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Experimental Study of Noise Control by Agro-Waste

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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 neighbourhood 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. Traditionally, noise is controlled by using expensive and non-biodegradable sound absorbing materials such as glass wool, polymer foams, and fabric filler and polymer fibres, posing an additional harm to the environment. The health risk factors associated with glass-and mineral-fibre materials, also provide an opportunity to develop the sound proofing material made of naturally available materials. At present the focus, is to develop a cheap, renewable and biodegradable sound proofing material with the help of maize (natural fibre) fibre/felt which is a non-abrasive, porous, good insulator, hygroscopic and combustible material for automobile, home appliances and architecture applications. Methodology of this project is that collection of rice straw, maize waste and gypsum from near by village. Rice straw is making into a small pieces of size 3 cm and maize waste is turned into a powder, these two ingredients are mixed in proportion and with the help of natural adhesive making into an acoustic board of size 150*150*10 mm finally tested were conducted on the boards. Results obtained for tests are 1) At 3200c acoustic board is turned into ash 2) compression of acoustic board is 2mm 3) water absorption test is about 40% and finally 4) sound absorption capacity is 37 decibels. As an alternative in our research project we are concerned with maximum utilization of agro-waste Material Such as maize to develop Noise absorbing Composite with Rice straw as reinforcing material and study of acoustical and flammability properties of Composites

KEYWORDS: Sound Reduction, Technology, Agro waste, Natural Fibre

I.INTRODUCTION

Now a day's, commercially available sound absorption materials for acoustic treatment used in the building construction industry consists of glass or mineral fibre materials. However, they are growing concern health and safety issues due to the potential health risks associated to these fibers when exposed to the human such as the effect from the fibre shedding from glass or mineral fibre to human lungs and eyes. These issues provide an opportunity for an alternative material from organic materials. In Malaysia, agricultural waste such as maize waste and rice straw are abundance and usually burnt or used as agricultural by products. Recently, natural fibres from agricultural are increasingly investigated for various usages in many structural and non structural applications such as substitute for synthetic fibres in composite materials and lining for automotive components. However, natural fibres such as rice fibre are as suitable as a substitute for synthetic fibre.

Most of the developed countries use practical techniques to minimize the nuisance such as barrier walls, duct silencers, acoustical wall panel, sound proof curtains, sound enclosures for industrial machinery and other similar noise control treatments that are installed near the source to effectively reduce the sound level. Building construction is a major contributor to environmental degradation and energy consumption, and reducing the impact of buildings on the environment has become a critical global challenge. The use of sustainable materials in construction can help to address this challenge. Agro waste products are abundant and widely available, but are often underutilized and contribute to environmental pollution. In recent years, there has been growing interest in using agro waste products as fillers in composite materials for building applications. One promising application of such composite materials is for noise control. Noise pollution is a major problem in urban and industrial environments, and can have negative impacts on

health and well-being. Developing sustainable, effective, and affordable noise absorbing materials is therefore a critical need. However, India has not yet yielded much into this issue as noise reduction methods are costly. Therefore, it is necessary to find out cost effective solution to control industrial noise. The average person cannot sleep, at 120 decibels the ear registers pain, but hearing damage begins at a much lower level, about 85 decibels. The duration of the exposure is also important. There is evidence that among young Americans hearing sensitivity is decreasing year by year because of exposure to noise, including excessively amplified music. These are cheaper, renewable and abundance, non-abrasive and does not give rise to health issues during processing and handling.

Materials and methods

Study area

This study was conducted in the rural area of Andhra Pradesh state this study was held in Beedupalli village, Puttaparthi mandal, Anantapur district. People who are living there they are mentally disturbed due to noise of air craft landing and takeoff time to make them free from that disturbance we are going to create acoustic board with locally available material. Sample collection method Sample waste collected manually by visiting the site in beedupalli the selected sample was transported to the laboratory to examine the properties of materials. Materials used

1. Rice straw
2. Maize waste
3. Adhesive
4. Gypsum

II. LITERATURE SURVEY

1. Noise Absorbing Composite Materials Using Agro Waste Products

Mr. Nagendra K.S., Ms. Tejaswini M.

Composite panels -Noise has determined effects on human lives and it is Nuisance to Environment in the current market which is hazardous. Conventionally, expensive sound absorption materials are employed to control noise disturbances. The use of synthetic materials as acoustic absorbers is still applied extensively in building industry. These non biodegradable materials do not only cause pollution to environment, but also contributes significantly in increasing Carbon-di-oxide causing effect of global warming and are also quite expensive for small need. Main objective is to find a sustainable and an eco-friendly materials to be an alternative sound absorber. Natural materials such have been receiving considerable attention as substitute for Synthetic materials. Hence, it is possible to utilize Agro waste Material as a potential candidate for sound Absorption Panel.

2. Composite Eco-Friendly Sound Absorbing Materials Made of Recycled Textile Waste and Biopolymers

Chiara Rubino, Marilés Bonet : Composite sheet, made of 100% wool waste fibers. Experimental results demonstrated that the samples had thermal conductivity ranging between 0.049 and 0.060 W/(m K), well comparable to conventional building materials. Similarly, acoustic results were very promising, showing absorption coefficients that, for the given thickness, were generally higher than 0.5 from 500 Hz on, and higher than 0.9 from 1 kHz on. Finally, the effects of the non-acoustic properties and of the air gap behind the samples on the acoustic behavior were also analyzed, proving that the agreement with absorption values predicted by empirical models was also very good.

3. Sustainable absorption panels from agricultural wastes

It can be concluded that the acoustic panel made from a mixture of 25% coconut coir powder with 75% shredded waste paper provided higher absorption coefficient compared to the performance of the other samples. This might be caused by the size of the coir powder which is very small, creating less void space in between the panel and thus causing it to absorb less sound. Since sound absorption is very much affected by the availability of void space of the panel, further studies on other potential materials from waste should be conducted.

4. Noise absorbing materials using waste products

the usage of the rice husk and bamboo as noise absorbing materials propylene cloth as they are available abundantly in the environment and cheaper than other traditional methods. The use of renewable materials from a sustainable source is increasing in variety of applications raising. So, use of Panels which is combination of natural cellulose fiber with other resources such as bio-polymers, resins or binders based on renewable raw materials. It is proposed to develop a comprehensive Acoustic Panel for absorption of noise level. It is also envisaged to design the fixture with in building

interior space. This cost effective method will potentially open the door for a wide variety of Agro waste in development of Acoustic Panels.

5. The major findings from literature review are as follows:

The experimental analysis of the thermal properties showed that all the samples have thermal conductivity ranging between 0.049 and 0.060 W/(m K), independent of the binder used. Porosity variation also affected the air flow resistivity of samples, influencing their acoustic performance.



III. ACTUAL METHODOLOGY AND DISCUSSION

Rice Straw Rice straw is a by-product produced when the harvested paddy is separated from the grains after plants are threshed. They are threshed either manually, using stationary threshers or combine harvesters. Each kg of milled 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 world is equal as 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.

1. Rice Straw

The biochemical composition of rice straw and wheat straw is characterized by a typical composition of an agricultural-based lignocelluloses residue: it contains on average 30 – 45% cellulose, 20 – 25% hemicelluloses, 15 – 20 % lignin, as well as a number of minor organic compounds. Rice straw is poor in nitrogen, but relatively high in inorganic compounds, often referred to as ash.



1.1. Properties of Rice Straw

- Water or moisture does not pass through the surface of straw due to presence of wax nature on its outer surface.
- Due to presence of hollow space it exhibit light weight property.
- It has good thermal resistance nature

2. Maize waste

The maize stem was composed of 24% soluble, 26% hemicelluloses, 43% cellulose and 7% lignin components. The bundles occurring towards periphery are smaller in size and more crowded, whereas those at the central region are larger in size and more spaced. All the bundles are common to the stem and leaves, the central ones from the median veins of the leaf blade and small peripheral ones form the marginal bundles. Un-like most of the grasses maize stem is not hollow in the intermodal region.

3. Gypsum

Gypsum is one of the widely used construction material mainly in interior designing. Properties and products of gypsum to be used as building material in construction works are discussed. Gypsum is used as surface materials. Its application is prominent in wall and ceiling construction. The use of gypsum can also be done at the field in the form of plaster. It is also manufactured as a prefabricated unit, like gypsum board which is bought at the time of installation. Gypsum is a white to gray mineral found in the earth's crust. It is chemically known as hydrous calcium sulphate ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) which is obtained through mining from vast veins. It gains different forms. It is seen as sand in certain areas.

Methodology:

Steps involved in the preparation of acoustic boards

1. Collecting of dried maize plant from the beedupalli and rice straw is also collected along with maize plants.
2. Dried maize plant skin is removed then white colour stem is present inside that material is used in this project.
3. Taking that white colour stem making into small pieces which is comfortable for making powder.
4. Rice straw is cutting into small pieces with 3 cm length wise.
5. Taking the maize waste powder and rice straw in the ratio of 2:1.
6. Natural adhesive is prepared with flavour powder, sugar and vinegar these there are mixed in hot water and stirred it well.
7. It will look as a gum which is white in colour.
8. Then the maize waste powder, rice straw and natural adhesive is mix well.
9. Take a mould of dimensions 150mm*150mm*10mm apply any oil or grease to it because to remove the sticky nature.
10. Place the mix into the mould compact it well evenly.
11. Let it dry in sunlight about 24 hours.
12. After 24 hours apply 200gms of gypsum powder to the board and again dry it in sunlight about 2-3 hours.
13. Repeating this procedure for different ratios like 3:1, 4:2 etc.....





IV. RESULT

Experimental tests conducted for the acoustic boards:

1. Fire resistance test
2. Moisture absorption test
3. Compression test
4. Sound absorption test

Test on the Acoustic Boards

Compression
Test

Moisture
Absorption Test

Fire Resistance
Test

Noise
Absorption Test

Water absorption test result

Initial weight of the acoustic board (w_1) = 39 grams

Final weight of the acoustic board (w_2) = 65 grams

The amount of water absorbed by the acoustic board = $(w_2 - w_1) / w_2 * 100$

Water absorption = $(65 - 39) / 65 = 0.402$

Water absorption in percentage = 40.2% The amount of water absorption by the acoustic board is 40.2%.

Compression test results: Initial thickness of the acoustic board (h_1) = 10mm

Final thickness of the acoustic board (h_2) = 8mm

Compaction height = $h_1 - h_2 = 10\text{mm} - 8\text{mm} = 2\text{mm}$

The compression or compaction height of the acoustic board is 2mm.

Sound absorption test result

This method is done with the help of mobile application so result is shown automatically. The result shown is 37 decibels.



Figure showing sound absorption frequency in mobile application Interpreting the results: from above study and experiments we got a final result as 67 decibels according to iso average sound level in residential area should be 40 decibels by comparing our acoustic board results with this our results are within the limit and it is suitable for residential areas and materials unused in this are bio degradable and these boards are very light weight and when we come to cost compression it is very cheap and it is available in half of the cost of market products.

V. CONCLUSION

By using acoustic board we can reduce the sound which is producing unnecessarily. But our them is to reduce sound with along economy .by using agro waste as a acoustic material we experimental we concluded that this agro material is good sound reducer and produced in less economy .this project is a solution of one of social activities that is sound pollution . People belongs to poor background they can't adopted high cost acoustic boards .we can put a check to this problem by agro acoustic boards because they are less cost to adopt.

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