Indoor Environment Quality and Related Health Effects of Occupants in Laboratories Building of Public University

By

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Thesis Submitted in Partial Fulfillment of the Requirements for
Bachelor (Hons.) Environmental Health And Safety
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JULY 2015

DECLARATION

I hereby declare that this thesis is my original work and has not been submitted previously or currently for any other degree at UiTM or any other institutions.

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JULY 2015

ABSTRACT

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Laboratory basically is a facility where a relatively small amount of chemical are used regardless of its application. Ventilation system together with exhaust system acts as the most important safety feature to control the chemical from affecting the human health. Unhealthy air quality usually indicated insufficient ventilation in the building. Apart from that, thermal comfort level was important to keep the occupant in a free stress working space. Therefore, the purpose of this paper was to investigate if the ventilation rate and fume hood face velocity is adhering to the international guideline as stated in ASHRAE Standard 62.1 and ANSI Z9.5. Then thermal comfort level was analysed by monitored the temperature and relative humidity level in the building and compared it with ASHRAE Standard 55. Air pollutant (n=30) was measured to determine the air quality level in the laboratory building (n=30) and linked it to the human health and perception of the laboratory occupants. This study involved participant from students (n=150) and laboratory staffs (n=19) of three departments. Diffuser air velocity (n=27) and face velocity of fume hood (n=26) is measured using anemometer, whereas the relative humidity (n=30), temperature (n=30) and air pollutant (CO, CO_2, TVOC and PM_{10}) is measured using EVM 7. Ventilation rate is obtained from the air velocity calculation. The average mean of air pollutant which was CO_2=377.20±46.80ppm, CO=0.00±0.3ppm, TVOC=2.13±0.83ppm did not exceed the recommended level except for PM_{10} with a mean average of 63.933±39.30µg/m^3. However, all of the air pollutant is found exceeded the recommended level in certain laboratory and store, this indicates a bad IAQ level in the laboratory. The finding was supported by two sick-building symptoms which is more prevalence amongst lab staff compared to student which are cough and drowsiness with a p-value less than 0.05. The average mean level of relative humidity=55.232±7.36% and temperature=23.44±3.54^{0}C did not represent the whole situation as the required thermal comfort level was not achieved. The average mean level of face velocity is 0.51±0.27m/s with certain lab has a high level of face velocity and some have a lower level. Ventilation rate average mean was 3.92±4.63ACH which was higher than recommended level. As a conclusion, hypothesis was achieved as there was an association between the indoor air environment and health of occupant in lab. This was proven by the longer working hours of the lab staff that have a more prevalence of health symptom compared to the students, further assessment is suggest to be conducted so that the optimum performance and energy efficiency can be obtained, thus reducing the cost of the operation and maintenance, without compromising the occupants health.

Keyword: CO, CO_2, TVOC and PM_{10}, Temperature, Relative Humidity, Ventilation Rate, Sick-Building Syndromes

ACKNOWLEDGEMENT

Here, I would like to take this opportunity to praise my greatest gratitude to God for giving me strength, opportunity and His blessing in completing this thesis in the required given time. The thesis appears in its current form due to the assistance and guidance of several people.

First and foremost, I would like to express my sincere gratitude to my supervisor Dr. K Subramaniam for the continuous support, for his patience, motivation, and enthusiasm. His knowledge and guidance have helped me a lot during the research and writing process of this thesis. I also owe my gratitude to Miss Murni Amirra binti Mohd Aminuddin, who have been very patience and helpful in guiding me throughout the project especially during the proposal phase. My sincere thanks go to all laboratory staff of Nutrition and Dietetic Department, and Medical Laboratory Technology (MLT) Department especially to Pn. Masmadianty Muhammad for helping me preparing the laboratories and willing to wait until my monitoring done. I am also would like to express my deep appreciation to the Department of Environmental and Health especially to Pn Maziah Manad and En. Ameran Saiman for always listening, helping and answering to my problem.

I would like to thanks my teammates for helping and supporting me through thick and thin. Moreover, I would like to acknowledge En Shamsul Amri that helped me with document printing and other technical support of the University Technology Mara, Puncak Alam that attend to my request. Last but not least, I would also like to thanks my family members as they were always supporting me and encouraging me with their prayers and best wishes. Thank You.

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