

Project Code :
(for RCMO use only)



RU GRANT FINAL REPORT FORM

Please email a softcopy of this report to rcmo@usm.my

A PROJECT DETAILS	
i	Title of Research: A green approach towards synthesis and characterization of Ni(II)- and Pd(II)-N-heterocyclic carbene complexes of pincer ligands: their application in catalytic olefin oxidation studies.
ii	Account Number: 1001/PKIMIA/811217
iii	Name of Research Leader: Assoc Prof Dr. Rosenani S.M Anwarul Haque, PhD
iv	Name of Co-Researcher: Prof Teoh Siang Guan
v	Duration of this research: a) Start Date : 15 July 2012 b) Completion Date : 14 October 2015 c) Duration : 3 years and 3 months d) Revised Date (if any) :
B ABSTRACT OF RESEARCH	
<p><i>(An abstract of between 100 and 200 words must be prepared in Bahasa Malaysia and in English. This abstract will be included in the Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)</i></p> <p>Abstract</p> <p>Novel silver(I)- and Mercury(II)-N-Heterocyclic Carbene (NHC) Complexes of pincer ligands were successfully synthesized in good yields. The prepared complexes were then used for the transmetalation reactions to synthesize the required Nickel(II)- and Palladium(II)-NHC complexes. All the synthesized compounds were characterized by various spectroscopic and analytical techniques. X-ray crystallographic technique was used to determine the structural orientations of the molecules. The compounds were tested for possible biological and catalytic behavior. Silver(I) and palladium(II) complexes showed excellent antibacterial and anticancer results.</p>	

H. a) Results/Benefits of this research

Hasil Penyelidikan

No. Bil:	Category/Number: Kategori/ Bilangan:	Promised	Achieved
1.	Research Publications (Specify target journals) <i>Penerbitan Penyelidikan (Nyatakan sasaran jurnal)</i> Targeted journals, 1. J. Organomet. Chem. 2. Trans. Met. Chem. 3. Acta Cryst. E. <i>Have been successfully achieved.</i>	8 publications	18 publications Please see Appendix 4
2.	Human Capital Development		
	a. Ph. D Students	2	3
	b. Masters Students	1	3
	c. Undergraduates (Final Year Project)		6
	d. Research Officers		
	e. Research Assistants		
	f. Other: Please specify		
3.	Patents <i>Paten</i>		
4.	Specific / Potential Applications <i>Spesifik/Potensi aplikasin</i>	Anticancer, Antimicrobial and catalytic applications	Achieved
5.	Networking & Linkages <i>Jaringan & Jalinan</i>		
6.	Possible External Research Grants to be Acquired <i>Jangkaan Geran Penyelidikan Luar Diperoleh</i>		

- Kindly provide copies/evidence for Category 1 to 6.

b) Equipment used for this research.

Peralatan yang telah digunakan dalam penyelidikan ini.

Items Perkara	Approved Equipment	Approved Requested Equipment	Location
Specialized Equipment Peralatan khusus	1. CHN Analyzer 2. NMR 3. FTIR 4. X-ray crystallography	1. CHN Analyzer 2. NMR 3. FTIR4. X-ray crystallography	Instruments 1 to 3 are available in USM, while Instrument 4 is in the School of Physics, USM.
Facility Kemudahan	Glass-blowing Workshop Electronic workshop Chemical storeroom (Central Store and School Store)	Glass-blowing Workshop Electronic workshop Chemical storeroom (Central Store and School Store)	In the School of Chemical Sciences
Infrastructure Infrastruktur	2 research laboratories equipped with water, electricity and nitrogen gas supply outlet.		In the School of Chemical Sciences

- Please attach appendix if necessary.

C BUDGET & EXPENDITURE

i

Total Approved Budget : RM 148,250.00

Yearly Budget Distributed

Year 1 : RM 60,750

Year 2 : RM 46,750

Year 3 : RM 41,750

Total Expenditure : RM 145,958.05

Balance : RM 2,291.95

Percentage of Amount Spent (%) :

*# Please attach final account statement (eStatement) to indicate the project expenditure
Please see appendice 3*

ii Equipment Purchased Under Vot 35000

No.	Name of Equipment	Amount (RM)	Location	Status

Please attach the Asset/Inventory Return Form (Borang Penyerahan Aset/Inventori) – Appendix 1

D RESEARCH ACHIEVEMENTS

i Project Objectives (as stated/approved in the project proposal)

No.	Project Objectives	Achievement
1	Syntheis of NHC pincer salts.	The salts were succesfully synthesized
2	Synthesis of silver(I) complexes of pincer type NHC ligands.	Pure compounds were succesfully isolated
3	Synthesis of Palladium(II)- and Nickel(II)-NHC complexes via NHC transfer reaction from Ag(I)-NHC and Hg(II)-NHC complexes.	Transmetallation to Palladium(II)-NHC complexes was very succesful, yielding various structural motifs.
4	Characterisation using a wide range of spectro-analytical techniques viz., ¹ H and ¹³ C NMR, elemental analysis, FT-IR, etc., were used for structural elucidation of the non-crystalline complexes.	The elucidate structures agree well with the proposed compounds.
5	Evaluation of the biological activity of the Silver(I)- and Palladium(II)-NHC complexes.	All the metal complexes showed several times better activity than the corresponding NHC salts, indicating that metals play a significant role against inhibition of bacteria and proliferation of cancer

		cells.
6	Evaluation of the catalytic activity of the Palladium(II)-NHC complexes.	Catalytic activities of selected Palladium(II)-NHC complexes were very promising.

ii Research Output

a) Publications in ISI Web of Science/Scopus
18 publications please see appendice 1

No.	Publication (authors,title,journal,year,volume,pages,etc.)	Status of Publication (published/accepted/ under review)

b) Publications in Other Journals

No.	Publication (authors,title,journal,year,volume,pages,etc.)	Status of Publication (published/accepted/ under review)

c) Other Publications
(book,chapters in book,monograph,magazine,etc.)

No.	Publication (authors,title,journal,year,volume,pages,etc.)	Status of Publication (published/accepted/ under review)

d) Conference Proceeding

No.	Conference (conference name,date,place)	Title of Abstract/Article	Level (International/National)

Please attach a full copy of the publication/proceeding listed above

iii Other Research Output/Impact From This Project
(patent, products, awards, copyright, external grant, networking, etc.)

➤ International collaboration from China.

E HUMAN CAPITAL DEVELOPMENT**a) Graduated Human Capital**

Student	Nationality (No.)		Name
	National	International	
PhD		3	1. Mohammed Z. Ghadhayeb 2. Muhammad Adnan Iqbal 3. Patrick O. Asekunowo
MSc	3		1. Noorhafizah Binti Hasanudin 2. Zetty Zulikha Binti Hafiz 3. Choo Sze Yii
Undergraduate			

b) On-going Human Capital

Student	Nationality (No.)		Name
	National	International	
PhD		3	1. Tabinda Fatima 2. Yeap Choon Wan 3. Hussaini Sunusi Yahaya
MSc		1	1. Puvana Devi A/P Selivaroojoo
Undergraduate			

c) Others Human Capital

Student	Nationality (No.)		Name
	National	International	
Post Doctoral Fellow		1	1. Dr. Patrick O. Asekunowo
Research Officer			
Research Assistant			
Others (.....)			

F COMPREHENSIVE TECHNICAL REPORT

Applicants are required to prepare a comprehensive technical report explaining the project. The following format should be used (this report must be attached separately):

Please see appendix 2

- Introduction
- Objectives
- Methods
- Results
- Discussion
- Conclusion and Suggestion
- Acknowledgements
- References

G	PROBLEMS/CONSTRAINTS/CHALLENGES IF ANY
	<p><i>(Please provide issues arising from the project and how they were resolved)</i></p> <p>There were no issues.</p>
H	RECOMMENDATION
	<p><i>(Please provide recommendations that can be used to improve the delivery of information, grant management, guidelines and policy, etc.)</i></p> <ol style="list-style-type: none"> 1. Providing central support, training, and tools to expedite the grants process 2. Defining specific priorities; for instance some projects give preference to some current health problems such as dengue fever etc. This should be given priorities over others. 3. Adhering to decisions. 4. Removing barriers, such as obtrusive approval processes. 5. Streamlined approaches: To improve the efficiency of the grant process by simplifying or eliminating unnecessary steps.

Project Leader's Signature:

Rasman

Name :

Date :

H.

COMMENTS OF PTJ'S RESEARCH COMMITTEE
KOMEN JAWATANKUASA PENYELIDIKAN PERINGKAT PTJ

General Comments:

Ulasan Umum:

Pencapaian yang sangat baik khususnya
daripada segi perubatan jurnal.



Signature and Stamp of Chairperson of PTJ's Evaluation Committee

Tandatangan dan Cop Pengerusi Jawatankuasa Penilaian PTJ

Prof. Dr. Yeap Guan Yeow

Timbalan Dekan

(Penyelidikan, Siswazah dan Jaringan)

Pusat Pengajian Sains Kimia

Date :

25 Mei 2016

Tarikh :

Signature and Stamp of Dean/ Director of PTJ

Tandatangan dan Cop Dekan/ Pengarah PTJ

Prof. Dr. Afidah Abdul Rahim

Dekan

Pusat Pengajian Sains Kimia

Universiti Sains Malaysia

Date :

26/5/2016

Tarikh :

User Code: SYAKIRAH / USMPGLIVE / PKIMIA

Program Code: Votebook9100

Current Program: Votebook (Header)

Current Date: 24/05/2016 11:23:53 AM

Version: 15.124, Last Updated at 04/05/2016

DB: 13.02, 9/27/2010 VB: 13.01, 3/14/2011

Switch Language: English / Malay

Wildcard: eq. Like 100%, Like 10%1, Like %1

Element 1: 1001 Element 2: % Element 4: PKIMIA
 Element 5: 811217 Year: 2016

Detail	Excel	Budget Rule	Budget Control	Account Description	Budget Account Code	Roll over	Budget	Cash Received	Advanced	Commit	Actual	Available	Percentage
	Excel	49	T	Projek Kumpulan Wang Uni Penyelidikan	1001.111.0.PKIMIA.811217	59,000.00	0.00	0.00	0.00	0.00	0.00	59,000.00	0.00%
	Excel	49	T	Projek Kumpulan Wang Uni Penyelidikan	1001.115.0.PKIMIA.811217	-2,325.00	0.00	0.00	0.00	0.00	0.00	-2,325.00	0.00%
		49	T	SubTotal		56,675.00	0.00	0.00	0.00	0.00	0.00	56,675.00	0.00%
	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.221.0.PKIMIA.811217	-11,529.14	0.00	0.00	0.00	0.00	0.00	-11,529.14	0.00%
	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.223.0.PKIMIA.811217	-78.75	0.00	0.00	0.00	0.00	0.00	-78.75	0.00%
	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.224.0.PKIMIA.811217	1,720.00	0.00	0.00	0.00	90.00	0.00	1,630.00	0.00%
	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.227.0.PKIMIA.811217	11,667.00	0.00	0.00	0.00	0.00	0.00	11,667.00	0.00%
	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.228.0.PKIMIA.811217	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00%
	Excel	50	T	Projek Kumpulan Wang Uni Penyelidikan	1001.229.0.PKIMIA.811217	-48,499.16	0.00	0.00	0.00	0.00	1,400.00	-49,899.16	0.00%
		50	T	SubTotal		-46,720.05	0.00	0.00	0.00	90.00	1,400.00	-48,210.05	0.00%
	Excel	51	T	Projek Kumpulan Wang Uni Penyelidikan	1001.335.0.PKIMIA.811217	-7,633.00	0.00	0.00	0.00	0.00	0.00	-7,633.00	0.00%
		51	T	SubTotal		-7,633.00	0.00	0.00	0.00	0.00	0.00	-7,633.00	0.00%
	Excel	53	T	Projek Kumpulan Wang Uni Penyelidikan	1001.552.0.PKIMIA.811217	-30.00	0.00	0.00	0.00	0.00	0.00	-30.00	0.00%
		53	T	SubTotal		-30.00	0.00	0.00	0.00	0.00	0.00	-30.00	0.00%
		9999		GrandTotal		2,291.95	0.00	0.00	0.00	90.00	1,400.00	801.95	0.00%

