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A CONCEPT OF COOLING CLOTHING FOR CONSTRUCTION WORKERS IN MALAYSIA

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Abstract:
The construction industry is the one of the highest contributor towards economic growth in a country. The construction industry also acts as an indicator whether the nation is developing or stagnated. Every year all around the globe each nation has their own construction running whether it is a small project or mega money project. Hence, job opportunities are present and being offered to all people to get involved in construction industry. But, the construction industry is the high level of risk industry where the dangers exposure towards the workers are high. There are many accidents occurred annually and also many fatalities for examples are heat stroke and heat related illness accidents. Thus, heat exposure also considered as a threat to workers' safety. Research has shown a linkage between heat exposure to increased rate of unsafe behaviours. The purposes of this research were to tackle the issue and propose a new concept of clothing for construction workers. The principal method of this research is to ensure the comfortable of workers when working under a heat and to reduce the heat stress. By designing a cooling clothing, the workers will be more comfortable and can increase their productivity. Hence, it also can reduce the accidents occur related to heat illness.

Keywords: Construction, Workers, Cooling Clothing, Ergonomics, Heat

1.0 INTRODUCTION

In this modern era, there are many developments that occurred worldwide. Hence, the number of construction project also increases. Construction has always been regarded as one of the most dangerous industries due to its unique nature (Jannadi & Bu-Khamsin, 2002). There are many accidents happened in construction. According to statistics from the United States (US) Department of Labor, fatal injuries on construction sites account for18% of total occupational fatalities in 2014. There are many accidents occurred on the construction site and one of the accidents are heat stroke and heat related illness where the heat exposure is considered as a threat to workers' safety (Chan et. al, 2017). Research also has shown a linkage between heat exposure to increased rate of unsafe behaviours (Ramsey, 1988). Other research shown that heat can interrupt their ability to stay alert or concentrated (Hancock & Vasmatzidis, 2003). Heat exposure may also effects individuals' cognitive performance.

When worker doing their work in normal environment, the physiological and psychological functioning in normative zone compare when the environment become more demanding. So, the problem need some fixing and be minimized. Thus, the objectives of the research are to understand the concept of cooling clothing technology that want to be adapted. Secondly, to identify the material and another objective is to propose the design and features for the cooling clothing suitable for Malaysian workers.

2.0 LITERATURE REVIEW

Thermal discomfort is one of the challenging factors during work in hot or humid condition such as mines, foundries, and desert region (Sakar & Kothan, 2014). Heat and moisture management are essential to reduce the workers heat stress. Auxiliary cooling garments are also required to help the process of human body cooling (Sakar & Kothan, 2014). Personnel who work under the heat are prone to suffer from heat strain or even heat stroke and to prevent it always by a heat protective suit. The heat protective

suit was worn by the worker where it acts as a shield did not do enough unfortunately it impede the dissipation of metabolic heat generated due to work (Sakar & Kothan, 2014). By designing a cooling clothing for the workers, it can create a cooler microclimate to facilitate removal of metabolic heat.

2.1 Features of Clothing

The concept of cooling clothing here is to give the workers more comfortable during their work. In order to improve clothing comfort, clothing design can be based on sweat production patterns of different the body. The conventional clothing design from the same material and fabric structure has a limited ability to provide balanced comfort for all the local body parts (Varadaraju & Srinivasan, 2017). The clothing also enables them to have a better ergonomics experience where they can do their work without any restriction because of the clothing is lightweight and not oversize. The construction workers also worn many kinds of clothing during their work such as clothing for construction workers consist of cotton, polyester, and woven. While using safety vest is crucial, the clothing itself also important to the workers to feel comfortable during their work. With designing a standardize clothing that have many features such as lightweight fabric, cooling fabrics, not oversize sleeves, can generated a cooling condition towards the body by perspiration and have some safety elements it can improve the condition of workers on-site.

2.2 The materials of clothing

The materials of clothing acts as important factor for the cooling clothing where the materials itself can produce the process of cooling. The thermal comfort is related to fabric's ability to maintain skin temperature and allow transfer of perspiration produced from the body. Other than that, the fabric criteria such as cover, porosity, areal density and thickness have a direct bearing to the clothing comfort (Alam & Ghosh, 2013). There are many types of fabric in the world that can be choose such as woven, non-woven, cotton, and linen where a medium weight with little elasticity and suitable for warm weather and lastly the knit fabric where have an excellent stretch capability (Garza, 2013). But, which one of those are suitable materials for cooling clothing? From the Standford University, their engineers have developing a new low-cost, plastic based textile and if applied to cloth it will cool your body more efficiently. This new material works by allowing the body to discharge heat in two ways that will make a wearer feel 4 degree Fahrenheit cooler than cotton clothing (Standford University, 2016).

3.0 METHODOLOGY

The methodology that been used to carry out this research are desk study and experimental method. From the desk study, many valuable information and facts can be gathered. Examples of desk study such as surfing website, journal articles and book articles. Because of this, the research can be conduct properly and have valid sources of information to refer. An experiment need to be conduct for the selection of materials that need to be apply. There will be a selection of materials where from the experiment can help to select the most suitable materials.

4.0 ANALYSIS AND FINDINGS

4.1 The cooling clothing concept for workers

The cooling clothing is a medium to enhance the performance of the workers by giving them a thermal comfort. With a condition of construction site when hot sunny day, the heat will absolutely cause a disturbance towards the workers. With this cooling clothing not only, it can protect the body but gives a comfort to the workers by evaporation. The concept of this cooling clothing is adapted from the sportswear apparel where the sweat inside the body can act as medium for cooling purposes. After that, to give it more flexibility towards the worker the clothing will be easy to stretch and avoiding and disturbance to the workers. For this cooling clothing, bright colour and a reflective light will be adopted to suit the construction industry.

4.2 The concept design of cooling clothing

The design of this product is a simple round neck for wide range of people and uses. The concept of cooling clothing is to give the workers hours of cooling relief. In addition, this cooling clothing also is light in weight and durable. Other than that, cooling clothing which have a two layer of polyethylene to a layer of polyester microfiber blended with elastane or spandex will give more comfortable environment for the workers.

Figure 1 shows the concept of cooling clothing and safety vest

From the Figure 1 it shows the concept of the clothes which the colour is shiny and bright yellow colour. The reason of the chosen colour is because of the idea is to give a safety factor towards the workers while wearing the shirt. In another word, the element of safety vest is to be implement towards the cooling clothing. Not just the bright colour but the glowing stripes of the safety vest also will be implemented.

5.0 CONCLUSION

As for the conclusion, this cooling clothing is just a concept which to give construction workers more thermal comfort while doing their work in hot environment and can increase their performance and productivity. Based on the objectives of the research, conclusion can be made where concept of this cooling clothing is the evaporative cooling technology where the clothes generated a cooling process by the perspiration of the body. As a result, the workers can have more comfort because of the cooling relief towards their body and consequently can enhance their work performance. Meanwhile, the material of the cooling clothing is based on the polyethylene materials that can cool the body 2-degree celcius more than any other materials. This can be approved by the Standford University statement which the new material works by allowing the body to discharge heat in two ways that will make a wearer feel 4 degree Fahrenheit cooler than cotton clothing. Next, the propose design and features for the cooling clothing are suitable for Malaysian workers. In addition, this cooling clothing also will have a high-visibility and reflective features same like a safety vest to give the cooling clothing a safety factor and help the workers visibility on the site.

To summarise, the hope of minimizing the amount of accidents related to heat stress or stroke can become a reality with the idea of this cooling clothing. Lastly, the specific clothing for the construction workers also can signal the construction industry is evolving too not just towards their method of construction but also towards their appearance and branded.

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