

UNIVERSITI MALAYSIA PERLIS

DECLARATION OF THESIS

Author's full name SITI SHUHADAH BINTI MD SALEH  
Date of birth 13<sup>th</sup> JUNE 1984  
Title EFFECT OF CHEMICAL MODIFICATION OF EGGSHELLS  
POWDER FILLED LOW DENSITY POLYETHYLENE COMPOSITES  
Academic Session 2009/2010

I hereby declare that the thesis becomes the property of Universiti Malaysia Perlis (UniMAP) and to be placed at the library of UniMAP. This thesis is classified as:

- CONFIDENTIAL (Contains confidential information under the Official Secret Act 1972)\*  
 RESTRICTED (Contains restricted information as specified by the organization where research was done)\*  
 OPEN ACCESS I agree that my thesis is to be made immediately available as hard copy or on-line open access (full text)

I, the author, give permission to the UniMAP to reproduce this thesis in whole or in part for the purpose of research or academic exchange only (except during a period of \_\_\_\_\_ years, if so requested above).

Certified by:

\_\_\_\_\_  
**SIGNATURE**

\_\_\_\_\_  
**SIGNATURE OF SUPERVISOR**

840613-02-5510

DR.SUPRI A.GHANI

**(NEW IC NO. / PASSPORT NO.)**

**NAME OF SUPERVISOR**

Date \_\_\_\_\_

Date: \_\_\_\_\_

NOTES: \* If the thesis is CONFIDENTIAL or RESTRICTED, please attach with the letter from the organization with period and reasons for confidentiality or restriction.

© This item is protected by original copyright

## APPROVAL AND DECLARATION SHEET

This thesis titled Effect of Chemical Modification of Eggshells Powder Filled Low Density Polyethylene Composites was prepared and submitted by Siti Shuhadah Binti Md Saleh (Matrix Number: 0730410162) and has been found satisfactory in terms of scope, quality and presentation as partial fulfillment of the requirement for the award of degree of Master of Science (Materials Engineering) in University Malaysia Perlis (UniMAP). The members of the Supervisory committee are as follows:

**DR. SUPRI A.GHANI, Ph.D.**

Lecturer  
School of Materials Engineering  
Universiti Malaysia Perlis  
(Head Supervisor)

**BRIG. JEN. DATO' PROF. DR. KAMARUDIN HUSSIN, Ph.D.**

Vice Chancellor  
Universiti Malaysia Perlis  
(Co-Supervisor)

Checked and Approved by

---

**(DR. SUPRI A.GHANI)**

Head Supervisor

(Date: \_\_\_\_\_)

School of Materials Engineering  
Universiti Malaysia Perlis

2010

## ACKNOWLEDGEMENT

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

Alhamdulillah and thank to Allah, which has gave me the commitment and the strength to finish this project. First of all I would like to express my sincere gratitude to project supervisor Dr.Supri A.Ghani for his support throughout my time at UniMAP. His talents, dedication, and enthusiasm for research will be a continuing source of inspiration. My thanks also for my co-supervisor Brig. Jen. Dato' Prof. Dr. Kamarudin Hussin.

Special thanks to my father Md Saleh bin Abdullah, my mother Rahmah binti Senik, my sister Siti Rodziah and Siti Rosilah & family for their patience, understanding, unflinching love and support through the ups and downs. I also wish to express my appreciation to Dr Salmah Hussiensyah and Prof. San Myint , who made many valuable suggestions and gave constructive advice. I also would like to express thanks to the Dean School of Materials Engineering, Dr. Khairul Rafezi Ahmad with the approval of my master thesis.

I also would like to express my gratitude to all postgraduate colleagues in School of Materials Engineering especially Dahlia, Nurul Izza, Raudah, Radzi Ali, Shahrizan and Hashahrin. Not forgetting for all technicians of School of Materials Engineering, especially Mr Norzaidi, Mr Nasir, Mr Azmi, Mr Rosmawadi and Mr Hazrul for the guidance to operate the lab equipments. My sincere thanks also goes to my friends Nur Hanim Naim, Zubir, Nur Syuhada, Zarimawati, Nur Farhan ,Nurul Husna and Rosyidi for their support.

Not forgotten, I would like to express my gratitude and thanks to our late lecturer Allahyarham Prof Nasir and my best friend Allahyarham Mohd Hafizuddin Abd Hady.

Specials thanks to Ministry of Science, Technology and Innovation (MOSTI) for financial support via National Science Fellowship Scheme (NSF). Finally, I would like to thank everyone that has been involved in this project directly or indirectly for their help and contribution. Thank you very much!

Thanks to Almighty ALLAH

SITI SHUHADAH BINTI MD SALEH

UNIVERSITI MALAYSIA PERLIS

© This item is protected by original copyright

## TABLE OF CONTENTS

	<b>Page</b>
<b>DECLARATION OF THESIS</b>	i
<b>PERMISSION TO USE</b>	ii
<b>APPROVAL AND DECLARATION SHEET</b>	iii
<b>ACKNOWLEDGEMENT</b>	iv
<b>TABLE OF CONTENTS</b>	vi
<b>LIST OF TABLES</b>	xi
<b>LIST OF FIGURES</b>	xii
<b>LIST OF SYMBOLS, ABBREVIATIONS OR NUMENCLATURE</b>	xvii
<b>ABSTRAK (BAHASA MELAYU)</b>	xx
<b>ABSTRACT (ENGLISH)</b>	xxi
<b>CHAPTER 1: INTRODUCTION</b>	
1.1 Research Background	1
1.2 Research Objectives	5
<b>CHAPTER 2: LITERATURE REVIEW</b>	
2.1 Composite	7
2.1.1 Definition of Composites	7
2.1.2 Classification of Composites	9
2.1.3 Polymer Composites	10

2.1.3.1	Thermoplastic and Thermoset Composites	10
2.1.3.2	Matrix and Filler	10
2.2	Polyethylene (PE)	12
2.2.1	Introduction of Polyethylene	12
2.2.2	Structure and Properties of Polyethylene	13
2.2.3	Type of Polyethylene	14
2.2.4	Low Density Polyethylene	15
2.2.5	Structure and Properties of Low Density Polyethylene (LDPE)	16
2.3	Filler in Composites	17
2.3.1	Organic Filler and Inorganic Filler	18
2.3.2	Eggshells Powder (ESP)	19
2.3.2.1	Introduction of Eggshells	19
2.3.2.2	Composition of Eggshells	19
2.3.2.3	Application of Eggshells	20
2.4	Chemical Modification	21
2.5	Interfacial Adhesion	22
2.6	Type of Coupling Agent	22
2.6.1	Titanate Coupling Agent	23
2.6.2	Isophthalic Acid	24
2.6.3	Ethylene Diamine	24
2.6.4	Polyethylene-Grafted-Maleic Anhydride (PEMAH)	25

## CHAPTER 3: METHODOLOGY

3.1	Materials	27
3.2	Preparation of Eggshells Powder	28
3.3	Modification of Eggshells Powder	29
3.3.1	Pre-treated with Sodium Hydroxide	29
3.3.2	Modified with Isophthalic Acid	30
3.3.3	Modified with Ethylene Diamine-co-Isophthalic Acid	30
3.4	Sample Preparation of Composites	30
3.4.1	Compounding of Composites	30
3.4.1.1	The Addition of Polyethylene-grafted-Maleic Anhydride in the Composites	32
3.4.2	Compression of Composites	32
3.5	Testing and Characterizations	33
3.5.1	Tensile Test	33
3.5.2	Scanning Electron Microscopy Study (SEM)	34
3.5.3	Thermogravimetric Analysis (TGA)	34
3.5.4	Differential Scanning Calorimetry (DSC)	35
3.5.5	Water Absorption Test	35



## CHAPTER 4: RESULTS AND DISCUSSION

4.1	Effect of Isophthalic Acid and Ethylene Diamine-co-Isophthalic Acid Modified Eggshells Powder Filled Low Density Polyethylene Composites	36
4.1.1	Mechanical Properties	36
4.1.2	Morphology Properties	41
4.1.3	Water Absorption Analysis	48
4.1.4	Thermal Analysis	51
4.2	The Effect of Polyethylene-Grafted-Maleic Anhydride as a Compatibilizer on Properties of Eggshells Powder Filled Low Density Polyethylene Composites (LDPE/ESP <sub>PEMAH</sub> )	58
4.2.1	Mechanical Properties	58
4.2.2	Morphology Properties	61
4.2.3	Water Absorption Analysis	63
4.2.4	Thermal Analysis	64
4.3	The Comparison Effect of Various Modifications of Eggshells Powder and CaCO <sub>3</sub> as filler in LDPE Composites	68
4.3.1	Mechanical Properties	68
4.3.2	Morphology Properties	72
4.3.3	Water Absorption Analysis	74
4.3.4	Thermal Analysis	75

## CHAPTER 5: CONCLUSION AND SUGGESTION FOR FURTHER WORK

5.1	Conclusions	79
5.2	Suggestion for Further Work	81

<b>REFERENCES</b>	<b>82</b>
-------------------	-----------

<b>APPENDIX A</b>	<b>89</b>
-------------------	-----------

<b>APPENDIX B</b>	<b>90</b>
-------------------	-----------

<b>APPENDIX C</b>	<b>91</b>
-------------------	-----------

<b>APPENDIX D</b>	<b>92</b>
-------------------	-----------

<b>APPENDIX E</b>	<b>93</b>
-------------------	-----------

<b>APPENDIX F</b>	<b>94</b>
-------------------	-----------

<b>APPENDIX G</b>	<b>95</b>
-------------------	-----------

<b>APPENDIX H</b>	<b>96</b>
-------------------	-----------

<b>APPENDIX I</b>	<b>97</b>
-------------------	-----------

<b>APPENDIX J</b>	<b>98</b>
-------------------	-----------

## LIST OF TABLES

Tables No.		Page
Table 3.1:	Semi quantitative analysis of $\text{CaCO}_3$ using X-ray fluorescence spectrometer	28
Table 3.2:	Inorganics compound of eggshells powder investigated by using X-ray fluorescence spectrometer	29
Table 3.3:	Formulation of unmodified eggshells powder (ESP) filled low density polyethylene composites	31
Table 4.1:	Data of $T_{-50}$ wt%, FDT and residual mass (RM) of LDPE/ESP, LDPE/ESP <sub>1</sub> and LDPE/ESP <sub>M</sub> composites	54
Table 4.2:	The thermal parameter DSC for LDPE/ESP, LDPE/ESP <sub>1</sub> and LDPE/ESP <sub>M</sub> composites	57
Table 4.3:	Data of $T_{-50}$ wt%, FDT and residual mass (RM) of modified Polyethylene-grafted-maleic anhydride eggshells powder filled low density polyethylene composites	65
Table 4.4:	The thermal parameter DSC for LDPE/ESP and LDPE/ESP <sub>PEMAH</sub> composites	67
Table 4.5:	Data of $T_{-50}$ wt%, FDT and residual mass (RM) of LDPE/ $\text{CaCO}_3$ and LDPE/ESP composites with various modifications	76
Table 4.6:	The thermal parameter of LDPE/ $\text{CaCO}_3$ and LDPE/ESP composites with various modifications from Differential Scanning Calorimetry	78

## LIST OF FIGURES

Figures No.		Page
Figure 2.1:	Type of Composite	9
Figure 2.2:	Ethylene structure	13
Figure 2.3:	Polyethylene structure	14
Figure 2.4:	Isophthalic acid structure	24
Figure 2.5:	Ethylene diamine structure	24
Figure 2.6:	Polyethylene-grafted-maleic anhydride structure	26
Figure 3.1:	Z-Blade mixer	31
Figure 3.2:	Electrically heated hydraulic press	33
Figure 3.3:	Scanning electron microscopy (SEM)	34
Figure 4.1:	Effect of filler loading on the tensile strength of eggshells powder (ESP), isophthalic acid modified eggshells powder (ESP <sub>I</sub> ) and ethylene diamine-co-isophthalic acid modified eggshells powder (ESP <sub>M</sub> )	37
Figure 4.2:	Mechanism illustration of isophthalic acid modified eggshells powder	38
Figure 4.3:	Mechanism illustration of ethylene diamine-co-isophthalic acid modified eggshells powder	38

Figure 4.4:	Effect of filler loading on the elongation at break of eggshells powder (ESP), isophthalic acid modified eggshells powder (ESP <sub>I</sub> ) and ethylene diamine-co-isophthalic acid modified eggshells powder (ESP <sub>M</sub> ) filled low density polyethylene composites	39
Figure 4.5:	Effect of filler loading on the Young's modulus of eggshells powder (ESP), isophthalic acid modified eggshells powder (ESP <sub>I</sub> ) and ethylene diamine-co-isophthalic acid modified eggshells powder (ESP <sub>M</sub> ) filled low density polyethylene composites	41
Figure 4.6:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP5 composites at magnification 400X	42
Figure 4.7:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP <sub>I</sub> 5 composites at magnification 400X	42
Figure 4.8:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP <sub>M</sub> 5 composites at magnification 400X	43
Figure 4.9:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP15 composites at magnification 400X	44
Figure 4.10:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP <sub>I</sub> 15 composites at magnification 400X	44
Figure 4.11:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP <sub>M</sub> 15 at magnification of 400X	45
Figure 4.12:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP25 composites at magnification 400X	46
Figure 4.13:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP <sub>I</sub> 25 composites at magnification 400X	47

Figure 4.14:	Scanning electron micrograph of tensile fracture surfaces of LDPE/ESP <sub>M</sub> 25 at magnification of 400X	47
Figure 4.15:	Water absorption versus time of LDPE/ESP composites with different filler loading	48
Figure 4.16:	Water absorption versus time of LDPE/ESP <sub>I</sub> composites with different filler loading	49
Figure 4.17:	Percentage of water absorption versus time of LDPE/ESP <sub>M</sub> composites with different filler loading	50
Figure 4.18:	Percentage of equilibrium water absorption versus filler loading for LDPE/ESP, LDPE/ESP <sub>I</sub> , and LDPE/ESP <sub>M</sub> composites	50
Figure 4.19:	Thermogravimetric analysis curves of LDPE/ESP composites with different filler loading	51
Figure 4.20:	Thermogravimetric analysis curves of LDPE/ESP <sub>I</sub> composites with different filler loading	52
Figure 4.21:	Thermogravimetric analysis curves of LDPE/ESP <sub>M</sub> composites with different filler loading	52
Figure 4.22:	Differential scanning calorimetry curves of LDPE/ESP composites with different filler loading	55
Figure 4.23:	Differential scanning calorimetry curves of LDPE/ESP <sub>I</sub> composites with different filler loading	55
Figure 4.24:	Differential scanning calorimetry curves of LDPE/ESP <sub>M</sub> composites with different filler loading	56

Figure 4.25:	Effect of filler loading on the tensile strength of eggshells powder (ESP) filled low density polyethylene composites with and without PEMA <sub>H</sub>	58
Figure 4.26:	Mechanism illustration of interaction between eggshells powder with PEMA <sub>H</sub> in the composites	59
Figure 4.27:	Effect of filler loading on the elongation at break of eggshells powder (ESP) filled low density polyethylene composites with and without PEMA <sub>H</sub>	60
Figure 4.28:	Effect of filler loading on the Young's modulus of eggshells powder (ESP) filled low density polyethylene composites with and without PEMA <sub>H</sub>	61
Figure 4.29:	Scanning electron micrograph of tensile fracture surfaces of eggshells powder (ESP) filled low density polyethylene composites with and without PEMA <sub>H</sub> at magnification of 400X: a) LDPE/ESP5 composites, b) LDPE/ESP15 composites, c) LDPE/ESP25 composites, d) LDPE/ESP <sub>PEMA<sub>H</sub></sub> 5 composites, e) LDPE/ESP <sub>PEMA<sub>H</sub></sub> 15 composites and f) LDPE/ESP <sub>PEMA<sub>H</sub></sub> 25 composites	62
Figure 4.30:	Percentage water absorption versus time of LDPE/ESP <sub>PEMA<sub>H</sub></sub> composites with different filler loading	63
Figure 4.31:	Percentage of equilibrium water absorption versus filler loading for LDPE/ESP and LDPE/ESP <sub>PEMA<sub>H</sub></sub> composites.	64
Figure 4.32:	Thermogravimetric analysis curves of LDPE/ESP <sub>PEMA<sub>H</sub></sub> composites with different filler loading	65
Figure 4.33:	Differential scanning calorimetry curves of LDPE/ESP <sub>PEMA<sub>H</sub></sub> composites with different filler loading	66

Figure 4.34:	Effect of various modifications of eggshells powder and $\text{CaCO}_3$ on tensile strength of LDPE composites	68
Figure 4.35:	Effect of various modifications of eggshells powder and $\text{CaCO}_3$ on elongation at break of LDPE composites	70
Figure 4.36:	Effect of various modifications of eggshells powder and $\text{CaCO}_3$ on young's modulus of LDPE composites	71
Figure 4.37:	Scanning electron micrograph of tensile fracture surfaces of various modifications of eggshells powder filled low density composites at 25 percent filler loading at magnification of 400X: a)LDPE/ $\text{CaCO}_3$ composites, b) LDPE/ESP25 composites, c)LDPE/ESP <sub>1</sub> 25 composites, d)LDPE/ESP <sub>M</sub> 25 composites and e)LDPE/ESP <sub>PEMAH</sub> 25 composites	73
Figure 4.38:	Effect of various modifications of eggshells powder and $\text{CaCO}_3$ on percentage of equilibrium water absorption of LDPE composites	74
Figure 4.39:	Thermogravimetric analysis curves of LDPE/ $\text{CaCO}_3$ and LDPE/ESP composites with various modifications	75
Figure 4.40:	Differential scanning calorimetry curves of LDPE/ $\text{CaCO}_3$ and LDPE/ESP composites with various modifications	77



## LIST OS SYMBOLS, ABBREVIATIONS OR NUMENCLATURE

$\mu\text{m}$	Micron meter
ABS	Acrylonitrile butadiene styrene
$\text{Al}_2\text{O}_3$	Aluminium oxide
ASTM	American society for testing and materials
$\text{C}_2\text{H}_4 (\text{NH}_2)_2$	Ethylene diamine
$\text{C}_2\text{H}_4$	Ethylene
$\text{C}_6\text{H}_4 (\text{COOH})_2$	Isophthalic acid
$\text{CaCO}_3$	Calcium carbonate
$\text{CaO}$	Calcium oxide
Cl	Chlorine
cm	Centimeter
$\text{Cr}_2\text{O}_3$	Chromium oxide
$\text{CuO}$	Copper oxide
DMA	Dynamic mechanical analyzer
DSC	Differential scanning calorimetry
ES	Eggshells
ESCR	Environmental stress crack resistance
ESP	Eggshells powder
FDT	Final decomposition temperature ( $^{\circ}\text{C}$ )
g	Gram
HDPE	High density polyethylene
HMWHDPE	High molecular weight high density polyethylene

kg	Kilogram
LDPE	Low density polyethylene
LLDPE	Low linear density polyethylene
LOI	Loss of ignition
MA	Maleic anhydride
MFI	Melt flow index
min	Minute
mm	Millimeter
MnO	Manganese oxide
Mt	Percentage of water absorption
MW	Molecular weight
MWD	Molecular weight distribution
NaCl	Sodium chloride
NaOH	Sodium hydroxide
°C	Degree celcius
OVX	Ovariectomy
PE	Polyethylene
PEMAH	Polyethylene-grafted-maleic anhydride
PP	Polypropylene
PS	Polystyrene
RM	Residual mass
rpm	Rotation per minute
S	Sulfur
SEM	Scanning electron microscope
SiO <sub>2</sub>	Silicon dioxide
T <sub>-50</sub> %	Temperature of 50% weight loss (°C)

TEM	Transmission electron microscopy
$T_g$	Glass transition temperature
TGA	Thermogravimetry analysis
$T_m$	Melting temperature
UHMWPE	Ultra high molecular weight polyethylene
ULDPE	Ultra low density polyethylene
UTM	Universal testing machine
VLDPE	Very low density polyethylene
w t%	Weight percent
Wd	Original dry weight
WN	Weight after exposure
$\Delta H_f$	Enthalpy of fusion of the composite

© This item is protected by original copyright

**KOMPOSIT POLIETILENA KETUMPATAN RENDAH BERPENGISI SERBUK KULIT  
TELUR YANG TERUBAHSUAI SECARA KIMIA**

**ABSTRAK**

Komposit polietilena ketumpatan rendah berpengisi serbuk kulit telur (LDPE/ESP) telah dikaji. Komposit disediakan menggunakan pencampur bilah-Z pada suhu 180°C dengan menggunakan kelajuan putaran 50 rpm selama 6 minit. Sampel komposit ditekan pada acuan menggunakan penekan hidraulik panas. Penekanan panas melibatkan prapemanasan pada suhu 180°C selama 4 minit diikuti oleh penekanan selama 2 min pada suhu yang sama dan penyejukan bertekanan selama 2 minit. Didapati bahawa kekuatan tensil dan pemanjangan pada takat putus komposit menurun bila pembebanan pengisi bertambah. Modulus Young untuk komposit bertambah bila pembebanan pengisi bertambah. Komposit kemudiannya diubahsuai menggunakan asid isofetalik (LDPE/ESP<sub>I</sub>), etilena diamina-co-asid isofetalik (LDPE/ESP<sub>M</sub>) dan polietilena-graf-maleic anhydride (LDPE/ESP<sub>PEMAH</sub>). Di dapati bahawa rekatan antara muka telah meningkatkan kekuatan tensil dan rintangan penyerapan air untuk komposit LDPE/serbuk kulit telur terubahsuai berbanding komposit LDPE/serbuk kulit telur yang tidak diubahsuai (LDPE/ESP). Ia juga meningkatkan kestabilan terma dan peratusan penghabluran komposit. Rekatan antara muka yang lebih baik di antara kulit telur dan LDPE telah menyebabkan peningkatan sifat-sifat mekanikal komposit LDPE/serbuk kulit telur terubahsuai seperti yang dilihat pada permukaan patah tensil menggunakan SEM.

# EFFECT OF CHEMICAL MODIFICATION OF EGGHELLS POWDER FILLED LOW DENSITY POLYETHYLENE COMPOSITES

## ABSTRACT

*Eggshells powder filled low density polyethylene (LDPE/ESP) composites were studied. The composites were prepared by using Z-blade mixer at 180°C using a rotor speed of 50 rpm for 6 minutes. Sample of composites were compression moulded, in an electrically heated Hydraulic press. Hot press procedures involved preheating at 180°C for 4 min followed by compression for 2 min at the same temperature and subsequent cooling under pressure for 2 min. It was found that the tensile strength and elongation at break for the composites decreased with the increasing filler loading. Young's modulus for the composites increases with the increasing filler loading. Then the composites were modified with isophthalic acid (LDPE/ESP<sub>I</sub>), ethylene diamine-co-isophthalic acid (LDPE/ESP<sub>M</sub>) and polyethylene-grafted-maleic anhydride (LDPE/ESP<sub>PEMAH</sub>). It was found that improvement in interfacial adhesion has enhanced the tensile strength and water absorption resistance of LDPE/modified eggshells powder composites compare to LDPE/unmodified eggshells powder composites (LDPE/ESP). Its also increased thermal stability and percent of crystallinity of composites. Better interfacial adhesion between LDPE and eggshells powder are responsible for the improvement of mechanical properties of LDPE/modified eggshells powder composites, as evident by scanning electron microscopy (SEM) on tensile fracture surface of the composites.*

## CHAPTER 1

### INTRODUCTION

#### 1.1 Research Background

Polymers play an important role in our society. Over the past few decades, polymers have replaced many conventional materials, such as metal and wood, in many applications. This is due to the advantages of polymers over conventional materials (Kuo, Wang, Chen, Hsueh, & Tsai, 2009). Polymer become as important materials that can suited with many application in everyday life. It's was use in house ware to the components of the space shuttle. Polymer industry has the large economic advantage over synthesizing new polymeric materials to fulfill the materials need. The currently available commercial materials cannot satisfy the growing need for new advanced material. Many researchers try to improve the materials properties to fulfill the requirement for application in the new era of technologies.

Currently, research to enhance polymer properties with addition of filler to form composite materials has increased and widely practised in industry. Composites represent an important class of engineering materials (Gonzalez, Albano, Ichazo, & Diaz, 2002). It's

used in various applications as decks and docks, packaging film, pipes, tubes, window frames or, sporting goods, office equipment and also as materials in the automobile industry and ect. (Suwanprateeb, 2000). Composite materials are those that are formed by the combination of two or more materials to achieve properties that are superior to those of its constituents (Yeh, Feng, Sun, Hsun, & Hsiao, 2003). Polymers filled with solid particulate or fibrous fillers of organic and inorganic nature are classified as polymeric composite materials. Polymer composite consists of a polymer resin as the matrix, with filler as the reinforcement medium (Callister, 2003).

Fillers often increase the performance of polymeric products. The degree of improvement on the judicious choice of filler, particle size and shape, the fraction of filler, and the surface treatment promoting interaction between the polymer matrix and filler (Yeh & Jyun-Jye, 1999). The addition of fillers to polymers is fast and cheap methods to modify the properties of the base materials. The right combination matrix and filler can result in new composite materials with enhanced properties. This reinforcing effect is primarily due to hydrodynamic interaction between the polymer and filler surfaces (Shokri & Bakhshandeh, 2006). It has long been known that the incorporation of filler into polymer matrices lead to a significant improvement in the physical, mechanical and electrical properties of polymer composites. Filling or reinforcement of polymers to enhance some properties of the material is one of the most important and popular methods of production of plastics, rubbers, coatings, adhesives, etc., which must possess the necessary mechanical and physical properties for any given practical application.

Considerable interests have been generated in the manufacture of thermoplastic composites due to their unique properties, such as good mechanical properties and thermal stability and reduce product cost (Kwon et al., 2002; Luyt, Molefi, & Krump, 2006). The introduction of particulate mineral fillers into a thermoplastic polymer can improve some mechanical properties such as Young's modulus, but it effects some others

properties, like impact strength, adversely. Due to the combination of more than one material, the properties of composites are influenced by many factors such as filler characteristic, filler content, interfacial adhesion, etc. (Liang, 2006; Osman, Atallah, & Suter, 2004). This can cause the behaviour of filled polymer to be more complex and different from its unfilled counterpart (Suwanprateeb, 2000). A variety of inorganic and organic reinforcing fillers may be incorporated into thermoplastic in order to improve specific properties or reduce cost (Ferreira, Errajhi, & Richardson, 2006). The addition of inorganic filler to polymers has received considerable attention lately (Fu, Feng, Lauke, & Mai, 2008; Jancar, 1999; Kwon et al., 2002; Luyt & Geethamma, 2007; Mareri, Bastide, Binda, & Crespy, 1998; Mittal, 2007; Osman et al., 2004; Pinchuk et al., 2000; Siti Rohana, Salmah, & Kamarudin, 2008).

Polyolefin's has been widely used owing to their high performance such as a high modulus, high tensile stiffness, high chemical resistance, and low cost for processing (Miyagawa, Tokumitsu, Tanaka, & Nitta, 2007). Polyethylene is used extensively in many fields, including agricultural, automotive and food-packing films. Polyethylene is commonly used in the polymer industry to its abrasion resistance, flexibility, excellent electric insulation properties, low toxicity and easy processing (Bellayer, Tavard, Duquesne, Piechaczyk, & Bourbigot, 2009). Low density polyethylenes (LDPE) are among the most common used plastics and often used as blends for balanced mechanical properties and process ability (Fu, Men, & Strobl, 2003; Huang, Roan, Kuo, & Lu, 2005; Pospisil, Forteln, Michalkova, Krulis, & Slouf, 2005; Yeh et al., 2003). LDPE is usually filled with starch, calcium carbonate, wood flour and others filler to lower the price and improve properties or provide reinforcement (Garg & Jana, 2007).

Calcium carbonate is one of the most widely used filler or extender pigment in the plastic industry. Calcium carbonate has been extensively employed as filler in polymer composites, because of its several remarkable benefits such as abundant raw material