UNIVERSITI PUTRA MALAYSIA

EVALUATION OF INDOOR AIR QUALITY IN SELECTED DAYCARE CENTRE IN KLANG VALLEY, MALAYSIA USING SUBJECTIVE AND OBJECTIVE MEASUREMENT

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DOCTOR OF PHILOSOPHY
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By

TEZARA CIONITA

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy

June 2013

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Abstract of the thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

EVALUATION OF INDOOR AIR QUALITY IN SELECTED DAYCARE CENTRES IN KLANG VALLEY, MALAYSIA USING SUBJECTIVE AND OBJECTIVE MEASUREMENTS

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June 2013

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In Malaysia nowadays both parents are normally working without family support and reliable helpers. This situation has forced the parents to send their children to day care centre (DCC). The first objective was to conduct a survey based on pilot study which involved getting information from 300 parents and the second objective was involved with measurement of IAQ parameters of temperature, relative humidity, velocity, particulate matter (PM_{10}), carbon dioxide (CO_2) and carbon monoxide (CO) levelsin DCC. From the measurement and survey, result showed that location is the first priority of preference (40%), building and facilities (30%) and service (30%) and the main objective of this work is to develop a comprehensive ranking system for daycare centre (DCC).From the questionnaire and measurement the ranking of a good DCC was developed. 45 DCC in Klang Valley was selected because Klang Valley has the industrial, main road and residential areas and majority of the population are working. The data collection was conducted during the operating hours of DCC (8am-5pm) using IAQ meter model TSI 8762, VeloCalc TSI and TSI

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DustTrak which were placed within the children's breathing zone (0.5-0.7mfrom the floor). Average inside temperature was 26-27ºC with KL as the highest (27.23ºC). Indoor relative humidity (RH) in all DCC was ranged between 47% and 76.7% and the average air velocity was ranged between 0.12m/s and 0.13m/s. DCC in industrial area in Kuala Lumpur, Selangor and Hulu Langat has the highest level of PM_{10}(63-68µg/m^3), CO (2.9-3.7ppm) and CO_2(802-805ppm) and the DCC in the residential area has the lowestlevel of PM_{10}(64-65µg/m^3), CO (2.3-2.9ppm) and CO2 (725-733ppm). In Comparison of DCC location which was industrial, main road and residential areas, DCC near industrial area has the highest value of PM_{10}, CO and CO_2 compare to DCC near main road area and DCC in residential area. The average concentrations of PM_{10}, CO and CO_2 near industrial area were 69.8 µg/m^3, 2.93 ppm and 804.16 ppm. Meanwhile, PM_{10}, CO and CO_2 DCC near the main road area and DCC in residential area were 68.88 µg/m^3, 2.79 ppm and 725.56 ppm respectively. DCC with natural ventilation had lower concentration level of CO and CO_2 compared to DCC with air conditioning system andgenerally each room is fitted with 4-8 windows and 2 doors, provided with ceiling fan or air conditioning unit. All values fall within TWA (time weighted average) of 8 hours recommended by DOSH guidelines 2010. It can be drawn from the results that the factor and its weightage of preferred DCC was as location (40%), building (30%) and service (30%) respectively and the selection of DCC can be based on DCC grades which was grade 1 (13-15 points), grade 2 (10-12), grade 3 (7-9) and grade 4 (3-6).From the study it can be concluded that DCC with integrated system of good service, location and premise has the highest accumulated point which determine a good practice of DCC.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PENILAIAN KUALITI UDARA DALAMAN DI PUSAT PENJAGAAN HARIAN TERPILIH DI LEMBAH KLANG, MALAYSIA MENGGUNAKAN PENGUKURAN SUBJEKTIF DAN OBJEKTIF

Oleh

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Di Malaysia kini kedua-dua ibu bapa bekerja tanpa sokongan keluarga dilanjutkan atau pengasuh yang boleh dipercayai. Keadaan ini telah mendorong ibu bapa untuk menghantar anak-anak mereka ke pusat jagaan harian (DCC).Objektif pertama adalah untuk menjalankan kaji selidik berdasarkan kajian perintis untuk mendapatkan maklumat daripada 300 ibu bapa yang terlibat dan objektif kedua terlibat dengan penyukatan parameter daripada IAQ yaitu suhu ruang, kelembapan, halaju, habuk terampai (PM_{10}), karbon dioksida (CO_2) dan karbon monoksida (CO) dalam DCC.Dari ukuran dan kajian, hasilnya menunjukkan lokasi yang keutamaan pertama keutamaan (40%), bangunan dan kemudahan (30%) dan perkhidmatan (30%) dan objektif utama kerja-kerja ini adalah untuk membangunkan satu sistem ranking yang komprehensif untuk penjagaan pusat (DCC).Dari soal selidik dan pengukuran kedudukan yang baik DCC telah dibangunkan. 45 DCC di Lenbah Klang dipilih kerana mempunyai kawasan, perindustrian jalan raya dan kediaman utama dan kebanyakan dari penduduknya bekerja. Pengumpulan data dijalankan semasa waktu operasi DCC (8:00-17:00) menggunakan IAQ meter model TSI 8762,

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VeloCalc TSI dan TSI DustTrak yang diletakkan di dalam zon pernafasan kanak-kanak (0.5-0.7m dari lanta). Purata suhu dalaman adalah 26-27ºC dengan KL adalah yang tertinggi (27.23ºC). Kelembapan Dalaman (RH) di semua DCCadalah antara 47% dan 76.7% dan halaju udara purata adalah antara 0.12m/s dan 0.13m/s. DCC di kawasan perindustrian di Kuala Lumpur, Selangor dan Hulu Langat mempunyai tahap tertinggi PM_{10} (63-68 μg/m^3), CO (2.9-3.7 ppm) dan CO_2 (802-805 ppm) dan DCC di kawasan kediaman mempunyai tahap PM_{10} (64-65 μg/m3), CO (2.3-2.9 ppm) dan CO_2 (725-733 ppm) yang paling rendah.Dalam Perbandingan lokasi DCC dalam kawasan perindustrian, jalan utama dan perumahan, DCC berhampiran kawasan perindustrian mempunyai nilai tertinggi PM_{10}, CO dan CO_2 berbanding dengan DCC berhampiran kawasan jalan utama dan DCC di kawasan kediaman.Kepekatan purata PM_{10}, CO dan CO_2 dalam DCC yang berhampiran kawasan perindustrian ialah 69.8 μg/m3, 2.93 ppm dan 804,16 ppm. Sementara itu, PM_{10}, CO dan CO_2 dalam DCCyang berhampiran kawasan jalan utama dan DCC di kawasan kediaman adalah 68,88 μg/m3, 2.79 ppm dan 725,56 ppm masing-masing.DCC dengan pengudaraan semula jadi mempunyai tahap kepekatan CO dan CO_2 yang lebih rendah berbanding DCC dengan sistem penyaman udara dan secara amnya setiap bilik dilengkapi dengan 4-8 tingkap dan 2 pintu dengan kipas siling atau unit penyaman udara.Semua nilai termasuk dalam TWA (purata berwajaran masa) dalam 8 jam yang disarankan oleh garis panduan JKKP 2010. Maka daripada itu dapat diambil keputusan bahawa faktor dan pemberat DCC pilihan adalah lokasi (40%), pembinaan (30%) dan perkhidmatan (30%) dan pemilihan DCC boleh berdasarkan gred DCC yaitu gred 1 (13-15 mata), gred 2 (10-12), gred 3 (7-9) dan gred 4 (3-6). Daripada kajian ini, dapat dibuat kesimpulan bahawa DCC dengan

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sistem bersepadu perkhidmatan yang baik, lokasi dan premis mempunyai titik tertinggi terkumpul yang menentukan amalan baik DCC.

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Tezara Cionita

June 2013

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I certify that a Thesis Examination Committee has met on the 27–06-13 to conduct the final examination of Tezara Cionita on hes thesis entitled "Evaluation of Indoor Air Quality in Daycare Centre in Klang Valley, Malaysia Using Subjective and Objective Measurement" in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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