

A Study on the Effectiveness of Banana Fibers (*Musa acuminata*) and Coconut Fibers (*Cocos nucifera*) as Insulating Materials Used as Additional Roofing of a House

De Los Santos, Joaquin; Reyes, Dan; Rivera, Adrian; Rosanes, Gabriel

AJHS Grade 9 Advanced Science

Father Masterson Dr. Quezon City, 1800 Metro Manila, Philippines

April 6, 2021

joaquin.delossantos@obf.ateneo.edu, narciso.reyes@obf.ateneo.edu, adrian.rivera@obf.ateneo.edu, gabriel.rosanes@obf.ateneo.edu

Introduction

The Philippines is known for its hot temperatures, and improper insulation may worsen the heat. Improper insulation is common in rural areas, therefore, there's a need for a solution that's sustainable, and effective. In this study, the researchers aimed to utilize local plant materials that can act as heat insulators for roofs. The researchers used banana fibres (*Musa acuminata*) and coconut fibres (*Cocos nucifera*) as the roof coating of houses to see their effect on the temperature inside the houses. The researchers hypothesized that using the fibres of banana (*Musa acuminata*), and coconut (*Cocos nucifera*) as roof coating will have a significant effect on lowering the heat within houses.

The objectives of this study are to:

- Determine if these fibres are effective alternative materials for roof insulation.
- Decrease the risk of heatstroke in low-income places.

METHODOLOGY

GATHERING OF MATERIALS FOR THE HOUSES

Cut the plywood to desired dimensions using a saw

Assemble using wood glue

Paint the interior and the exterior of the 3 houses black

Place fibers on their respective houses by pasting with ga glue gun



Place all 3 houses in an open area with similar conditions

Place a room thermometer in the house when it's time to record (9AM, 12PM and 3PM)

Gather the data on the temperatures of the 3 houses and place the data in the data table

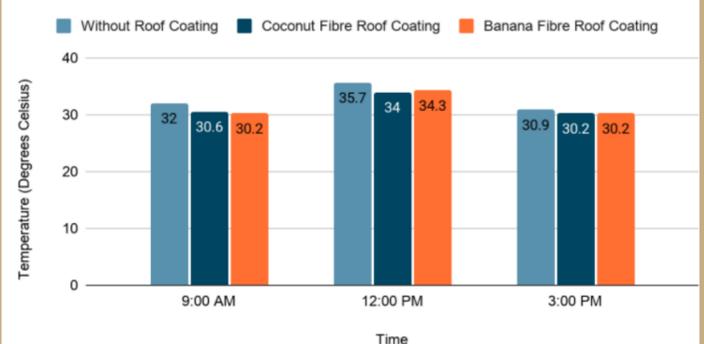
References and Acknowledgements

- References
- Klippe, A. (2019, April 25). Summer in the Philippines: Heat index, explained. Flood Control Asia RS. <https://floodcontrol.asia/summer-heat-index-philippines/#%7E:text=According%20to%20the%20Manila%20Bulletin,the%20public%20of%20heat%20stroke.>
- Manohar, K., & Adeyanju, A. (2016b). A Comparison of Banana Fiber Thermal Insulation with Conventional Building Thermal Insulation. *British Journal of Applied Science & Technology*, 17(3), 1-9. <https://doi.org/10.9734/bjast/2016/29070>
- Ahmad, W., Farooq, S. H., Usman, M., Khan, M., Ahmad, A., Aslam, F., Yousef, R. A., Abduljabbar, H. A., & Sufian, M. (2020). Effect of Coconut Fiber Length and Content on Properties of High Strength Concrete. *Materials*, 13(5), 1075. <https://doi.org/10.3390/ma13051075>
- familyeducation.com. (2017, August 2). Science for Students: What Makes a Good Insulator? <https://www.familyeducation.com/school/science-students-what-makes-good-insulator>
- Scitable. (n.d.). Plant Cells, Chloroplasts, Cell Walls | Learn Science at Scitable. Retrieved March 17, 2021, from [https://www.nature.com/scitable/topicpage/plant-cells-chloroplasts-and-cell-walls-14053956/?error=cookies_not_supported&code=60407447-c69e-4ba6-8a23-04b6b9ea3450#%7E:text=What%20is%20the%20cell%20wall%3F&text=A%20plant%20cell%20wall%20is,cell%20wall%20\(not%20pictured\).](https://www.nature.com/scitable/topicpage/plant-cells-chloroplasts-and-cell-walls-14053956/?error=cookies_not_supported&code=60407447-c69e-4ba6-8a23-04b6b9ea3450#%7E:text=What%20is%20the%20cell%20wall%3F&text=A%20plant%20cell%20wall%20is,cell%20wall%20(not%20pictured).)

Acknowledgements
We would like to thank our Science teacher, Mrs. Dela Cruz, for guiding us and for her continuous support through her comments and suggestions about our work as well as always being available for consultations. We would also like to thank some members of ours, Dan Reyes and Gab Rosanes, for agreeing to conduct the experiment in their own homes. We would also like to thank Mrs. Reyes for helping us with the measurements in making our houses. We would also like to thank Rav Castellano, Kiel Viquiera, Joe Tiglao and Joaquin Pineda for giving their comments and suggestion in our methodology. We would also like to thank each members' parents for helping us buy the materials needed. Without Home Depot and Ace hardware, our experiment will also not be possible so we would like to give thanks to them as well. Lastly, we would like to thank each other, Joaquin De Los Santos, Dan Reyes, Adrian Rivera, and Gabriel Rosanes. Without each other's support, we would not be able to brainstorm ideas, conduct, and finalize this research

DATA AND ANALYSIS

Figure 1. The Averages of the Temperature of the Insides of the Houses at Different Times



Over 3 trials of exposing the three houses to heat, it has been observed that the banana fiber (*Musa acuminata*) or coconut fiber (*Cocos nucifera*) had a significant effect on the temperature of the house throughout the day.

Below: Figure 2. The three houses Left to right (Control Group, Banana Fibers, Coconut Fibers)



It has been observed that due to having compounds found in cell walls (cellulose, lignin, etc.) which account for the rigidity of the fibres which make the fibres effective insulators of heat. This is because rigid structures won't move as much when they receive heat meaning that there will be a lower movement of particles which leads to low heat. Thus, less heat is transferred to the insides of the houses through these fibres.

Conclusion and Recommendation

We have concluded that banana fiber (*Musa acuminata*) and coconut fiber (*Cocos nucifera*) had a significant effect in insulating heat but we were not able to conclude whether which is better than the other for there were trials where banana fibers were more effective in insulating heat than the coconut but there is also another trial that shows that coconut fibers were more effective in insulating heat and the final trial showed that both of the houses with these fibers had the same temperatures.

We can avoid inconsistencies by using red alcohol thermometers instead of digital thermometers to get more accurate readings. It is also advisable to constantly leave the houses directly exposed to sunlight to get consistent results. We can also research even more about the fibers we have used to learn if other scientists conducted a similar experiment and if they got different results which will greatly help us with our research.