

Development of Noise Absorbing Composite Materials Using Agro Waste Product

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Abstract— Increasing use of electrical and mechanical appliances at home and industries has created a concern for noise pollution created by them. Urbanization and heavy growth of construction work in every neighborhood further emphasize the need of new technologies for noise reduction. Noise created by different machines can be controlled either by suppressing the noise generating factors or by using the noise proofing materials which help to reduce the acoustic wave's energy by blocking or absorption. At present the focus, is to develop a cheap, renewable and biodegradable sound proofing material with the help of jute fibre which is a non-abrasive porous, good insulator, hygroscopic and combustible material for automobile, home appliances and architecture application

Keywords— Cheap, Renewable, Biodegradable, Jute.

I. INTRODUCTION

Noise is nuisances caused in the outside world due to various reasons, involving machines, transportation systems, engines, aircraft, etc. Noise pollution has great adverse influences on the environment, human health and economy. How to reduce the damages caused by the noise pollution has become an important issue. Therefore, to avoid this unwanted noise various types of acoustic panels are nowadays used. Generally panels are made of synthetic porous and fibrous materials as they serve as good acoustic insulators absorbing most sound whereas dense, hard, impenetrable materials reflect most sound. The products such as foam, rock wool, and glass wool made from minerals are known for their toxicity and polluting effects which are harmful to human health as well as to the environment. It has been shown that their production can release more carbon dioxide into the atmosphere compared to those made from natural materials. In order to support "Green" environment campaign, Acoustic absorbers from natural materials are therefore of interest due to their biodegradability and sustainability. As an alternate, natural fibres like jute, cotton, flax, ramie, sisal, and hemp obtained from renewable resource can be used as a cheap, biodegradable and recyclable sound absorbing materials. Although composites made of jute fibre/felt with other fibres are being used for various applications in the automotive industry, construction, building sectors, furniture etc.

II. LITERATURE REVIEW

1.1 Rice straw-wood particles and bamboo composite for sound absorbing wooden construction materials(2003)

From this source we got a brief information on agro materials, their properties and their capabilities of absorbing sound to a great extent. The recommended properties of the rice straw-wood particle composite boards are described, to absorb noise, preserve the temperature of indoor living spaces, and to be able to partially or completely substitute for wood particle board and insulation board in wooden construction.

1.2 The design of an Acoustical multi-layer coir fibres sound absorption panel. (Eur J Science Research; 2008)

This reference gives us the idea of making layers of the material to obtain multi-layer panels. Layers of rice straw, bamboo and polypropylene should be combined properly with proper readings and proper structure. This reference helped us in making structure and properly placing all the materials so that their maximum utilization can be done.

1.3 New low-cost insulation particle boards from mixture of all agro waste material. (Build Environment research work; 2004)

From this source we information of making low cost but an effective panel which can absorb sound and can decrease noise pollution. All the materials which we are using are waste and natural conventional materials which are available in abundance in nature. By using such materials the cost automatically decreases and making of such panels become easy and more convenient.

1.4 Uses of acoustic panels in our day to day life. (BMJ quality & safety; 2005)

From this research paper we got to know the uses of acoustic panels. Acoustic panels are designed to combat noise pollution. They are often used in noisy areas to reduce, correct and absorb noise pollution. This panels are designed in such a that they can be used in restaurants, reception hall or (more frequently) in offices giving a decent look and finish. Using such kind of the panels in auditorium will give effective results in watching movies or attending any conference.

III. MATERIAL AND METHOD

1.1 Design

The dimensions of the materials are given below:

Dimension = 25cm x 30cm

Bamboo strips = 30cm x 1cm

Thickness = 0.2cm

Rice straw length = 30cm

Weight/area and dimension of composites have been set at 200g/m² and 300g/m² dimension of 25cm x 30cm .The non-woven web was rolled and cut into 25cm x 30cm rectangles. After determining the total weight of the bamboo and rice straw necessary to achieve the desired concentration. For achieving good strength agro waste concentration is divided into 3 different ratios as 30/70, 50/50 and 70/30 (Rice straw / Bamboo). For knowing good strength concentration of binding material and agro-wastes are divided into 2 ratios. i.e., 50/50 and 70/30 (Agro-waste /Polypropylene).

Bamboo strips are cut into 30cm x1cm dimension and thickness is maintained about 0.2cm. Rice straw is cleaned to remove weeds and other wastes. The rice straw length is made maintained around 30cm .These agro-wastes are sundried for 2 days to remove the moisture content in the materials. Rice straw and bamboo are laid in parallel to each on top and bottom with the layer of polypropylene web in between it. To achieve smooth surface rice straw is laid, both at top and at the bottom surface. The layered mass of agro-wastes (bamboo strips and rice straw) and polypropylene web was pressed in between two Teflon coated aluminum sheets in a pre-heated compression machine which is maintained at 170°C under desire control pressure.

After 120sec minutes PP melts and it is passed through the voids and starts binding with agro wastes. After 1200seconds cold water is turned on until the hot plates temperature decreases to 500°C and then pressure is removed. The composite is removed and it is placed in conditioning room. The procedure is followed for all ratios and the composites are tested for the study.

1.2 Materials Used In Developing Panel

The materials used in developing a noise absorption boards are as follows:

1.2.1 Rice straw :

Rice straw is a by-product produced when the harvested paddy is separated from the grains. They are thrashed either manually, using stationary threshers or combine harvesters. Each kg of rice produced results in roughly 0.7–1.4 kg of rice straw depending on varieties, cutting-height of the stubbles, and moisture content during harvest. The average rice straw produced in the world is equal to the annual rice produced. About 45% to 63% of rice straw is used for cattle feeding purpose and the remaining rice straw is dumped or it is burned in the open field.

The biochemical composition of rice straw and wheat straw is characterized by a typical composition of an agricultural-based lignocellulose residue: it contains on average 30 – 45% cellulose, 20 – 25% hemicellulose, 15 – 20 % lignin, as well as a number of minor organic compounds.

(a). The details of different inorganic compounds in rice straw

**Table
 Properties of Rice Straw**

SR NOS	COMPONENT	MEAN VALUE (%)	MIN VALUE (%)	MAX VALUE (%)
1	WATER CONTENT	23.9	6.8	88
2	VOLATILES	83.9	80.1	98.2
3	ASH	18	9.6	24.4
4	HHV	18824	17673	19718
5	C	48.7	43.3	60
6	H	5.92	4.94	7.01
7	O	44.2	30.8	50.4
8	N	1.05	0.57	2.11
9	S	0.14	0.07	0.23
10	CI	0.481	0.013	0.909
11	CELLULOSE	36	28.1	41
12	HEMI CELLULOSE	24	21.5	26.5
13	LIGNIN	15.6	9.9	23.3

1.2.2 Bamboo :

Bamboo is the naturally occurring composite material which grows abundantly in most of the tropical countries. It is considered as composite material because it consists of cellulose fibers imbedded in a lignin matrix. Cellulose fibers are aligned along the length of the bamboo provides maximum tensile strength.

It is a cheap and fast-grown resource with superior physical and mechanical properties compared to most wood species, bamboo offers great potential as an alternative to wood.

Bamboos are subfamily of grass, grown in all over the world except Europe. Currently there are 1200 species of bamboo in the world. It is divided into the two main groups i.e., woody and herbaceous group. Woody bamboo are interesting one due to its size. In Asia, bamboo grow about 40m tall. It is fastest growing plant on earth having a growth increment of 11cm per day.

The specific gravity of bamboo varies from 0.4 to 0.8 depending on its anatomical structure. The composition of bamboo is primary cellulose of 60%, hemi cellulose and lignin of 32%. Bamboo has good acoustic property due to the presence of voids in it. It helps in mitigating water pollution due to high nitrogen consumption. It generates up to 35% of oxygen. It has good mechanical strength.

1.2.3 Poly propylene :

It is a non-woven thermosetting fabric material. It is used in many fields due to its property. It is called as engineering plastic. It is flexible, good resistance to fatigue. The density of PP varies between 0.895 to 0.92g / cubic cm. It is thermally resistant to all solvents. PP's melting point lies around 162degree Celsius. It is a slow degradable material. Due to its thermosetting property it is used has a binding agent in developing the composite material.

IV. CONCLUSION

Acoustic panel is a special kind of the panel made of sound absorbing composite materials. Its job is to provide sound insulation. Between the two outer walls the sound absorbing material is inserted and the wall is porous. Thus, when the sound is passed through an acoustic panel, the intensity of sound is decreased. The loss of sound energy is balanced by producing the heat energy. Here, we are using agro waste material to make the panel economical. The maintenance of this panel is easy and is durable. The acoustic panels are also easy to install.

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