

การออกซีไดซ์อย่างเลือกจำเพาะของไฮโดรคาร์บอนอิ่มตัว แอลกอฮอล์และสารที่มีกำมะถันด้วย
สารเชิงซ้อนของโลหะแทรนซิชัน

นางสาวอุทุมพร ทองอินทร์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรดุษฎีบัณฑิต

สาขาวิชาปิโตรเคมี

คณะวิทยาศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

ปีการศึกษา 2548

ISBN 974-14-3373-5

ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

SELECTIVE OXIDATION OF SATURATED HYDROCARBONS, ALCOHOLS
AND SULFUR- CONTAINING COMPOUNDS BY TRANSITION METAL
COMPLEXES

Miss Uthumporn Thong-in


A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy Program in Petrochemistry

Faculty of Science
Chulalongkorn University
Academic Year 2005
ISBN 974-14-3373-5


481616


Thesis Title Selective Oxidation of Saturated Hydrocarbons, Alcohols
and Sulfur-Containing Compounds by Transition Metal
Complexes
By Miss Uthumporn Thong-in
Field of Study Petrochemistry
Thesis Advisor Assistant Professor Warinthorn Chavasiri, Ph.D.


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

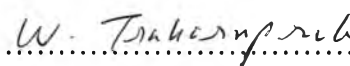
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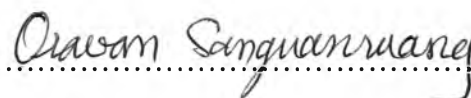
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ปฏิกิริยาออกซิเดชันจัดเป็นปฏิกิริยาชนิดหนึ่งที่น่าสนใจเป็นอย่างยิ่งในการเปลี่ยนรูปสารอินทรีย์ งานวิจัยนี้มุ่งเน้นที่จะศึกษาและพัฒนาระบบตัวเร่งปฏิกิริยาสารประกอบเชิงซ้อนของโครเมียม โดยการศึกษาที่ใช้โครเมียมสเตียเรต และ โครเมียมพิโคลิเนตในการเร่งปฏิกิริยาออกซิเดชันของแอลกอฮอล์ร่วมกับTBHP ที่อุณหภูมิ 70°C เป็นเวลา 24 ชั่วโมง ปฏิกิริยาให้ปริมาณผลิตภัณฑ์ และความเลือกจำเพาะสูง โดยเฉพาะแอลกอฮอล์ทุติยภูมิที่ไม่มีความเกะกะ สำหรับปฏิกิริยาออกซิเดชันของแอลกอฮอล์ปฐมภูมิจะให้ผลิตภัณฑ์เป็นกรดคาร์บอกซิลิกโดยการเกิดผ่านสารประกอบแอลดีไฮด์ก่อน อย่างไรก็ตาม เมื่อใช้ตัวออกซิเดนต์อื่น เช่น ไฮโดรเจนเปอร์ออกไซด์ หรือ โซเดียมไฮเปอร์คลอไรด์ในระบบตัวเร่งปฏิกิริยาเดียวกัน ปรากฏว่าไม่สามารถเกิดปฏิกิริยาออกซิเดชันของแอลกอฮอล์ได้ นอกจากนี้ภายใต้สภาวะดังกล่าว เมื่อประยุกต์ใช้กับปฏิกิริยาออกซิเดชันของสารประกอบไฮโดรคาร์บอน พบว่า ปฏิกิริยาเกิดขึ้นได้ดีกับสารประกอบประเภทเบนซิลิก และเมื่อเปรียบเทียบความสามารถในการเร่งปฏิกิริยา ระหว่าง โครเมียมสเตียเรตและโครเมียมพิโคลิเนตพบว่า สารประกอบเชิงซ้อนของโครเมียมทั้งสองให้ผลในการเร่งปฏิกิริยาไม่ต่างกัน แต่โครเมียมพิโคลิเนตสามารถแยกออกจากปฏิกิริยาได้ง่ายกว่า และสำหรับปฏิกิริยาออกซิเดชันของสารที่มีกำมะถันเป็นองค์ประกอบ ปฏิกิริยาเกิดขึ้นอย่างรวดเร็วจึงเหมาะที่จะประยุกต์ใช้ในกระบวนการกำจัดสารประกอบกำมะถันในสิ่งแวดล้อม ปฏิกิริยาออกซิเดชันที่ได้พัฒนาขึ้นนี้เชื่อว่าเกิดผ่านกระบวนการฟรีแรดิคัล

สาขาวิชา...ปิโตรเคมี.....ลายมือชื่อนิสิต.....
ปีการศึกษา.....2548.....ลายมือชื่ออาจารย์ที่ปรึกษา.....

4473854123: MAJOR PETROCHEMISTRY

KEY WORD: OXIDATION OF ALCOHOLS/ CHROMIUM COMPLEXES

UTHUMPORN THONG-IN: SELECTIVE OXIDATION OF SATURATED HYDROCARBONS, ALCOHOLS AND SULFUR-CONTAINING COMPOUNDS BY TRANSITION METAL COMPLEXES: ASST. PROF. WARINTHORN CHAVASIRI, Ph.D., 125 pp. ISBN 974-14-3373-5.

Oxidation reactions are interesting for functionalization of organic compounds and remain a reaction of considerable value in organic synthesis. This study focuses on the development of a catalytic system based on chromium catalysts. For this research, chromium(III) stearate and chromium(III) picolinate catalysts were utilized for the first time with *tert*-butyl hydroperoxide as an oxidant for the oxidation of alcohols. This reaction was achieved at 70°C for 24 h and the corresponding carbonyl compounds were obtained in high yield with good selectivity especially for secondary alcohols without steric hindrance. The oxidation of primary alcohols afforded the corresponding carboxylic acids *via* aldehydes. Otherwise, the use of other oxidants such as hydrogenperoxide or sodium hypochlorite afforded the unnecessary ability for the alcohol oxidations. After the optimized condition was established, this oxidation system was applied to the oxidation of various hydrocarbons. This catalytic oxidation also expressed good results for the oxidation at a benzylic position. Chromium(III) stearate and chromium(III) picolinate expressed comparable activity toward oxidation reaction, however chromium(III) picolinate was easy to separate from the reaction medium. This developed system was also appropriate for the oxidation of sulfur containing compounds. The outcome revealed that this system was suited to be employed as chemical remediation process in environmental viewpoint. These developed chromium(III) catalyst oxidation systems were believed to undergo *via* a free radical process.

Field of study Petrochemistry

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Academic year.....2005.....

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ACKNOWLEDGEMENTS

The author wishes to express appreciation to her thesis advisor Assistant Professor Dr. Warinthorn Chavasiri for his valuable instructions, kind supervision, profound assistance, encouragement and suggestions throughout the course of this research. In addition, thanks are extended to Natural Products Research Unit for the support of chemicals and laboratory facilities.

The greatest thanks are also extended to Associate Professor Dr. Supawan Tantayanon, Associate Professor Dr. Wimonrat Trakarnpruk, Professor Dr. Padet Sidisunthorn, Associate Professor Dr. Wasna Jaturonrusmee and Dr. Orawan Sanguaruang for their suggestions, comments, corrections and helps as thesis examiners. Moreover, thanks are extended to the Graduate School, Chulalongkorn University for their research grant.

A deep affectionate gratitude is acknowledged to her family for their understanding, encouragement and support throughout the course of education. Especially, thanks to her friends for friendship and helps throughout the entire course of study. Without them, the author would never have been able to achieve this goal.

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LIST OF ABBREVIATIONS

AcOH	acetic acid
anh	anhydrous
aq	aqueous
atm	atmosphere
b	broad (IR)
b.p.	boiling point
BTF	benzotrifluoride
°C	degree celsius
CHP	cumene hydroperoxide
cm ⁻¹	unit of wavenumber
Cr(acac) ₃	chromium(III) acetylacetonate
Cr(bza) ₃	chromium(III) benzoylacetate
Cr(cur) ₃	chromium(III) curcumin
Cr(pic) ₃	chromium(III) picolinate
Cr(str) ₃	chromium(III) stearate
d	doublet (NMR)
dd	doublet of doublet (NMR)
eq	equivalent (s)
equiv	equivalent (s)
Fig	Figure
g	gram (s)
GC	gas chromatography
h	hour(s)
Hz	hertz
IR	infrared
<i>J</i>	coupling constant (NMR)
m	multiplet (NMR)
m	moderate (IR)
MeCN	acetonitrile
min	minute(s)

mL	milliliter (s)
mmol	millimole (s)
m.p.	melting point
<i>N</i> -Boc	<i>N</i> - <i>tert</i> -butoxy-carbonyl
NMR	nuclear magnetic resonance
OAc	acetate
PCC	pyridinium chlorochromate
PhIO	iodozobenzene
ppm	part per million
py	pyridine
q	quartet (NMR)
quar	quartet (NMR)
quint	quintet (NMR)
R _f	retardation factor singlet (NMR)
RT	room temperature
s	singlet (NMR)
s	strong (IR)
t	triplet (NMR)
TBHP	<i>tert</i> -butyl hydroperoxide
<i>t</i> -BuOOH	<i>tert</i> -butyl hydroperoxide chemical shift (NMR)
TEMPO	2,2,6,6-tetramethylpiperidinoxy
TLC	thin layer chromatography
w	weak (IR)
%	percentage