

UTILIZING BAMBOO AS A NON-FIBROUS SOUND ABSORBER

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“I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Structure & Material)”

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ABSORBER**

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## ABSTRACT

The usage of synthetic materials in the production of sound absorber can cause the pollution to the environment and affect to the human health. In order to prevent this problem, many researchers have been done to the natural material to get their acoustical properties. This natural material is sustainable and biodegradable. It not causes pollution to the environment during its process. This thesis is study about the acoustical properties of the bamboo materials. Bamboo with the smaller diameter is one of the most wasted natural materials that not been used properly by the human. Bamboo is design and fabricates in the form of sample for the test to investigate their absorption coefficient using the impedance tube method. Various parameter of bamboo sample has been test in order to know factor that affecting the sound absorption of bamboo material. The result is analysed and compare with each parameter to find which one is suitable to use for production of sound absorber. A good absorption coefficient of material found is above 0.5 with the frequency of 1 kHz and above.



## ABSTRAK

Penggunaan bahan sintetik dalam pembuatan bahan penyerap bunyi boleh menyebabkan pencemaran kepada alam sekitar dan menjejaskan kesihatan manusia. Buluh juga tidak menyebabkan pencemaran persekitaran semasa dalam process penggunaannya. Untuk mengelakkan masalah ini daripada terus berlaku, para penyelidik telah melakukan kajian ke atas bahan semula jadi untuk mendapatkan ciri-ciri penyerap bunyi bagi bahan tersebut. Bahan semula jadi adalah sentiasa boleh digunakan dan mesra alam. Tesis ini merupakan kajian terhadap buluh yang berdiameter kecil yang selalu tidak di manfaatkan oleh manusia. Beberapa parameter telah diuji untuk mendapatkan nilai penyerapan yang terbaik. Buluh telah dijadikan sample untuk menjalankan satu eksperimen untuk mendapatkan nilai penyerapan bunyi. Hasilnya dianalisis dan dibandingkan dengan setiap parameter untuk mengetahui parameter yang terbaik untuk digunakan bagi membina satu penyerap bunyi daripada buluh. Nilai penyerapan bunyi yang bagus bagi sesuatu bahan adalah 0.5 keatas dengan kekerapan melebihi 1 kHz.

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**LIST OF SYMBOLS**

$R_1$	=	Air flow resistance
$u$	=	Velocity
$P$	=	Pressure
$H$	=	Porosity
$\alpha$	=	Absorption coefficient
$Z_c$	=	Properties of impedance
$k_c$	=	Complex amount of sound wave
$\lambda$	=	Wavelength
$c$	=	Wave speed
$f$	=	Frequency

## LIST OF ABBREVIATION

ASTM	American Society for Testing and Materials
ISO	International Organisation for Standardisation
OSHA	Occupational Safety and Health Administration
dpf	Denier Per Filament
dB	Decibel
EN	Standard for inspection
LEFM	Linear Elastic Fracture Mechanics
LDS DACTRON	Dynamic Signal Analyzer-PHOTON+
G.R.A.S	Generally recognized as safe

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## CHAPTER 1

### INTRODUCTION

#### 1.1 BACKGROUND

In this technological era, the buildings construction in this country occurs very rapidly over time. Material such as rocks, clay, wood, brick and some other material has been used to build the buildings. The building construction typically has been divided into several segmented, such as, floor, wall, roof, plumbing and the building insulation. The building insulation is one of the important segmented that need to be considered. In order to get a quality life, noise control is one of the very important requirements in our living environment ( Seddeq,H.S, 2009 ). Noise is one of the type of pollution, it can cause hearing damage, stress, and can change the personal attitude. To overcome this problem, the sound proofing material has been used in the buildings construction to reduce the frequency of unwanted sound wave that can cause the sound pollution to the environment (Oldham,D.J, 2011).

The sound proofing in the buildings is made from an acoustical material that plays an important role in the acoustical engineering. This material has been used as noise control in residential soundproofing, acoustics studio, automotive soundproofing, and industrial noise control in the form of sound absorber that has been put in the building wall in order to control the sound that emitted from the source.

Among sound proofing material in the building that had been use during the past years, the material is come from the conventional synthetic material. This synthetic material has many disadvantages, especially in their durability and can cause the pollution to the environmental. Putra et al. (2010) find that the use of synthetic material as sound absorber in the building can cause pollution to the environment and it also released the green gas house to the atmosphere during its production. Greenhouse gases keep the temperature of the earth increase and this situation can effect to the human health. The numbers of death has been increase every year because of the changing of weather and dehydration. This gas also can give an impact on environment and economy.

The production of this synthetic material cause the air pollution, it has been known to release the carbon dioxide to the atmosphere compare to the product that made from the natural material (Asdrubali, 2006). The campaign to get the green environment cannot be achieved because of the releasing of this carbon dioxide gas. The production of these synthetic fibers becomes harmful because it is using the chemical. Sodium hydroxide and carbon disulphide are type of chemicals that has been used. These chemicals had been getting from oil, natural gas, and coil. These chemicals are very harmful to human health because it can enter the water supply, for the worker, the risk to get the lung disease is high.

The other disadvantages of this material is cannot stand the heat, and also non-biodegradable compared to the natural materials. Non-biodegradable means that when this product are not been used, it has to be discharge. For this process, the petrochemicals not break down in the soil, and these chemicals can spread to the environment. Compare with the natural material that biodegradable, it is safe to use and not harmful to the human health and environment. Along with the high cost of chemical material and global warming, this had been motivating the manufacturers to produce products using the natural material. Natural material such as bamboo, paddy, coir fiber, and kapok fiber had the potential to be the sound absorbing material.

## **1.2 PROBLEM STATEMENT**

Noise control is one of the major requirements to improve the living environment. In the construction sector, all building must be put the sound absorber. This sound absorber absorbed the sound wave that flow through it. The usage of synthetic material to build a sound absorber can cause much effect to the human health and pollution to the environment. In order to save energy and to save the environment, there are many natural materials have potential to be sound absorber. One example is bamboo. There has been a lack of discussion on this material, particularly on its acoustical characteristic.

## **1.3 OBJECTIVE**

The overall aims for this study are:

1. To fabricate bamboo as non-fibrous sound absorber.
2. To measure the sound absorption coefficient of the panel using the impedance tube.

## **1.4 SCOPE**

The scope including for this study are:

1. Material preparation, design and fabrication.
2. Measurement of absorption coefficient in impedance tube.

## 1.5 METHODOLOGY

Based on the objective mention above, the study is narrowed down to be more specific, in order to give a clearer view on critical point. The methodologies of this study are:

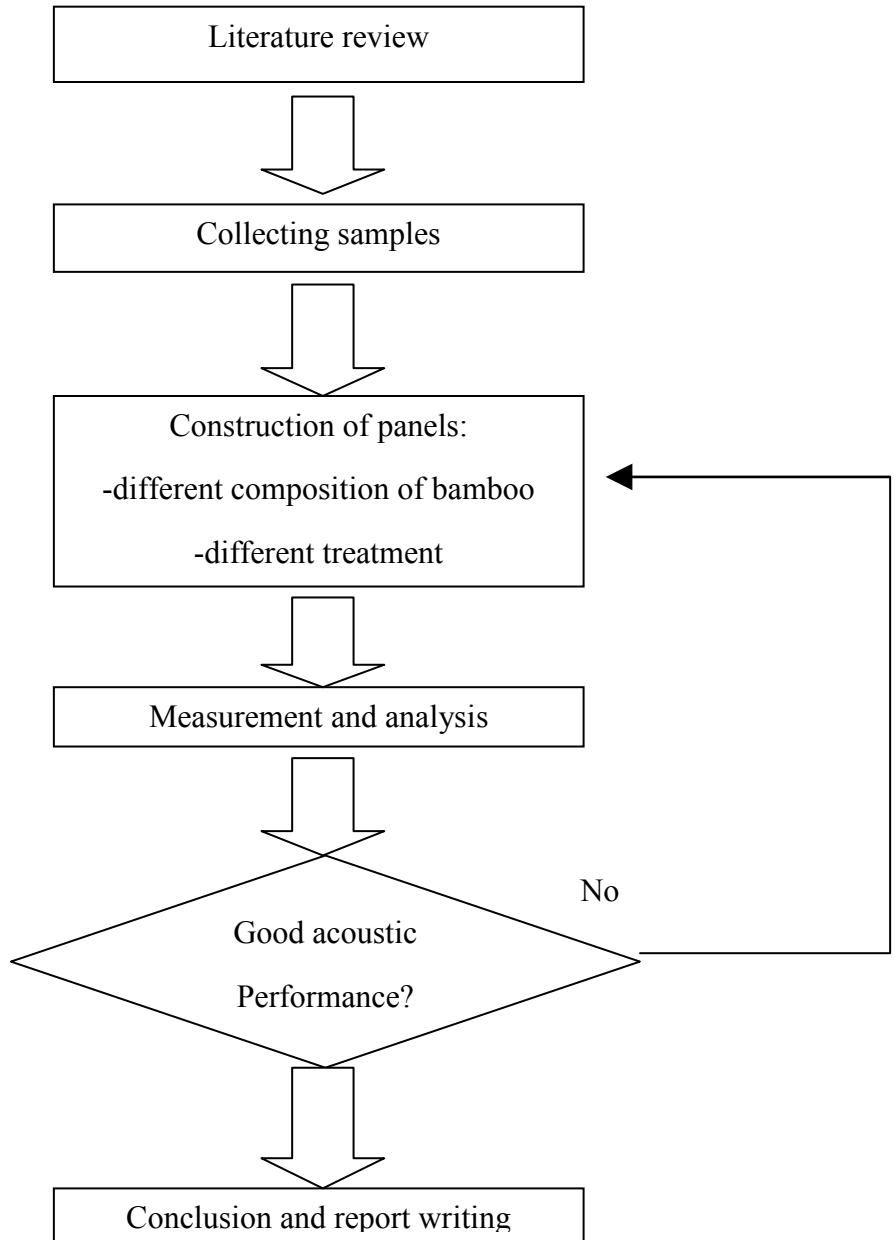


Figure 1.1: Diagram of the methodology flow chart

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

The literature review is about the comparison issue between the different authors, it highlight the researched study. Literature review is also a group of writer who get the similar conclusion about the topic and its show the connection between the research and the previous study. A literature review is a script of what have been done by researcher or the other organization (Shuttleworth. M, 2009). The reading process, analyze, and summarizing research and scholar materials about a study, it's a note areas of disagreement between the author (Arlene Fink, 2009).

#### **2.2 NOISE**

Every day, we have heard many different of sound and most of the sound is the sound that always we hear. For example, sound of music from the loud speaker, sound of construction site, people talking to each other, traffic sound and even dog barking when someone passed through your home. However, if the sound of the music from the loudspeaker has distracting you from doing your work, sound of construction site give you a headache and dog barking interfere you when sleep, this