UNIVERSITI TEKNOLOGI MARA

THERMOPHYSIOLOGICAL COMFORT PROPERTIES AND THERMOREGULATORY RESPONSES ON ENFORCEMENT PERSONNEL CLOTHING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried according to Universiti Teknologi MARA's regulations. It is original and results from my work unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I hereby acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating my study and research conduct.

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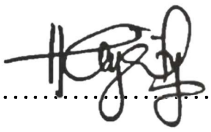
Signature of Student	:	 ……..
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ABSTRACT

The choice of fabric parameters such as fibre type and structure play key roles in the thermoregulatory process due to the change and loss of heat and moisture through sweat evaporation and heat dissipation. This study investigates the thermophysiological comfort properties of ripstop fabrics from different material composition percentages of polyester/cotton (P50C50 and P35C65) and nylon/cotton (N50C50 and N20C80). The first part of the study focuses on the fabric's air permeability, thermal resistance, water vapour resistance and water vapour permeability. In the second part, thermoregulatory responses from the fabric on test subjects wearing enforcement personnel clothing during intense physical activities were measured. The results suggest that the air permeability of the fabrics depends on thread density. Fabrics with the lowest thread density (P50C50; thread count ratio 0.436) exhibited the highest air permeability. This is due to its open structure, allowing more air to pass through the fabric. The results also indicate that the fibre content affects the thermal resistance of the fabrics. Fabrics with higher proportion of cotton, showed higher thermal resistance results (P35C65; 0.0341 ± 0.0006 m^2.K/W and N20C80; 0.0209 ± 0.0022 m^2.K/W). This is due to the low thermal conductivity properties of cotton (0.026-0.065 W/mK). Regarding water vapour permeability results, its trends are proportional to the air permeability results (r = 0.8). For the overall moisture management results, the P50C50 fabric has a score of 4 for Overall Moisture Management Capability (OMMC) and Accumulated One-way Transport Index (AOTI), which means this fabric can absorb sweat and transport it to the external environment. Thus, the P50C50 fabric gave the best thermophysiological comfort properties, as indicated by the study. The thermoregulatory study indicated that the N20C80 clothing does not offer a greater thermal balance than P50C50 clothing. The Rate of Perceived Exertion (RPE) of the participants was rated higher for N20C80 as compared to P50C50 ($P < 0.001$; P50C50 11.2 ± 1.1, N20C80 12.3 ± 1.1). Results from thermoregulatory response revealed a significantly greater for thermal sensation ($P < 0.001$; P50C50 3.2 ± 0.8, N20C80 3.8 ± 0.7), sweating sensation ($P = 0.05$; P50C50 6.8 ± 3.0, N20C80 7.8 ± 3.1), skin wetness ($P = 0.007$; P50C50 5.4 ± 2.2, N20C80 5.9 ± 2.2), clothing comfort ($P < 0.01$; P50C50 6.0 ± 1.4, N20C80 7.7 ± 1.7) and clothing humidity ($P = 0.001$; P50C50 6.4 ± 2.7, N20C80 7.1 ± 2.6). This demonstrates that participants wearing N20C80 clothing felt warmer than the P50C50 clothing. This result is consistent with thermophysiological findings suggesting that N20C80 had lower water vapour permeability, lower air permeability and poor One-Way Transport Index (AOTI) properties. According to the Perceptual Response Survey of the respondents, the P50C50 was more convenient to wear for 8 km uphill running on a treadmill during the exercise study. This indicated that P50C50 would have a better thermoregulatory response to regulate the thermal equilibrium between human skin and the environment.

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TABLE OF CONTENTS