UNIVERSITI TEKNOLOGI MARA

INVESTIGATION OF CERAMIC NATURAL VENTILATION USING MODIFIED STONEWARE BODY FOR POTIENTIAL APPLICATION IN TERRACE HOUSE

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and the result of my own work, unless indicated or acknowledged as referenced work. This thesis has not been submitted to any academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Globally, the energy demand has increasingly from time to time and it has indirectly increases the energy consumption of electricity. Ventilation nowadays is the best embodiment, zero consumed of electricity which is very eco-friendly system that provides natural air freshening ventilation system that will be able to reduce the consumption of the electricity usage especially in the residential and building area. Currently, there are 3 types of ventilation, which are natural ventilation, mechanical ventilation and hybrid ventilation. The basic theory of air ventilation is the process of involving two processes, which is infiltration and exfiltration of air. Infiltration in this study can be defined as the air moving to a conditional space inside the wall and these was the main focused. While exfiltration means is the hot air inside moving to the outside through the ventilation walls. Currently, the usages of ceramic ventilation block are less practical to used and lack of the scientific research on ceramic ventilation blocks. This research is to study the potential of ceramic stoneware ventilation wall created from extruding technique as conceptual modern ventilation wall taking consider of residency house. The methodology of this research contains 3 phases, which is process in to the study on literature review, material investigation, design development and fabrication. At the early phase this research studying on ventilation system, which is on its mechanism of the ventilation system, the design of ventilation, method to producing the ventilation system and identifying the suitable testing conducted. Phase two is investigation on material, which is by using the modified stoneware clay body, conducting the testing of the physical properties of the stoneware body and exploring the design through the morphological chart. Third phase by fabricating and evaluation phase. At the end of this research the ventilation blocks was created with using the stoneware clay and the new design of the ventilation block has been produce. From this study, we obtained stoneware body with 10 % $CaCO_3$ and as fired at 1100 °C was suggested as ventilator materials due to its low fired shrinkages of 7.38 % with acceptable MOR strength of 18.75 N/mm^2 and water absorption of 6.5 %. It was successfully integrated to the air existing ventilation system via developed morphological chart. A prototype was sintered with 1100 °C and attached to the cements blocks which complied with basic requirements of Malaysian standard guidelines.

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CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF STUDY

Many Southeast Asian countries have practiced high economic growth along with the rapid development over the last few decades. This resulted in great rise of energy consumption especially in urban areas. As such, the nation-wide final energy demand in Malaysia has increased fivefold over the last two decades, while the total population has doubled in the past 30 years from 10.4 million in 1970 to 22.2 million people in the year of 2000. Malaysia's energy consumption has increased in these recent years. Besides, Malaysia is one of the fastest growing building industries worldwide, where the corresponding energy demand would significantly increase in the next coming years (Daghigh et. al., 2012).

The quality of life of many Malaysian is also increasing. This includes better workplace and residency where being comfort is the ultimate factor for better productivity. Malaysia is a tropical country with high humidity. This makes Malaysia a very hot country in the day. Most of Malaysia buildings (workplace and residential) are equipped with air conditioner. This is to cool and create comfort environment. Using air-conditioner is part of the energy consumption. Hence, alternative way to make the building cool is through the improvement of ventilation system. Ventilation is the movement of the air. According to Oxford dictionary, ventilation means to provide a good quality air supply for the room and building. It is also known as "lubang angin", "Tebar Layar" (lubang angin keluar masuk) based on Kamus Dewan. Whereas in Webster Dictionary, (2003), ventilation defined as the act or process of ventilating, circulation of air (providing fresh air) and a system or means providing fresh air. It is a process that regulates air circulation from outside and inside the building. Infiltration and exfiltration are the terms that defining the ventilation process based on Awbi, (2003).