Comparison Of Character Of Coco Fiber Material In Reducing Heat As A Potential Of Building Wall Insulation

Kemala Jeumpa[1], Selamat Triono[2], Rusnardi Rahmat[3]

[1]Lecturer of Faculty of Engineering, State University Medan
[2]Lecturer of Faculty of Engineering, State University Medan
[3]Lecturer of Faculty of Engineering, State University Padang

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Abstract- This paper was purposed to examine the comparison of the potential of coco fiber as a wall insulation of buildings in reducing heat based on the character. For the fulfillment of thermal comfort in buildings requires engineering, knowledge and skills and innovation. One way to reduce the hotter air inside the room can be done through the wall so as to reduce the use of air conditioning. The walls need protection and dampening of the sun's heat that can make the room inside the building has thermal comfort. Based on this, it is necessary to conduct research on natural materials that can function in reducing heat through the wall of the building. The test is done by comparing the material character. The material is coco fiber material with two types of thickness, namely 1 centimeter, and 2 centimeters. This coco fiber material is coated with a cement mixture which also functions as an adhesive the fiber. Other materials are a mixture of cement and sand which is usually used as a plaster wall. In this case the test by providing heat on one side of the fiber part and measuring the temperature that occurs on the other side of the fiber. The same heat test and treatment is also carried out on the material without a fiber. The results found that there is a significant difference between the temperature of heat that occur in various character of fiber with material without fiber. The fiber material a lower heat temperature based on thick fiber character than the material without a fiber. This indicates that coco fiber material has different potential as heat insulation based on character of fiber's thickness which can be used as material to coat the building walls of solar heat radiation.

Keywords: coco fiber, insulation, building wall, cement, reducing heat, character

I. INTRODUCTION

Sunlight is the main source of heat in the building, the heat of sunlight will mainly enter the room through the media of roof and wall. About 83% of the sun's heat in the form of infrared rays on the roof and building walls are absorbed and emitted into the room by radiation, conduction and convection. In humid tropical climates, the building coating is a building element that must be able to protect the occupants from the sun's heat, also reducing the radiant heat forwarded into the building. Therefore one of the functions of the building coating is to control or reduce the heat load from solar radiation into the building (transmission). The entry of solar radiation into the building can be through a vertical cover that is a wall or a horizontal or sloping cover that is roof. Cooling the space in this way is classified as passive cooling system that relies heavily on air movement as a hot carrier medium in the morning to late afternoon to reduce room's temperature (Cook) 1985 & (Giovani) 1994 (Santoso).

Global warming causes the warming of the earth's temperature so that the use of air conditioner in the room is also increasing as the need for comfortable room condition is also higher. This will increase the energy use of the earth and increase the contribution of rising earth temperatures and greenhouse effect. From the research of (Bourdeau) 1999 (Hari, 2016), also revealed the fact that 50% of the energy absorbed in a building is only consumed by refrigerators only, therefore 30% of the total energy required by a country is usually used in housing. This figure is from conditions in developed countries that are more manageable, for in developing countries this figure will not be smaller even believed otherwise. If this fact not handled strategically, there will be a terrible impact on sustainable nation development. Based on these factors, it needs to be balanced with the existence of building innovations that can save energy and environmentally friendly, as has been developed in several countries.

The heat on the wall will propagate into the room so the room becomes hot. Walls need protection and dampening from the sun's heat so that indoor space will not heat up. Therefore one way to inhibit heat from outside the room can be done through the wall. Non-heated rooms can reduce the use of air conditioning. By reducing the use of air conditioning means to save energy and also save the earth and the environment.

Environmental awareness can be realized with the use of materials derived from nature as a form of energy conservation and environmental protection. For example coco fiber, is one of the waste that has not been fully utilized in Indonesia. The amount of coco fiber capacity produced from coconut harvest annually in Indonesia is quite large where coco fiber is a large part of coconut fruit, which is 35% of the total weight of coconut.

Based on this matter, it is necessary to do research on natural materials that can reduce heat. The problem that arises in this study is how the potential of coco fiber material based on the character of thick fiber used as insulation to reduce heat. This research was conducted with the aim to know the potential of coco fiber which later can serve as a wall covering the building to reduce heat from outside.

II. REVIEW OF RELATED LITERATURE

Research on innovations related to environmentally friendly buildings to answer the phenomenon of global warming has been done by some researchers in research on building materials for walls that can reduce heat. Among them is Ayu Yuswita Sari et al, who conducted research on lightweight concrete panels focus on the pearlite as a mixture of concrete panels that can serve as a heat insulator. Likewise Agus Santoso et al, who conducted research on mortal mix materials with a focus on the utilization of pumice breksia as the main ingredient of instant mortar as a heat reducer. While Hary Wibowo conducts a hot conductivity study between styrofoam and rice coir and focuses on measuring the comparison between styrofoam particle board composition with rice coir particle board composition as a good material for heat insulators.

Similarly, several studies conducted by foreign researchers on building materials for a wall capable of muffling the heat among them by Xi Meng et al., who conducted a study of the wall of the building that focused on the addition of retro-reflective material on the wall, which can improve the temperature of the building by reflecting solar radiation back in the opposite direction. Furthermore, V.B Omubo-Pepple et al., which conducted a study on building walls with a focus on determining the thermal conductivity of cement reinforced by periwinkle shells (sea shells) used as construction materials. Meanwhile, Dubois Samuel et al., conducted a study of building walls with a focus on hygrothermal behavior of plant-based insulation products to assess their impact on energy performance in buildings, predict indoor climatic conditions and prevent unexpected degradation risks.

III. RESEARCH ELABORATIONS

A. Material

The material in this study consisted of several characters for coco fiber material, namely 1 centimeter, and 2 centimeter coated with a cement mixture. The other materials are mixtures of cement and sand commonly used as wall plaster material. Process making material can be shown in Figure 1 below.

Figure 1: Process of making coco fiber material

B. Approach

The research approach tests related to coco fiber in reducing heat was following the framework in Figure 2.

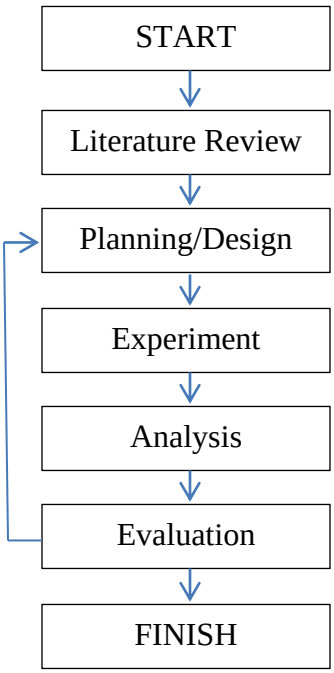

Figure 2. Flowchart of the Research Procees

The approach of this research is based on the experiment to know the potential thickness character of coco fiber in reducing heat. In this case testing is done by comparing the two test materials. After the fiber and cement is good enough to bind and harden then tested. In this case the test by providing heat on one side of the fiber part and measuring the temperature occurs on the other side of the fiber. The same heat test and treatment is also carried out on the material without a fiber. The heat given is 35 ˚C for 140 minutes. The instrument for measuring the temperature that occurs in the material is by using sensors connected to the computer and can be read on the monitor screen.

In testing, the material is placed in a box. Testing on this material is done by using 3 thermal sensors and one heater as a heater. The first sensor is placed on one side of the material connected to the heater as T1 which is the temperature given to the material. The second sensor is T2, which is ambient temperature in the test environment that is placed outside of the box. The third sensor, T3, is placed on the other side of the material which will detect the yield temperature that has been absorbed by the material. This heater is connected to a power source and a Ts controller which is a device to control the amount of temperature given.

IV. RESULTS OR FINDING

Research on innovations related to building materials that can reduce heat has been carried out by many researchers but not many have conducted research on the natural material of coco fiber. Coconut fruit composed of fibers that serve to protect the hard part called the shell, serves to protect the seeds that are only protected by the membrane attached to the inner side of the shell, there is a liquid containing many enzymes called coconut water, and solid phase settles on the wall of the shell along with the growing old fruit called coconut meat. It can be concluded that the coconut coir is part of the coconut that protects the inside of the coconut from the outside including from the heat of the sun. Based on this, coconut coir is estimated to have the potential for heat insulation so, it is necessary to research the character of coco fiber as building wall coating to reduce heat.

This study compared the potential character of thick coco fiber material to non-fiber material. The results test can be shown in the graph in the following figure. The figure shows that there are 3 graph lines: the top line shows the temperature given; the line in the middle shows the measured temperature after the material has been absorbed; the line below shows the temperature around the test.

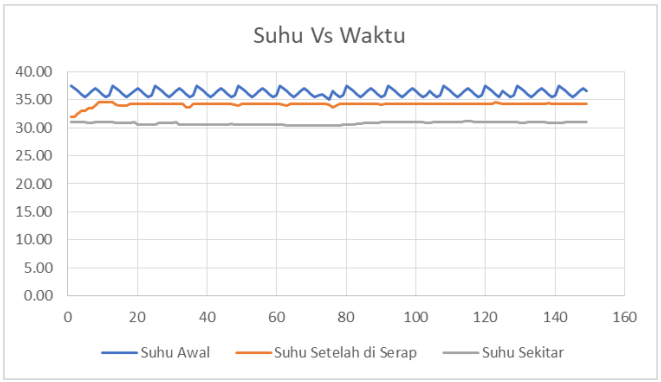

Figure 3: The results of material without fiber

The graph in Figure 2 shows the results test of material without fiber. The Y-axis of the series 1 line shows the amount of heat applied and measured on one side of the material expressed in Celsius, while series 2 shows the amount of heat absorbed by the material measured on the other side of the material, next the series 3 line shows the measured temperature in the environment around the test . The X-axis shows the length of time during the test expressed in minutes. The results obtained from the graph show that when given the heat of 35 Celsius for 140 minutes, the temperature measured on the other side of the material without fiber ranges from 34.5 ˚C.

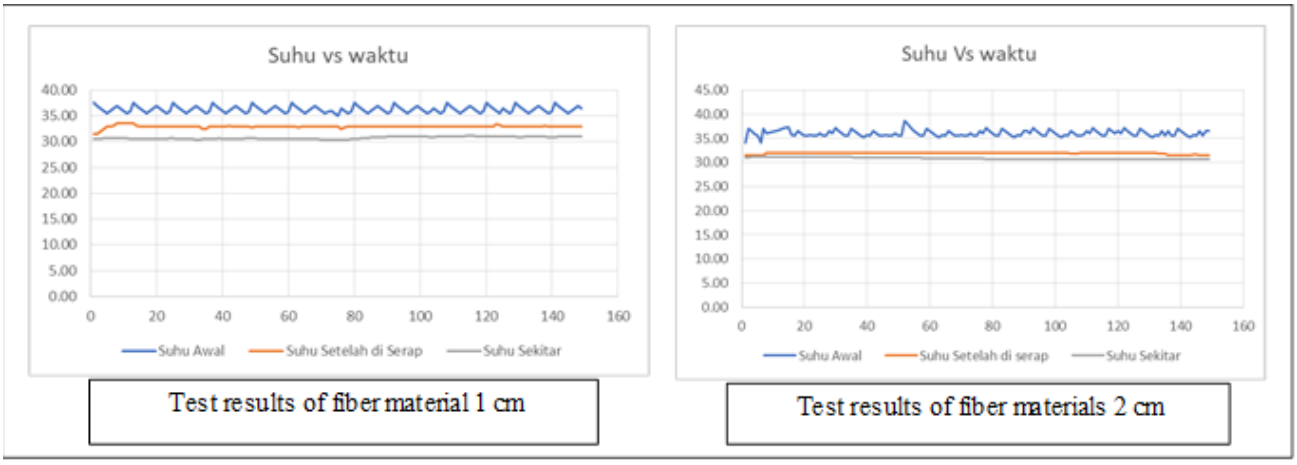

Figure 4: The results of coco fiber materials

The graph in figure 3 shows the test results of the fiber material with a thickness of 1 centimeter and 2 centimeters. The Y-axis of the series 1 line shows the amount of heat applied and measured on one side of the material expressed in Celsius, while series 2 shows the amount of heat absorbed by the material measured on the other side of the material, the series 3 line shows the measured temperature in the environment around the test . The X-axis shows the length of time during the test expressed in minutes. The results obtained from the graph of fiber material 1 centimeter show that when given the heat of 35 ˚C for 140 minutes the temperature measured on the other side of the material of fiber 1 centimeter ranges from 33 ˚C. The results obtained from the graph of fiber materials 2 centimeter show that when given the heat of 35 ˚C for 140 minutes the temperature measured on the other side of the material of fiber 2 centimeters ranges from 31.5 ˚C.

From the results of experiments conducted in this study showed a significant difference between the amount of temperature provided and the temperature measured between coco fiber and without fiber. From the comparison of thickness character of coco fiber material

shows that fiber material with a thickness of 2 cm is greater in reducing heat than the thickness of 1 cm. The results of this study may still be far from perfect because the test equipment used is still limited.

V. CONCLUSION

From the measured temperature comparison by coco fiber material, it can be concluded that fiber material with a thickness of 2 cm and 3 cm has the potential to reduce heat and has the potential as an insulating material for building wall coatings to reduce heat from outside. Based on the characteristics of types the coco fiber, the greater the heat that can be reduced.

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AUTHORS

First Author – Kemala Jeumpa is a lecturer at the Faculty of Engineering, majoring in Civil Engineering at the State University of Medan, Indonesia. Currently completing his doctoral studies in engineering. Research focus on engineering. Can be reached by email: ipajeumpa@gmail.com.

Correspondence Author – Kemala Jeumpa, email address: ipajeumpa@gmail.com.