

UNIVERSITI TEKNOLOGI MARA

**THE INDOOR AIR QUALITY ASSESSMENT OF ULTRAFINE
PARTICLES IN OFFICE BUILDINGS AT PETROLEUM REFINERY**

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JULY 2014

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged. The study is not meant to being published in any form, as stipulated in agreement of secrecy and non-disclosure.

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Date : 15th JULY 2014

ACKNOWLEDGEMENT

Foremost, I would like to take this opportunity to express my gratitude to Mr. Mustafa bin Saharan@Sahadan for granting me the opportunity to undergo practical training under HSES Department in PETRONAS Penapisan Melaka Sdn Bhd and for his invaluable guidance and advice. Besides that, for my training supervisor, Mr. Azhar B. Md. Shatar, thank you so much for believing me this far.

My sincere thanks also goes to Mr. Riffin, Mr.. Ramlan, Ms. Wan Che Zaharah, and Mr. Nur Arif from the Industrial Hygiene and Occupational Health Section for their patience and willingness to share their knowledge, experience and ideas in conducting this research. It gives me great pleasure to work with all PETRONAS staffs for their help and cooperation along conducting this research.

Special thanks and appreciation to my supervisor, Mr. Razi, for his commitment, guidance, support and motivation. As well to my co. supervisor, IR Nimi ,for her willingness to share experience, insightful comments and guide me during the process .I thank all of my lecturers and friends which had been guided me this far.

Last but not least, to my family for supporting me financially and continuous encouragement. Above all, I humbly give thanks to God's grace for making this research possible till the end and endurance for my strength.

ABSTRACT

THE INDOOR AIR QUALITY ASSESSMENT OF ULTRAFINE PARTICLES IN OFFICE BUILDINGS AT PETROLEUM REFINERY

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Introduction: An ultrafine particle is new concern under air quality nowadays, and there is no standard being established yet. Petroleum refinery is one UFP sources. The assessment IAQ of ultrafine particles was conducted inside office buildings at PETRONAS Penapisan (Melaka) Sdn. Bhd. during peak and non peak hour. There are four office buildings were selected for assessment.

Objective: The main aim is to study the IAQ of ultrafine particles in office building which being assessed in term of concern on IAQ status, baseline, highest UFP concentration, and trend relationship with other IAQ parameters.

Literature review: UFP related journals, TSI Indoor Air Quality Handbook, Guideline on Industry Code Of Practice 2010 by Department of Occupational Safety and Health, and ASHRAE Indoor Air Quality Standard 62-001 as reference during this study.

Methodology: The UFP assessment was conducted via walkthrough inspection, sampling readings of UFP, temperature, RH, air movement, VOC and CO₂ during peak and non peak hour for each office. The preliminary questionnaire was distributed to 60 employees for IAQ status related to working environment condition. The instrumentation used for the study was TSI P-Trak Ultrafine Particle Counter 8525, PpbRae 3000, TSI VelociCalc 8347 and Quest AQ-5000pro.

Results and Discussion: From walkthrough inspection, all the HVAC system was found dusty in condition. The UFP baseline outdoor reading was lowered compared to the indoor reading. The highest indoor UFP reading at 8934.33 ppcc was higher during peak hour than non peak hour. There was significant effect of office building during peak and non peak hour, [$F(3,68) = 72.43, p < 0.01$]. The post hoc was performed and shown there was significant difference lie between each building. This shown that different working environment for each office building has an effect to UFP concentration. For trend, there is relationship of UFP with the IAQ parameters ($p < 0.05$). There is strong relationship of UFP during peak hour with temperature and CO₂ at pearson's r is 0.69 and -0.69 respectively. Whereas during non peak hour, there is strong relationship with temperature and relative humidity pearson's r is 0.69 for both. For IAQ status, there was association between working experience and concern on passive smoking activity, $X^2(1, N = 60) = 10.75, P = 0.01$.

Conclusion: The IAQ assessment of UFP in office building shown the UFP indoor concentration is higher than outdoor. This indicated the need for good ventilation. There is significant effect of office building which contributed higher UFP concentration. Aside that, there is relationship of UFP with other IAQ parameters during peak and non peak hour, and association between working experiences with concern on IAQ status. Hence, this assessment is not only beneficial for academic purposes, but useful for building proponent.

Keywords: UFP, Temperature, VOC, Air movement, RH, CO₂, Peak and Non peak Hour, Office, Petroleum refinery

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