# Industrial Noise Abatement Study by Using Natural Materials

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**Abstract**: This study explores the integration of innovative construction materials and techniques for industrial noise abatement. With the rising impact of industrial activities on surrounding environments, mitigating noise pollution has become a critical concern. This paper aims to assess the feasibility, , and performance of advanced materials such as sound-absorbing composites and cutting-edge construction methods designed to minimize noise propagation .The investigation encompasses a comprehensive analysis of material properties, including acoustic absorption coefficients, durability, and environmental sustainability. Concurrently, the study evaluates construction techniques like modular design and innovative structural configurations to optimize noise reduction in industrial settings.

**Keywords**: Noise meter, Impedance tube, Woodgrip, Natural materials, Industry.

## I. INTRODUCTION

The paper on "Industrial noise abatement study by using natural materials" searches into the exploration and implementation of materials engineered to mitigate and control sound transmission. In an increasing urbanization and environmental noise, the significance of developing effective noise reduction solutions is all over. This paper will search into the various materials, methodologies, and applications involved in creating a sonic environment conducive to improved well-being acoustic comfort. Industrial noise poses significant challenges to both human health and the environment. As industries continue to expand, there is a growing need for innovative construction materials and techniques to mitigate the adverse effects of noise pollution. In this paper we made several material combinations which are combine with binding material woodgrip. This study aims to explore and evaluate several solutions for industrial noise abatement, considering their effectiveness, cost implications, and overall feasibilities .Through this study, we seek to contribute valuable insights that will inform decision-making processes for a quieter and more sustainable industrial landscape.

**Problem Statement:**

In this paper industrial areas and worker well-being, the increasing noise levels present potentially leading to adverse health effects and reduced productivity. This study find to investigate the feasibility and efficiency of employing natural materials for noise abatement in industrial settings, aiming to enhance the working environment, safeguard employee health, and optimize overall industrial productivity sustainably.

**Objectives:**

1. The study of the noise and it's important physical characteristics.
2. To study the important sources of noise in

industrial sector.

3. To study the conventional and present methods of noise control and there limitations.
4. The study of new construction materials for noise reduction and their applications.
5. To study the effect of mix proportion and thickness of the product on effective noise reduction properties of the materials.

## II. LITERATURE REVIEW

**[1] Zhou Hong, Li Bo, Huang Guangsu and He Jia "A novel composite sound absorber with recycled rubber particles", Journal of Sound and Vibration 304 (2007) 400–406.** In this paper authors have presented new kind of sound absorber using recycled rubber with its attractive characteristics; low – cost, broadband sound absorption, thin in thickness and relatively simple processing. This paper throws light on sound attenuation of recycled rubber particles and its influence on acoustics properties of porous material, perforated material and composites (foam, glass wool etc.) in layers or in double layers. Recycled rubber of density 1001.5 kg/m3, highly irregular shapes and sizes ranging from 150–840 μm have selected for Specimen preparation. Two-microphone impedance tube (type 4206) of Bruel & Kjaer has applied to measure the normal incident absorption coefficient and other acoustic parameters according to the standard procedure detailed in ISO (10534-2).

**[2] Nailong ZHANG, Wentong YANG and Renyuan FEI, "Noise control technology for generator sets in enclosures", Front. Mech. Engg. China 2008, 3(4): 377–384.** In this paper authors have explained noise control techniques of enclosures for various machines in the industry. The sound-attenuated enclosure is more convenient and effective noise control method and it is acceptable for many types of power equipment. This paper also throws light on Active Noise Control (ANC) technique. By experimentation it has been seen that the noisecan be effectively reduced by 15 dB for propellers and 8-14 dB in adjacent cabins. Also noise cancellation using hybrid active-passive control technique has been studied from experimentation in which noise absorption coefficient achieved up to 0.82.

**[3] Jorge P. Arenas, Malcolm J. Crocker, "Recent Trends in Porous Sound-Absorbing Materials" SOUND & VIBRATION/JULY 2010.** This paper deals with various sound absorber materials since 1960's in regards with their drawbacks and ineffectiveness and their ill effects on the workers while processing these materials. In the 1970s, sound-absorbing materials from asbestos-based materials to new synthetic fibers changed although these new fibers were not much safer because of issues related to human health and global warming led the use of natural fibers instead of synthetic ones. Authors have highlighted the subsequent development in sound absorbent material compared with the older absorbing materials produced in the 1960s. The new materials have become safer, lighter and more technologically optimized. In addition, the concept of environment friendly, sustainable, recycled, and green-building materials will soon have an important role in the marketing of sound-absorbing materials.

**[4] Min Yang , Ping Sheng Annual Review Of Materials Research 47,83-114,2017** The recent advent of acoustic metamaterials has initiated a strong revival of interest on the subject of sound absorption. The present review is based on the physics perspective as the coherent basics of this diverse field.

**[5] Kishor Kalauni , SJ Pawar Journal Of Porous Materials 26 (96) ,1795-1819.2019** The sound is the pressure disturbance created over air particles Above and below atmospheric pressure it is a mechanical wave which requires a medium to propagate. The sound can generate from a source ,then travels through a medium and finally is recived by the receiver.

## III.DATA COLLECTION

**Questionnary Survey:**

Closed ended questionary survey carried out at the time of the visit to the industry viz. Sahyadri Industry and KPML Industry. This survey

gives the identification about the impacts of the sound on the workers and no provision to the worker regarding noise reduction impact. This survey also gives idea about requirement of solutions regarding noise reduction.

**Specimen Combinations:**

For test purpose various specimens are made with different natural materials like cowdung, rice straw, tulsi, coconut coir, salvinia mix with binding material woodgrip. Following are the combinations,

**Specimen I:** Woodgrip + Cowdung + Rice straw + Tulsi
**Specimen II:** Woodgrip + Cowdung + Coconut coir
**Specimen III** Woodgrip + Tulsi + Cowdung

**Specimen IV:** Woodgrip + Salvinia + Rice straw

**Specimen V:** Woodgrip + Salvinia + Rice straw + Tulsi

**Testing Set-Up:**

The testing set-up includes impendence tube, speaker, signal generator, union and noise meter as shown in the following figure.

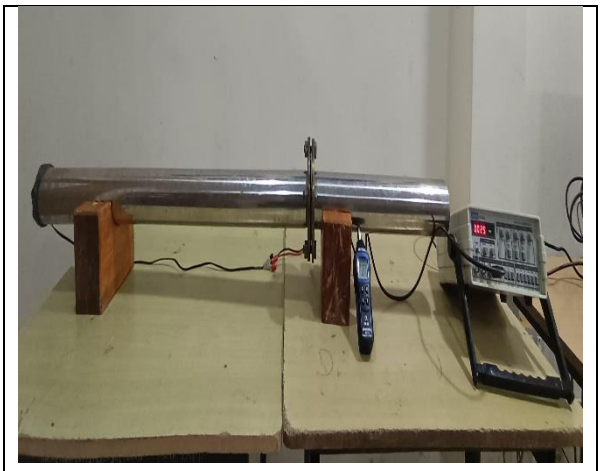

**Fig.3.1**.Testing Set-up

**Impedance Tube:**

An impedance tube is an instrument used to measure the acoustic impedance of materials, particularly in the field of acoustics and materials science. It consists of a tube with a loudspeaker at one end and a microphone at the other. By analyzing the sound waves as they travel through the tube and interact with the material under test, researchers can determine the impedance properties, helping characterize the material's acoustic behavior and absorption characteristics. Impedance tube measurements are crucial in designing materials for sound absorption or insulation applications.

**Noise Meter:**

A noise meter is also known as a sound level meter or decibel meter measures the intensity of sound in decibels (dB). It typically consists of a microphone to capture sound, a processor to analyze and display the results and a display to show the noise levels. These devices are commonly used to monitor and assess noise pollution in various environment, such as workplaces, public spaces and residential areas. Noise meter help ensure compliance with regulations and promote a healthier acoustic environment.

**Test Procedure:**

Streo speaker was used 5 watt produce noise intensity inside the imendance tube.30mHz function pulse generator use for in specimen testing. Providing frequency from 63Hz to 16000Hz function generator model specification. Impedance tube material is not mentioned in ISO 10534-2 but recommend that tube material must be sufficiently to avoid noise from outside or background of noise sources. Length of tube should be at least 10-15 times of tube diameter these are recommended in ISO 10534-2. Propagation tube fulfill all recommendation. Noise level meter (accordance with the international committee IEC-651) is used for noise level measurement.

The tube give accurate measurement for sound absorption coefficient. Objective of this tube give noise reduction coefficient for each specimen. Frequency generator noise level are measured from 63Hz -16000Hz. Gradually increased noise start from 63Hz up to the 16000Hz. Noise reduction coefficient (NRC) is ratio of intensity of reduced noise and intensity of incident noise.

## IV.RESULTS

The following table 4.1 shows the test results find after the test carried out by using impedance tube set-up:

**Please see table mention after reference.**

## V.CONCLUSION

- From this study it is found that average noise level is reduced by 9.32%.
- The maximum noise reduction value is 9.50%.in the combination of woodgrip + tulsi.+ cowdung.
- It is recommended for utilization of noise reduction in the industry, specially around the machine. The shape of the specimens are cubical to give maximum benefit. It helps to reduce the health issues of the workers occurs due to noise in the industry.
- Hence finally it is concluded that these material combinations benefited to reduce industrial noise. Also if it is used with coverage of laminates or fome board by making panel boards gives more impact.

## VI. REFERENCES

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**Table no. 4**

| **Material Combination with its Nomenclature** | **Mix Proportion** | **Specimen thickness (mm)** | **Octave Band Centre Frequencies (Hz)** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | 16000 |
| | | | **Incident Noise Intensity 'a' (dB)** | | | | | | | | |
| | | | 86.6 | 93.8 | 115.1 | 106 | 117.2 | 110.6 | 95.5 | 110 | 77.4 |
| | | | **Reduced Noise Intensity 'b' (dB)** | | | | | | | | |
| Woodgrip+ Cowdung +Ricestraw +Tulsi (W + C + D) | **1.5:0.5:0.5:0.5** | 12.5mm | 79.5 | 91.3 | 114..9 | 101.4 | 113.5 | 105 | 76.1 | 100 | 58.9 |
| Woodgrip+ Cowdung +Coconut Coir (W + C + CC) | **1.5:0.6:0.15** | 12.5mm | 79.6 | 92 | 112.2 | 100.5 | 112.6 | 100.5 | 74.1 | 101.2 | 70 |
| Woodgrip + Tulsi + Cowdung (W + T + C ) | **1.5:0.5:0.5** | 12.5mm | 79.8 | 92.3 | 111.6 | 101.5 | 110.1 | 103.9 | 74.8 | 101.1 | 71.5 |
| Woodgrip+ Salvinia +Ricestraw (W + S + R) | **1.5:0.5:7.5** | 12.5mm | 77.5 | 89.7 | 113.3 | 103.5 | 99.5 | 97.5 | 80.5 | 97.8 | 55.6 |
| Woodgrip+ Salvinia+ Ricestraw+ Tulsi (W + S + R + T) | **1.5:0.4:0.3:0.4** | 12.5mm | 76.1 | 88.3 | 114.1 | 102.4 | 102.1 | 99.4 | 76.6 | 97.4 | 54..5 |