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Developing Acoustic Noise Barriers with Blending of Coir and Jute

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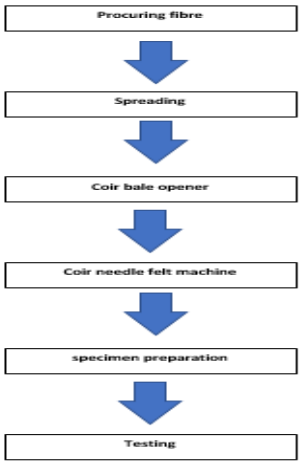
Abstract: **Problem statement: Noise control was one of the major requirements to improve the living environment. One of the methods to do that is provided by sound absorber. Commonly, multi-layer sound absorbers are applied to absorb broadband noise that was composed of perforated plates, air space and porous material. However, multi-layers sound absorbers effectiveness depends on their construction. This study was conducted to investigate the potential of using coconut coir fiber and jute fibre as sound absorber. The effects of porous layer backing and perforated plate on sound absorption coefficient of sound absorber using coconut coir fiber and jute fibre were studied. Approach: This material is made by blending coir and jute with different proportional ratio. The samples were tested at the acoustic lab of the psgtechs coe indutech, neelambur, Coimbatore according to ASTM E 1050-98 international standards for noise absorption coefficient. Results: The experiment data indicates that 70%coir and 30 %jute can improve noise absorption coefficient at low and high frequencies with significant increasing. 50mm thick layer coconut coir fiber and jute fiber with porous layer backing exhibit peak value at frequencies between 5000Hz to 6300Hz with maximum value of 0.72. The experimental results also found that the coconut coir fiber and jute fiber with 50:50 ratio gives lower value for higher frequency between 5000Hz to 63000Hz with value of 0.50. Conclusion: Noise absorption coefficient of coconut coir blended with jute fiber was increased at all frequencies. The results from the experimental tests show that70:30 ratio of coir and jute it has good acoustic properties at low and high frequencies and can used to be an alternative replacement of synthetic based commercial product. By using the porous layer and perforated plate backing to coconut coir fiber, the sound absorber panel shows a good potential to be an environmentally friendly product. This innovative sound absorption panel has a bright future because they are cheaper, lighter and environmentally compare to glass fiber and mineral based synthetic materials.**

Keywords: **Acoustic, barriers, blending, coir, developing, jute, noise**

1. Introduction

Noise is the unwanted and undesirable sound that affects the human ear and cause disturbances. Noise adversely affects the human health and cause permanent hearing loss, mental illness, cardiovascular diseases, sleeping disturbance, etc. The audible frequency range of humans is about 20Hz to 20000Hz. Sound waves above this frequency range affects the human ear and also the environment. High noise levels can be controlled by the use of suitable sound control materials such as acoustic materials. Acoustic is the science of sounds which deals with properties of sound waves Acoustical properties are those that govern how materials respond to sound waves, which are what we perceive as sound. We are all familiar with how a disturbance in a body of water will cause waves to develop and travel along the surface of the water in all directions away from the disturbance. It dampens the sound because of its porous nature. Available commercial sound absorption materials could be generally divided into two categories: resonant sound absorption materials and porous sound absorption materials. Porous sound absorption materials are composed of channels, cracks or cavities which allow the sound waves entering the materials. Sound energy is dissipated by thermal loss caused by the friction of air molecules with the pore walls, and viscous loss bring by the viscously of airflow within the materials. These energy consumption principles endow porous materials with broad frequency band for sound absorption. Our aim is to study the sound absorption coefficient of blended coir and jute. We done the sound absorption test in impedance test tube method. The coir and jute are converted into blog by coir needle felt machine. PVA is added for good fiber bonding. The blog is cut into round shape for sound absorption test. The sound absorption test is done in impedance tube.

2. Methodology



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3. Experimental Methods

1) Preparing sample by needle punch

For preparing sample of coir and jute coir felt needle punch machine is used. Sample made with coir felt needle punch machine is better than sample made from blending and layed method.

Table 1
Sample preparation

S.no	Coir%	Jute%
1	50	50
2	60	40
3	70	30

To prepare 3 individual 3kg sample we have blended with different fibre at different ratios. For sample one of 3kg contain 50% of coir fibre, 50% of jute fibre. For sample two of 3kg contain 60% of coir fibre, 40% of jute fibre. For sample three of 3kg contain 70% of coir fibre, 30% of jute fibre

4. Test Method

1) Sound absorption test

Sound absorption coefficients of multilayer nonwovens were measured according to ISO 10534-2. Nonwoven samples were cut into 100 and 29 mm diameters for the measurement of large and small tubes. Sound absorption coefficients of three samples (two replications from each material) were obtained by using a Brüel and Kjær impedance tube kit. The capillary flow poro meter (Porous Materials Inc., USA) has been successfully used to evaluate pore structures of multilayer nonwovens. Determination of porosity of samples according to ISO 15901-1 standard, 5 samples were prepared at 0.03 cm and determined by taking the average of the measurement values.

2) Procedure for sound absorption test

- Step 1: the web is cut to small square shape.
- Step 2: the PVA solution is applied in the cutted square sample.
- Step 3: the sample is placed on one another and some load is applied. The sample is kept in rest for 12 hrs.
- Step 4: the sample is cut into 99mm and 29mm dia for sound absorption test.
- Step 5: the specimen is placed in 99 and 29mm dia whole in impedance tube.
- Step 6: the sound frequency is passed from speaker to the specimen. And the sound absorption coefficient is calculated.
- Step 7: After the test is done remove the specimen from impedance tube.

5. Results

1) Sound absorption test

The sound absorption test is done in the impedance tube the combination of coir and jute. The specimen size and weight was same in all contribution. In 50:50 the minimum sound absorption coefficient was 0.07 in 250Hz frequency and maximum sound absorption coefficient was 0.57 in 63000Hz. In 60:40 ratio the minimum sound absorption coefficient was 0.08 in 250Hz and maximum was 0.60 in 63000 Hz. In 70:30 ratio the minimum sound absorption coefficient was 0.09 and maximum was 0.62 in 63000Hz.

Table 2
Sound absorption test table

S.no	Ratio	Frequency 250Hz	Frequency 500Hz	Frequency 1000Hz	Frequency 2000Hz
1	50:50	0.07	0.10	0.13	0.l6
2	60:40	0.08	0.12	0.16	0.21
3	70:30	0.09	0.16	0.24	0.29

6. Conclusion

In this work, the sound acoustic is are made from biodegradable fibre like coir and jute. PVA is used as resin which is used to increase tensile strength and compare to epoxy resin PVA is cheap and biodegradable. Needle punched nonwoven fabrics are produced from coir and jute with different proportional ratio. The following conclusions were made from the research work; In 50:50 the minimum sound absorption coefficient was 0.07 in 250Hz frequency and maximum sound absorption coefficient was 0.57 in 63000Hz . In 60:40 ratio the minimum sound absorption coefficient was 0.08 in 250Hz and maximum was 0.60 in 63000 Hz. In 70:30 ratio the minimum sound absorption coefficient was 0.09 and maximum was 0.62 in 63000Hz. Thus the coir and jute of 70:30 give better absorption coefficient that can be used to produce sound acoustic panel.

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