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**SYNTHESIS OF 1-PHENYL-3-METHYL-4-STEAROYLPYRAZOL-5-ONE
DOPED MESOPOROUS SILICA FOR REMOVAL OF METALS FROM
INDUSTRIAL WASTEWATER**



Mr. Chinnawat Satsananan

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

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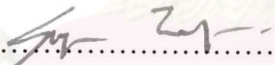
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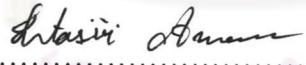
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Accepted by the Faculty of Science, Chulalongkorn University in
Partial Fulfillment of the Requirements for the Master's Degree


.....Dean of the Faculty of Science
(Professor Piamsak Menasveta, Ph.D.)

THESIS COMMITTEE


.....Chairman
(Associate Professor Supawan Tantayanon, Ph.D.)


.....Thesis Advisor
(Amarawan Intasiri, Ph.D.)


.....Member
(Associate Professor Wimonrat Trakarnpruk, Ph.D.)


.....Member
(Assistant Professor Aroonsiri Shitangkoon, Ph.D.)

ชินวัฒน์ ศาสตนันทน์ : การสังเคราะห์เมโซพอร์ซซิลิกาโดปด้วย 1-ฟีนิล-3-เมทิล-4-สเทียโรอิลไพราโซล-5-โอนเพื่อใช้ในการขจัดโลหะจากน้ำเสียอุตสาหกรรม

(SYNTHESIS OF 1-PHENYL-3-METHYL-4-STEAROYLPYRAZOL-5-ONE DOPED MESOPOROUS SILICA FOR REMOVAL OF METALS FROM INDUSTRIAL WASTEWATER) อ.ที่ปรึกษา : ดร.อมรรววรรณ อินทศิริ, 119 หน้า. ISBN 974-14-2257-1

งานวิจัยนี้มีวัตถุประสงค์เพื่อหาภาวะที่เหมาะสมในการสังเคราะห์เมโซพอร์ซซิลิกาโดปด้วย HPMSM เพื่อใช้เป็นสารดูดซับที่มีประสิทธิภาพในการขจัดโลหะจากน้ำเสียอุตสาหกรรม ผลการศึกษาอิทธิพลของสารตั้งต้นซิลิกาได้แสดงให้เห็นถึงการจัดเรียงรูพรุนขนาดกลางของซิลิกาอย่างมีระเบียบและการกระจายขนาดรูพรุนในช่วงที่แคบ เมื่อใช้ TEOS หรือเมโซพอร์ซซิลิกาที่ผ่านการเผาที่อุณหภูมิสูงเป็นสารตั้งต้นซิลิกา การเปรียบเทียบความยากง่ายในการสังเคราะห์, ลักษณะทางกายภาพและความสามารถในการสกัด Cu(II) ของสารดูดซับชนิดต่างๆ พบว่าซิลิกาที่สังเคราะห์จาก CTAB/TEOS ในอัตราส่วน 0.18 เป็นสารดูดซับที่มีประสิทธิภาพมากที่สุด การตรวจสอบปัจจัยที่มีผลต่อการสกัด Cu(II) ในรูปแบบคอลัมน์ SPE พบว่าปัจจัยที่สำคัญคือ อัตราเร็วในการไหลของสารละลายโลหะ โดยความสามารถสูงสุดในการสกัด Cu(II) ของสารดูดซับชนิดนี้มีค่าเท่ากับ 0.1764 โมล/กิโลกรัม เมื่อหาโดยใช้สมการของ Langmuir การศึกษาปัจจัยที่มีผลต่อสมบัติในการสกัดโลหะชนิดอื่นๆ ของเมโซพอร์ซซิลิกาโดปด้วย HPMSM ให้ผลสรุปว่า ความสามารถของซิลิกาในการสกัดโลหะเหล่านี้ดีที่สุด เมื่อในสารละลายโลหะมีเกลือ NaNO_3 อยู่ด้วย และมี pH มากกว่า 3 การศึกษาการเลือกจำเพาะต่อการสกัดโลหะจากสารละลายโลหะผสมระหว่าง Fe(III), Mn(II) และ Zn(II) พบว่าซิลิกาชนิดนี้มีความสามารถที่ดีเยี่ยมและมีการเลือกจำเพาะสูงต่อการสกัด Fe(III) โดยมีค่าการสกัดสูงสุดเท่ากับ 0.1825 โมล/กิโลกรัม เมื่อคิดจากกราฟของ Langmuir ซิลิกาชนิดนี้สามารถนำกลับมาใช้ใหม่ได้โดยปราศจากการสูญเสียประสิทธิภาพในการสกัด การศึกษาจลนพลศาสตร์ได้ชี้ให้เห็นถึงอัตราเร็วในกระบวนการสกัดโลหะของสารดูดซับชนิดนี้ การประยุกต์เมโซพอร์ซซิลิกาที่โดปด้วย HPMSM กับการขจัดโลหะชนิดต่างๆ จากตัวอย่างน้ำเสียอุตสาหกรรมที่มาจากแหล่งต่างๆ ได้ผลเป็นที่น่าพอใจ

สาขาวิชา..ปิโตรเคมีและวิทยาศาสตร์พอลิเมอร์...ลายมือชื่อนิสิต.....ชินวัฒน์ ศาสตนันทน์.....
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KEY WORD: HPMSP / MESOPOROUS SILICA / SOLID-PHASE EXTRACTION/
DOPED SILICA / METAL EXTRACTION

CHINNAWAT SATSANANAN : SYNTHESIS OF 1-PHENYL-3-METHYL-
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This work is aimed at evaluating the optimum condition for the synthesis of HPMSP doped mesoporous silica to be used as an effective sorbent for the removal of metals from industrial wastewater. Effect of silica precursors was studied which showed the good ordered arrangement of mesopore and the narrow pore size distribution of the HPMSP modified materials when the silica precursor was TEOS or calcined mesoporous silica. The synthesis facility, morphology and the Cu(II) extraction capacity of different materials were compared. The results indicated that the silica prepared from 0.18 CTAB/TEOS mole ratio was the most effective sorbent. Other factors influencing the Cu(II) extractability of this sorbent investigated by SPE column method revealed the crucial role of an extraction flow rate. The maximum capacity of this sorbent obtained by the Langmuir equation was found to be 0.1764 mol/kg. The profound study on the parameters affected the extraction properties of the HPMSP doped mesoporous silica towards other metal ions was also performed. The attainment of sorbent capacities for the extraction of these ions was achieved, provided that pH of metal solution was greater than 3 and the metal solution contained NaNO_3 salt. The extraction of metal from mixture solution of these three metal ions demonstrated the excellent capacity and the high selectivity of such silica to the extraction of Fe(III) ions. The Langmuir plot gave maximum Fe(III) extraction capacity of the sorbent equal to 0.1825 mol/kg. The reusability of this silica was also established without any decrease in its performance. The study of kinetic extraction revealed the rapidity of the metal extraction process of the sorbent. The application of the HPMSP doped mesoporous silica for the removal of various metals from different wastewater samples was also achieved with satisfactory results.

Field of study..Petrochemistry and Polymer Science..Student's signature *Chinnawat*
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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

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LIST OF ABBREVIATION

APD	average pore diameter
BET	Brunauer-Emmet-Teller
BJH	Barrett-Joyner-Halenda
CTAB	cetyltrimethylammonium bromide
H ₂ PMP	1-phenyl-3-methyl-pyrazolone
HPMSP	1-phenyl-3-methyl-4-stearoyl-5-pyrazolone
IUPAC	International Union of Pure and Applied Chemistry
LCT	liquid crystal templating
LLE	liquid-liquid extraction
SPE	solid-phase extraction
TEOS	tetraethylorthosilicate
XRD	X-ray diffraction



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