Study of Mycelium based Acoustic Absorbers Grown with Agricultural By-product Substrates
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WeARE Research Area

The research focuses on the study of biodegradable product that is produced with a mycelium fungi in conjunction of agricultural by-products as acoustic insulators and absorbers. The study focuses on finding the sound transmission, reflection and absorbance in various biodegradable composites that were produced with the mycelium fungi.

Motivation or Background

The purpose of this research is to be able to find sustainable alternatives for current acoustic products that are made with non-renewable resources or they use petroleum based glues that have no long term availability. The mycelium fungi uses agricultural by-products as its means to create different composites since the fungi binds differently according to the by-product thus creating different composite properties according to the substrate used. Before, these same by-products were considered to be waste products but with this new way to fabricate composites, we can take advantage of all the components of the plant harvested that increases the economical yield of each harvest and we can use these materials that have already consumed resources for its production.

Objectives

• Find the acoustic properties of various mycelium based composites such as their sound transmission, absorbance, and reflection properties.
• Compare the performance of the biodegradable material to the common acoustic absorbers available in the market.
• Make new composites based on the best performers and repeat the experiment.
• Find a good alternative renewable composite that can perform as well or better than current acoustic insulation materials

Methodology and Results

The material was tested using an impedance tube in conjunction with the two microphone and the four microphone method. The samples were cut into small circle samples so they could fit in the sample holder in order to be tested. However, the four microphone method proved to be numerically unstable for the compressed samples so it was discarded.
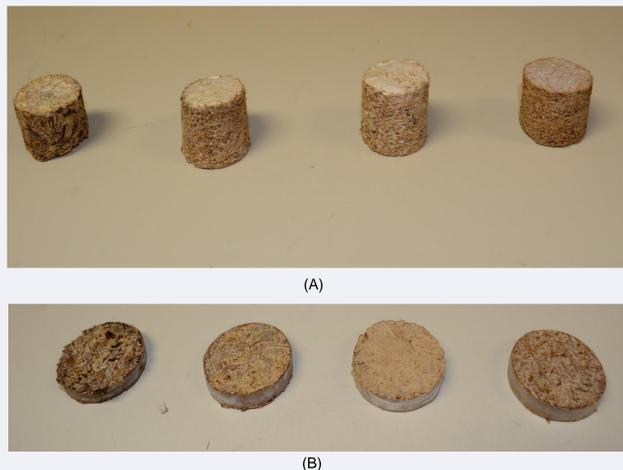
The numerical analysis was done through MATLAB in a script that ran the four microphone method and the two microphone method on the imported data. The two microphone method proved to be far more stable than the four microphone method so extended analysis was done by using the two microphone method. The microphones were then calibrated according to the microphone that provided the most consistent readings
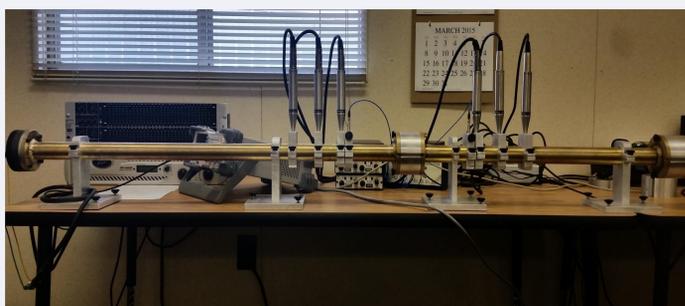
Overall, the biodegradable composite proved to be very effective in reflecting the sound comparable to the common acoustic materials. Therefore, the mycelium based material has proven to be a viable sustainable alternative that can replace and even outperform current commercial acoustic materials. The best performer among the multiple mycelium based composites was the compressed burr fiber that provided a dBA loss above 20. On the other hand, the uncompressed samples overall proved to be very ineffective as sound insulators.
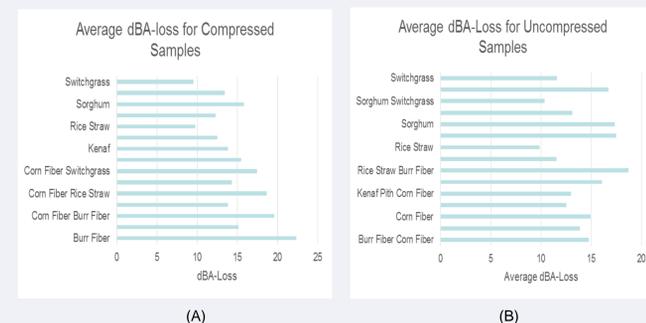

(A)

(B)

Fig. 1
Examples of the mycelium uncompressed (A) and compressed samples(B) tested

Fig. 2
Experimental setup

(A) (B)

Fig. 3
Average dBA loss measured of compressed(A) and uncompressed (B)samples tested

Skills and Experience

• Learned how to make effective flow charts for scripts

• How to develop experimental setups

• Experience making dynamic programs and spreadsheets to aid decision making

What I Learned

I improved my programming abilities and learned how to make my programs more dynamic to adapt to study different materials under different conditions.
I also learned about the new composite of how it is made, the multiple applications of it and the benefits of using this material.
I have also learned that in research is an iterative process and that the real world behaves very different from the ideal cases we study in the classroom.

Future Plans

The next steps in this research is to test the new composites and see how they perform in comparison to previous composites and see if there is an improvement. In addition, we will be working on a different method that uses three microphones to find the acoustic properties and see if it is a more viable option for materials with high reflection coefficients.

Acknowledgments

WeARE Project

References

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