of chromium (VI) in aqueous solution. With the chelating ability of chitosan, the enhancing of photocatalysis using this synthesis composite material was observed. Results obtained from adsorption activity shown that the adsorption isotherm pattern of TiO_2/chitosan film for chromium(IV) removal was followed the Langmuir adsorption isotherm model. For photocatalytic activity, using TiO_2/chitosan film with the highest chitosan content (2.5% chitosan, 0.4% Ti) can provide the highest efficiency in removing of 100 mg/L chromium(VI). The appearance rate constant (0.0255 min^{-1})of TiO_2/chitosan film was higher than that obtained from pure TiO_2(0% chitosan, 0.4% Ti) (0.0003 min^{-1}). While TiO_2/chitosan film with the highest Ti content (0.8% Ti, 1.5% chitosan), provided higher appearance rate constant(0.0358 min^{-1}) than that obtained from pure TiO_2 powder. From this work the synthesized composite material, TiO_2/Chitosan film can be a potential catalyst for heavy metal removal in further photocatalytic process.

Field of study Environmental Management Student's signature Piyaporn kumket

Academic year 2006 Advisor's signature Puangrat

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