



UNIVERSITI PUTRA MALAYSIA

***POLYETHYLENE SINGLE BUBBLE INSULATION CAPABILITY IN
REDUCING COOLING LOAD OF A LECTURE HALL***

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REDUCING COOLING LOAD OF A LECTURE HALL**

BY

MOHAMMED W. MUHIELDEEN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra
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In fulfilment of the requirement for the degree of Master Science

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May 2011

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Many researchers have done different studies on energy consumption, and its effects on thermal comfort, while this is important the amount of energy conservation was not done properly. The objective of this work is to study the potential of polyethylene aluminum single bubble as an insulator material for a lecture hall D.K.1 (15m × 12m × 6.6m) at Universiti Putra Malaysia. The lecture hall has an external wall facing North 112 East. The methodology involved taking measurements of air temperature, air velocity, relative humidity, and number of students for the month of April 2009 as input parameters for the three dimensional computational fluid dynamics (CFD) code name FLUENT 6.3 to determine potential reduction in temperature inside the lecture hall; the CFD results prior to further simulation work was checked against published literature.

Results from simulation work showed that a reduction temperature of 2.7 °C was possible for the lecture hall. An experiment was conducted on two adjacent small rooms (5m×2m×2.8m each) with and without insulation material on the external wall facing the same orientation as the lecture hall to verify the difference in temperature when using the insulation material. The measurements of air temperature and relative humidity were conducted using a far infrared thermometer and VELOMETER AVM 440 respectively. The measurements were conducted on two different days from 9 am to 3 pm. Results showed it was possible to get 3 °C temperature reductions when using the polyethylene aluminium single bubble insulator, and the calculation estimated showed potential saving of RM 1453.5 for one day. The capability of using polyethylene single bubble insulation is reducing cooling load by 2.7 °C and reduction of operation cost by RM 1453.5 per day for a 80 people lecture hall.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Master Sains

**KEUPAYAAN PENGGUNAAN PENEBAT POLIETILENA ALUMINIUM
GELEMBUNG SELAPIS BAGI PENGURANGAN BEBAN PENDINGINAN
DEWAN KULIAH**

Oleh

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Pengerusi: Profesor Madya Nor Mariah Adam, PhD, PE

Fakulti: Kejuruteraan

Ramai penyelidik telah menjalankan berbagai kajian tentang penggunaan tenaga dan kesannya terhadap keselesaan termal. Sungguhpun kajian ini penting pengabdian tenaga tidak dijalankan dengan baik. Oleh itu, objektif kajian adalah untuk mengkaji potensi polietilena aluminium gelembung selapis sebagai bahan penebat untuk mengurangkan beban pendinginan dewan kuliah DK1 (15m x 12m x 6.6m) di Universiti Putra Malaysia. Dewan kuliah ini mempunyai satu dinding luaran menghadap Utara 112 Timur. Kaedah kajian melibatkan menyukat suhu udara, kelajuan udara, kelembapan relatif, dan bilangan pelajar di dalam dewan tersebut selama sebulan dalam bulan April 2009 sebagai data masukan untuk kerja simulasi tiga dimensi dinamik bendalir pengkomputeran (CFDS) kod nama FLUENT 6.3. Keputusan kalibrasi CFD sebelum kerja simulasi seterusnya telah disemak dengan

keputusan daripada eksperimen sorotan literatur manakala kaedah simulasi adalah mengikut kaedah dipakai.

Keputusan kerja simulasi menunjukkan potensi pengurangan suhu udara di dalam dewan kuliah sebanyak 2.7 °C. Satu eksperimen telah dijalankan terhadap dua bilik kecil yang sebelahan (setiap satu 5m x 2m x 2.8m) dengan dan tanpa bahan penebat di dinding luaran yang menghadap arah yang sama seperti dinding luaran dewan kuliah. Tujuan eksperimen adalah untuk mengesahkan kesahihan keputusan simulasi nilai perbezaan suhu semasa menggunakan bahan penebat. Ukuran suhu udara dan kelembapan relatif menggunakan jangkasuhu infra merah jauh dan VELOMETER AVM 440 selama dua hari yang berlainan dari 9 pagi hingga 3 petang. Keputusan menunjukkan bahawa pengurangan suhu sebanyak 3 °C boleh di capai dengan penggunaan bahan penebat polietilena aluminium gelembung selapis, dan pengiraan yang dianggarkan menunjukkan penjimatan yang berpotensi sebanyak RM 1453.5 untuuk sehari. Keupayan bahan penebat polietilina gelumbung selapis dapat mengurangkan beban pendinginan dewan kuliah sebugak 2.7 °C denyan penjimatan leos operasi RM 1453.5 sehari.

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I certify that an Examination Committee has met on 6th of May 2011 to conduct the final examination of Mohammed W. Muhieldeen on his Master thesis entitled “POLYETHYLENE SINGLE BUBBLE INSULATION CAPABILITY IN REDUCING COOLING LOAD OF A LECTURE HALL” in accordance with Universities and University Colleges Act 1971 and the Constitution of Universiti Putra Malaysia [P.U.(A)106] 15 march 1998. The committee recommends that the student be awarded the Master of Science degree.

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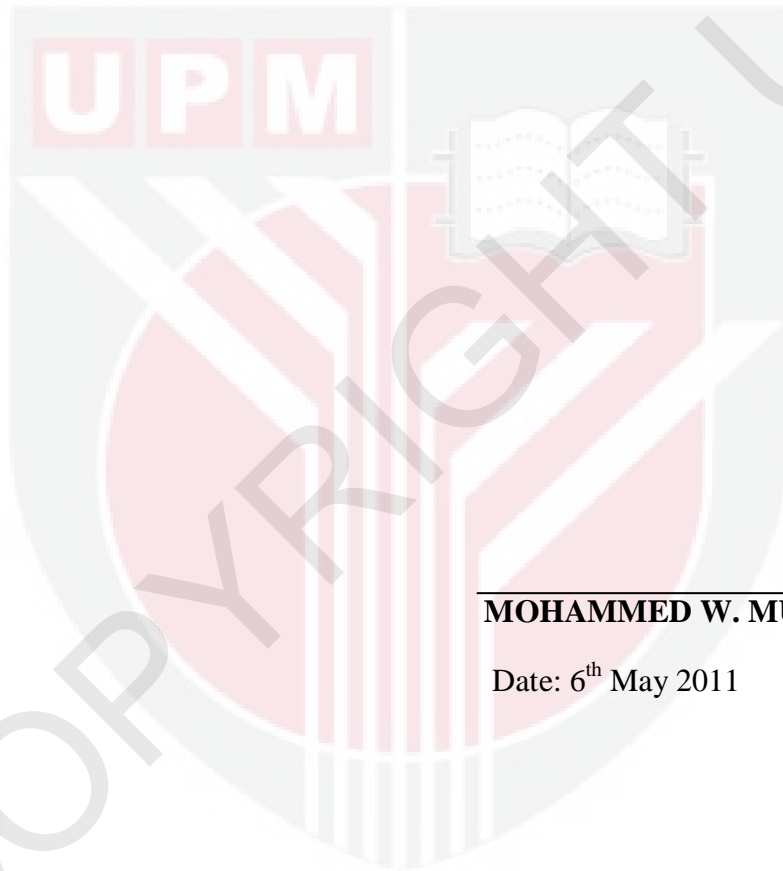
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DECLARATION

I declare that the thesis is my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institutions.



MOHAMMED W. MUHIELDEEN

Date: 6th May 2011

TABLE OF CONTENTS

| | Page |
|---|------------------------------|
| ABSTRACT | Error! Bookmark not defined. |
| ABSTRAK | Error! Bookmark not defined. |
| ACKNOWLEDGEMENTS | vi |
| DECLARATION | x |
| LIST OF FIGURES | xiv |
| LIST OF ABBREVIATIONS | xviii |
| 1 INTRODUCTION | 1 |
| 1.1 Background of the study | 1 |
| 1.2 Problem Statement | 2 |
| 1.3 Aim of the Study | 5 |
| 1.4 Objectives | 5 |
| 1.5 Scope and Limitation | 5 |
| 1.6 Importance of the Study | 6 |
| 1.7 Thesis Layout | 7 |
| 2. LITRETURE REVIEW | 8 |
| 2.1 Introduction | 8 |
| 2.2 Energy conservation | 11 |
| 2.3 Passive Methods | 15 |
| 2.4 Cooling Load | 16 |
| 2.5 Heat Transfer | 17 |
| 2.5.1 Conduction | 18 |
| 2.5.2 Convection | 19 |
| 2.6 Insulations | 20 |
| 2.6.1 Blanket Insulation | 20 |
| 2.6.2 Rigid Foam Insulation | 21 |
| 2.6.3 Loose Foam Insulation | 23 |
| 2.6.4 Insulated Concrete | 23 |
| 2.6.5 Liquid Foam Insulations | 25 |
| 2.7 Research on Buildings and Insulations | 26 |
| 2.7.1 Dynamic Insulation | 27 |
| 2.8 Computational Fluid Dynamics (CFD) | 32 |
| 2.8.1 CFD Modelling | 34 |
| 2.8.2 CFD Simulation | 35 |
| 2.9 Summary | 39 |

| | | |
|----------|--|-----------|
| 3 | METHODOLOGY | 40 |
| 3.1 | Pilot Study | 40 |
| 3.2 | Experimental | 45 |
| 3.2.1 | Test Building | 45 |
| 3.3 | Test Room | 47 |
| 3.3.1 | Data collection | 51 |
| 3.3.2 | Measuring Equipment | 52 |
| 3.4 | Polyethylene Aluminium Single Bubble | 54 |
| 3.5 | Cooling Load Calculation | 56 |
| 3.6 | Computational Fluid Dynamics Simulation | 62 |
| 3.6.1 | Geometry Meshing | 64 |
| 3.6.2 | Physical Properties | 66 |
| 3.6.3 | Boundary Conditions | 67 |
| 3.6.4 | Y^+ limit | 68 |
| 3.6.5 | Laminar Flow | 69 |
| 3.6.6 | Solver Equations | 70 |
| 3.7 | Validation for Simulation Study | 71 |
| 4 | RESULTS AND DICUSSION | 74 |
| 4.1 | Introduction | 74 |
| 4.2 | Result for Pilot Study | 74 |
| 4.3 | Field Survey | 75 |
| 4.3.1 | Internal Wall Temperature Distribution Lecture Hall (Without Insulation) | 77 |
| 4.3.2 | Temperature Distribution Inside the Lecture Hall Using Wall with Insulation (Polyethylene Aluminium Single Bubble) | 80 |
| 4.4 | The Outdoor Environment Parameters | 84 |
| 4.5 | The Indoor Environment Parameters (Without Insulation and With Insulation Polyethylene Aluminium Single Bubble) | 87 |
| 4.5.1 | Air Temperature (Without Insulation) | 87 |
| 4.5.2 | Relative Humidity (Without Insulation) | 88 |
| 4.5.3 | Air Temperature (With Insulation Polyethylene Aluminium Single Bubble) | 89 |
| 4.5.4 | Relative Humidity (With Insulation Polyethylene Aluminium Single Bubble) | 90 |
| 4.6 | Simulation Results | 91 |
| 4.6.1 | Chosen the Equipment / Software | 91 |
| 4.6.2 | Interpretation of the Features of Total Temperature | 92 |
| 4.6.3 | Flow Description | 105 |
| 4.7 | Comparison Between Experimental and CFD Results | 106 |
| 4.7.1 | Comparison between Experimental and CFD Results without Insulation | 106 |
| 4.7.2 | Comparison between Experimental and CFD Results with Insulation | 107 |

| | |
|--|------------|
| 4.7.3 The Comparison between the Difference in Temperature (Without Insulation and With Insulation) in Experimental Results and CFD Results | 108 |
| 4.8 Validation of Simulation Study | 109 |
| 4.9 Service Life and Cost | 112 |
| 4.10 Summary | 112 |
| 5 CONCLUSIONS AND RECOMMENDATIONS | 114 |
| 5.1 Introduction | 114 |
| 5.2 Conclusion | 114 |
| 5.3 Recommendations | 115 |
| 6 REFERENCES | 116 |
| APPENDICES | 119 |
| APPENDIX A HEAT TRANSFER COEFFICIENT CALCULATION | 119 |
| APPENDIX B ITEMS SPECIFIED AND FEATURES | 125 |
| APPENDIX C PREPROCESSING COMPUTATIONAL FLUID DYNAMICS | 127 |
| APPENDIX D CALCULATION | 134 |
| BIODATA OF STUDENT | 135 |
| LIST OF PUBLICATIONS | 136 |