Mycelium Based Acoustic Absorbers

Alex J. Lara

The University of Texas at San Antonio, San Antonio TX, 78249

Name: *Alex J. Lara*
Status*: Junior*
Department: *Engineering*
Area of Study: *Mechanical Engineering*
USDA/UTSA Mentor(s): F. Frank Chen, Ph.D.

WeARE Research Area

The WeARE systems program is a program aimed for students interested in green engineering and is affiliated with the USDA-ARS to give undergraduate students research experience in their field.

Motivation or Background

With the need for a sustainable future, environmentally safe and sustainable materials for future generations are of great interest. The material under examination, in the research, is a new bio-material produced by growing a mycelium binder onto an agricultural by-product that provides the bulk substrate. The mycelium is produced by the growth of the Basidiomycetes fungi on the by-products { corn fiber, cotton burr fiber, switch grass, cotton burrs, kenaf, sorghum, rice-straw}. The production of these boards require no adjuncts and is very energy efficient, as fungi thrives in a warm environment. The material is comprised of two alternative variants; a low density and a highly compressed board.

Objectives

1. The objective is to examine the potential for the boards to perform as acoustic absorbers.
2. Examine the acoustic properties in correlation with the substrate constituent mixtures such as, corn fiber+switch grass, cotton-burr+corn fiber, etc.

Methodology and Results

The testing protocol for the research was based on ASTM research protocols. The system for the experiment is a brass impedance tube with microphones placed to capture multiple frequencies for analysis by the data acquisition system. The captured data is then analyzed to determine the acoustic properties of uncompressed and compressed variants of samples for comparison with traditional acoustic materials

A second methodology was utilized, in which the standing wave ratios were measured with a microphone inserted into the tube, connected to an oscilloscope, to measure the maxima and minima of the wave. The methodology is based on the ISO testing protocol.

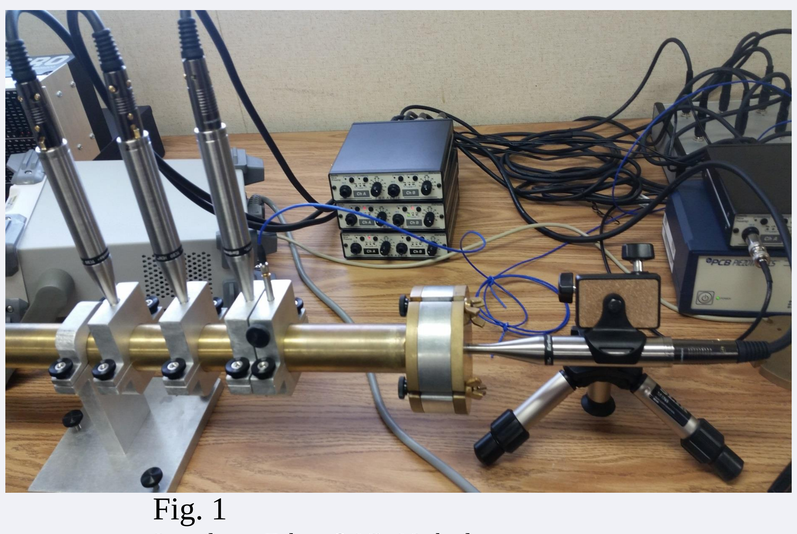

Fig. 1
Impedance Tube – 3-Mic Method

Of the compressed and uncompressed samples, the compressed hard-board materials' provide significant through-transmission absorption properties and suggests a promising future if it can be adapted to the other constraints of the acoustical absorber's market.

Upon trials and review, the four microphone method yielded unreliable results and was replaced with the development of a three microphone method, in which is based on the two-microphone method with a third microphone utilized to capture what has been transmitted through the material. As seen in Fig 1.

The research is on-going and requires the development of the three-microphone method for complete analysis of the samples.

Fig. 2
Compressed Samples

Skills and Experience

The following skills and experiences were gained:

- Signals Processing
- Machining
- Project Planning
- Experimental Research
- Developing Flow Charts
- Developing Standard Operating Protocols

What I Learned

The overall experience and objective has shed light onto the career path I have chosen. The diligence, care, and intuition an engineer must have are some of the qualities I have seen come about as I progressed further down my academic career. I was enlightened by witnessing the hard work of my mentor and revealed the steps I must take as a student to ensure a promising and successful career as a mechanical engineer. It was an honor to be a part of a organization dedicated for the betterment of society by agricultural innovation.

Future Plans

With the project status as ongoing, results will be analyzed with the three-microphone method development and implementation as well as measuring the Standard-Wave ratios for the compressed hard-board samples.

To build a career in renewable energy usage in mechanical systems, the future holds room for continued search in projects and research relating to my goal to provide a greener future.

Acknowledgments

Krystel K. Castillo, Ph.D., Sc. D.
Mathew G. Pelletier, Ph.D.
Greg A. Holt, Ph.D.
USDA-ARS Cotton Gin Lab

This work is supported by the U.S. Department of Agriculture/National Institute of Food and Agriculture through the Hispanic-Serving Institutions Education Program (2014-38422-22088).