Thermal Performance of Oil Palm Fibre and Paper Pulp as the Insulation Materials

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Abstract – Energy consumption for residential use in Malaysia is keep increasing yearly in order to maintain the internal thermal comfort of the building. Roof insulation material plays a vital role in improving the thermal comforts of the building while reduce the cooling load of the building. Oil palm industry in Malaysia had grown aggressively over the past few decades. Tons of oil palm waste had produced during the process such as empty fruit bunch fiber. Another waste material that available and easy to obtain is paper. Paper is a valuable material that can be recycled. Waste paper comes from different sources such as newspaper, office and printing papers. This study will take advantage of the available resources which could contribute to reduce the environment impact. The aim of this study is to investigate the thermal performance of roof insulation materials using mixture of oil palm fiber and paper pulp with different ratio and thickness. This study found that the thermal performance of the paper pulp is slightly better compare to the oil palm fiber. Thermal conductivity of the particle board reduces around 4.1% by adding the 10% of paper pulp into the total density of the particle board. By adding 75% of paper pulp, the thermal conductivity of the particle board could be reduced to 24.6% compare to the oil palm fiber board under the similar condition. Therefore, from this study, it could be concluded that paper pulp has high potential to be used as a building insulation material.

Keywords**:** Thermal Performance, Thermal Conductivity, Paper Pulp, Oil Palm Fiber, Bio-degradable Insulation Materials

I. INTRODUCTION

NOWADAYS, people are very concern on sustainable development in order to ensure the environment could be inherited to the next generation. According to the United Nations Brundtland Report (1987), the sustainable development had been defined as development that meets the need of the current situation without compromising the ability of future generations to meet their own needs [1]. The purpose of the implementation of sustainable development is to ensure that the environment is preserved and the natural resources can be retained for the future generations. The life quality of the citizens and the access of the dependable source of energy can be improved by implementing the sustainable development. In the meantime, it is also promoting the economic growth and climate change mitigation.

The industrial sectors in Malaysia consume the most energy (43%) compare to the transportation sector shows the second highest (36%) and the residential sector comes in third place with 14% energy consumption [2]. The energy consumption is directly proportional to the population growth. As population in Malaysia keep increasing, larger space is needed to accommodate the new residents. If the development could not be sustained, the energy usage will increase due to the increment of the population. These will result in the environmental pollution such as air pollution, water pollution, sound pollution and etc.

On the global average, buildings contribute 30% of CO2 emissions and consumed 30% of natural resources and produce 30% to 40% of land filled waste, which contribute significantly to the global warming [3]. It is also essential to reduce the environmental impact caused by the construction industry. These challenges can only be achieve through the innovation or the implementation energy-efficient technologies.

Cooling system and lighting consume the most energy compare to others housing appliance [4]. The design of the building envelopes and material used play an important role in reducing the energy consumption of the building. Compare to the walls, roof exposed more towards solar radiation. Referring to climate factors of Malaysia and the duration of roof exposure to solar radiation is longer compare to walls.

Some passive building envelope design could be implemented in the region like Malaysia. The implementation of the

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