STUDIES OF GEOPOLYMERIZATION ROUTE FOR METAKAOLIN GEOPOLYMERIC MATERIALS

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UNIVERSITI MALAYSIA PERLIS

2014

STUDIES OF GEOPOLYMERIZATION ROUTE FOR METAKAOLIN GEOPOLYMERIC MATERIALS

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A thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy

School of Materials Engineering
UNIVERSITI MALAYSIA PERLIS

2014

UNIVERSITI MALAYSIA PERLIS

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Academic Session : **2013/2014**

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ACKNOWLEDGEMENT

I would like to express my deepest thank of gratitude to Brig. Gen. Dato' Prof. Dr. Kamarudin Hussin, my main supervisor, for his supervision, guidance and encouragement throughout the progress of this work.

My acknowledgement to Mr. Mustafa Al-Bakri Abdullah, Assoc. Prof. Dr. Khairul Nizar, Assoc. Prof. Ruzaidi and Dr. Luqman for their leading, understanding, technical contributions as well as the constructive opinions and suggestions in the accomplishment of my research and thesis.

Sincerely, I would also like to express my appreciation to the Center of Excellence Geopolymer and Green Technology (CEGeoGTech) which provides me the laboratory equipments and all the members for their cooperation, sharing of technical knowledge and friendly assistance during the course of this study.

Furthermore, I am thankful to Universiti Malaysia Perlis (UniMAP), especially to the Dean, Dr. Khairel Rafezi, management staffs and technicians of School of Materials Engineering for the constant help with laboratory works and technical assistance in one way or another.

Special thanks are extended to King Abdulaziz City for Science and Technology (KACST) for granting the research. Also, I am grateful to the Ministry of Higher Education Malaysia for the financial support provided through the scholarship scheme.

Finally, my humblest obligations go to my parents, siblings and friends. Thank you for their love, continual support and encouragement for the success of my study.

TABLE OF CONTENT

CHAPTER 3: METHODOLOGY

CHAPTER 4: RESULTS AND DISCUSSION

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Al	Aluminium
Al_2O_3	Alumina
aq	Aqueous
BET	Branauer-Emmett-Teller
Ca	Calcium
Cr	Chromium
CSH	Calcium Silicate Hydrated
d	Day
EDX	Energy Dispersive X-ray Spectroscopy
Fe_2O_3	Iron (III) Oxide
FTIR	Fourier Transform Infrared Spectroscopy
GGBFS	Ground-granulated Blast Furnace Slag
h	hour
HCl	Hydrochloric acid
H_2O	Dihydrogen Monoxide
H_2SO_4	Sulphuric Acid
KOH	Potassium Hydroxide
K_2SiO_3	Potassium Silicate
LOI	Lost of Ignition
Mn	Manganese

MnO_2	Manganese Dioxide
Mg	Magnesium
Na	Sodium
Na_2SiO_3	Sodium Silicate
Na_2O	Sodium Oxide
K	Potassium
K_2O	Potassium Oxide
NaOH	Sodium Hydroxide
OH^-	Hydroxyl Ion
P	Phosphorus
PSD	Particle Size Distribution
S/L	Solids-to-liquid Ratio
S	Sulphur
s	solid
SiO_2	Silica
Si	Silicon
SEM	Scanning Electron Microscope
TiO_2	Titanium Dioxide
XRD	X-ray Diffraction
XRF	X-Ray Fluorescence
ZrO_2	Zirconium Dioxide
℃	Degree Celsius

Kajian Tentang Laluan Penggeopolimeran Untuk Bahan-bahan Geopolimer Metakaolin

ABSTRAK

Kajian tentang penghasilan serbuk geopolimer metakaolin adalah bertujuan untuk meningkatkan produktiviti dan penggunaan produk geopolimer. Proses penggeopolimeran telah diaplikasikan dalam penghasilan serbuk geopolimer untuk sintesis pes geopolimer. Lumpur geopolimer dihasilkan melalui proses pengaktifan metakaolin dalam larutan pengaktif beralkali (campuran larutan NaOH dan natrium silikat). Lumpur geopolimer yang dihasilkan dimasukkan dalam ketuhar untuk memperolehi pes pepejal dan seterusnya dikisarkan kepada serbuk bersaiz seragam. Melalui konsep "hanya menambah air", serbuk geopolimer dicampurkan dengan air dan diawetkan dalam ketuhar untuk menghasilkan pes geopolimer. Sifat-sifat fizikal dan mekanikal serbuk dan pes geopolimer termasuk kebolehkerjaan, tempoh pengesetan, ketumpatan pukal dan kekuatan mampatan telah dikaji. Selain itu, analisis SEM/EDX, XRD dan FTIR telah dijalankan. Keputusan menunjukkan bahawa keadaan optima untuk penghasilan serbuk dan pes geopolimer yang berkekuatan tinggi adalah dengan menggunakan larutan NaOH 8M, nisbah pepejal/cecair 0.80, nisbah larutan pengaktif 0.20, keadaan pemejalan pada suhu 80℃ selama 4 jam, 22% campuran air dan proses pengawetan yang dijalankan pada suhu 60℃ selama 72 jam. Pes geopolimer yang dihasilkan mempunyai ketumpatan pukal yang rendah dan berpotensi untuk dijadikan sebagai bahan ringan. Pencampuran serbuk geopolimer dengan air menyebabkan ketumpatan struktur dengan pembentukan gel geopolimer yang lebih padat. Serbuk dan pes geopolimer turut menunjukkan kombinasi fasa-fasa amorfus dan hablur apabila dikaji dengan analisis XRD. Intensiti fasa zeolit semakin meningkat dengan peningkatan penuaan dan ini menekankan manfaat zeolit dalam peningkatan kekuatan mampatan pes geopolimer yang dihasilkan. Di samping itu, analisis FTIR menunjukkan pembentukan ikatan geopolimer dalam struktur. Nisbah molar SiO_2/Al_2O_3, Na_2O/SiO_2, H_2O/Na_2O dan Na_2O/Al_2O_3 yang optima adalah 3.10, 0.37, 14.23 dan 1.15. Kajian atas nisbah molar oksida menyimpulkan bahawa nisbah molar Na_2O/Al_2O_3 dan H_2O/Na_2O memberi kesan yang tinggi kepada sifat mekanikal pes geopolimer. Hasil kajian ini jelas membuktikan bahawa penghasilan serbuk geopolimer metakaolin ini boleh digunakan dalam sintesis pes geopolimer.