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A critical review on noise absorbing construction material from waste(s)

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ABSTRACT

This study reveals the concept and applications of noise absorbing panels which is made from different materials both natural and artificial. As a part of the green construction and to reduce waste from the coir industry which is located in and around Coimbatore in large numbers. A noise absorbing panel is designed and made from the coir with the addition of polypropylene. The prepared sample is tested and the result is compared with other artificial made panels.

Keywords— *Coir, Noise absorbing panel, Polypropylene, Impedance tube method*

1. INTRODUCTION

Noise is generally referred to as unwanted or unpleasant sound. Noise absorption is one of the major requirements in daily life. Glass wool, foam, mineral fibres are some the artificial sound absorbing materials which are widely used. The usage and manufacture of these material results in increasing the carbon footprint. As an approach of green construction instead of using artificial fibres, we can utilise the natural fibre as an alternative. My research is to develop and design a cheap, renewable sound absorbing panel from the coir with the addition of polypropylene as a binding material. It would cheap, renewable, biodegradable, and recyclable material. The properties of coir are porous, lightweight, insulator, hygroscopic and non-abrasive in nature. These panels can be used as construction material in the future.

2. REVIEW OF LITERATURE

"Comparing sound absorption characteristic of acoustic boards made of Aspen particles and different percentage of Wheat and Barley straws".
Mohammad Ali Saadatnia, Ghanbar Ebrahimi, Mehdi Tajvidi.
This paper makes the study of noise absorbing panel made with two different materials like wheat and barley straws combined with aspen particles. The sample is made with the difference in their proportions and then tested for results. The resulting form this paper helps us to set a boundary limit for our material. It also helps in the preparation and testing of samples.

"Effect of pre-treatment on properties of coir-based green composite".
Chanakan Asasutjarit, Sarocha Charoenvai, Jongjit Hirunlabh, Joseph Khedari.
The major study in this paper is of pre-treatment of coir before using it for any other purposes. The physical, chemical and mechanical properties of the coir are analysed. It is proved that the pretreatment process had made better adhesion results. It is examined with the help of Scanning Electron Microscopy (SEM).

"Mechanical Testing on Glass Fibre Reinforced With Jute Fibre Composites"
S. P. Shree Vignesh, C. Sridharan, A. Tamilselvan, V. Saravanan, S. Rajaganapathy.
This study helps to understand the composite material made with jute fibre and glass fibre. The sample is made and tested for results with destructive and non-destructive tests. This composite material can be used for various applications and also as a construction material.

"Mechanical and Thermal Properties of PLA Biocomposites Reinforced by Coir Fibers".
Zhihui Sun, Li Zhang, Duoping Liang, Wei Xiao, and Jing Lin.
This study deals with the biocomposites made with PLA polylactic acid additionally reinforced with coir fibres. All the mechanical and thermal properties were tested and the result is analyzed. The sample is prepared with different proportions of coir and tested. The results show that the tensile strength is increased and the capacity of insulation is also found better.

"Polypropylene Matrix Composites Reinforced with Coconut Fibers"
Maria Virginia Gelfusoa, Pedro Vieira Gurgel da Silvab, Daniel Thomazinia.
This paper is about polypropylene matrix compound reinforced with coconut fibre. The sample is made into two categories chemically treated and mechanically treated with various proportions and tested as per ASTM. The material is also electrically tested and the result shows that mechanically treated composite give better performance.

"Coir Fibre Reinforcement and Application in Polymer Composites: A Review"
D. Verma, P.C. Gope, A. Shandilya, A. Gupta, M.K. Maheshwari.
This review paper is based on the coir fibre reinforced polymer composites and their properties. The mechanical properties of coir fibre are found to be matching with glass fibres. Application of coir fibre has been developed widely at present.

"Application of Sisal, Bamboo, Coir and Jute Natural Composites in Structural Upgradation"
Tara Sen, H. N. Jagannatha Reddy.
The natural fibres like sisal, bamboo, coir, and jute are studied in this paper. The mechanical, physical and chemical properties of all these fibres are studied comparatively. The application of these materials in a structural is examined. The advantages of each fibre are studied individually and compared with each other.

"Development of materials for construction with low environmental Impact made with low content of cement and with natural fibers"
Riana Herlina Lumingkewas
This purpose of this study is to identify new materials for the construction industry. The objective of this research is to develop coir fibre reinforced building material. The pretreated coir fibre increases the compressive and tensile strength of the concrete.

"Evaluation of Tensile and Flexural Properties of Coconut Coir and Coconut Shell Powder Reinforced Epoxy Composites"
Shivaraj C Kavalastrahiremath, Dr. B. Siddeswarappa, Mallikarjun Channalli.
This study had made analysis between treated and untreated coir fibre. The treatment is done by HCL. After testing the results shows that the treated coir has good flexural and tensile strength than the untreated coir fibre.

"Processing, Characterization, and Erosion Wear Behaviour of Coir Fiber Reinforced Epoxy Composites"
Geetanjali Das.
This paper deals with the coir fibre reinforced epoxy composites as an alternative for glass. This research studies all the physical, mechanical, and water absorption and erosion wear behaviour of coir with Al_2O_3 filler. The sample is made with and without fillers of different dimensions and tested. The results show the composites with fillers gives a good performance.

"Rice straw–wood particle composite for sound absorbing wooden construction materials"
Han-Seung Yang, Dae-Jun Kim, Hyun-Joong Kim
This paper is about wood particles board added with rice straw. The urea formaldehyde is used as binding material. The samples are made with variation in the specific gravity and tested. The sound absorbing coefficients of the samples are tabulated. The result shows that the composite particle with a specific gravity of 0.4 to 0.6 is suggested for the manufacturing process.

"Stabilized Lateritic Blocks Reinforced With Fibrous Coir Wastes"
M. G. Sreekumar, Deepa G Nair
This paper focuses on stabilized lateritic blocks reinforced with coir fibres. The sample is prepared with different proportions of coir content and tested. The results show good improvement in the strength and durability of fibre reinforced blocks with fibre content of 0.5%. It can successfully use for load bearing structures.

"Experimental analysis of coir fiber reinforced composite materials"
Pne Naveen
The research focuses on the analysis of coir fibre reinforced composite material with epoxy resin. The main objective is to replace the artificial fibre with natural fibre in construction material. The prepared samples of different proportions and length of fibre are tested mechanically. The test results show the increase in properties and can be used for structural and non-structural construction application.

"Experimental Study on Coir Fibre Mixed Concrete"
Achudhan
This study is made to analyse that coir fibre reinforced concrete gives better performance than conventional concrete. The samples are made of different proportions in M20 concrete and tested. The result shows that the addition of 3% of fibre increases the strength.

"Effect of Fiber Length Variations on Mechanical And Physical Properties Of Coir Fiber Reinforced Cement-Albumen Composite (CFRCC)".
A. Zuraida, S.Norshahida, I. Sopyan, and H. Zahurin
This paper shows the effect of length variation in fibre while making a composite. The cement albumen composite is prepared of difference in their length. The samples were tested for flexural, compressive strength, moisture content, bulk density, and water content. The results show that the increase in the length of fibre increases the strength but decreases the workability. It also increases the moisture content and water absorption property.

"Chemical Modification Effect on the Mechanical Properties of Coir Fiber"
Samia S. Mir, Syed M. N. Hasan, Md. J. Hossain, and Mahbub Hasan
This paper shows the chemical modifications in the coir fibre. This research is done to increase the adhesion between the coir fibre and the polymer. It will increase the strength of the composite material. The coir is treated in two different stages for better performance. The samples of two staged treated coir are tested. The second staged treated fibre gives good mechanical performance than raw coir fibre.

"Attenuation of Noise by Using Absorption Materials and Barriers"
Lamyaa Abd AL-Rahman, Raja Ishak Raja and Roslan Abdul Rahman
This paper reviews on synthetic materials used for absorption purposes. It also gives a summarization of considering organic materials as an alternative. This review helps us with the research carried out further in green materials.

"Recent Developments in Coir Pith Based Particle Boards: A Review"
Narendar, R and Priya Dasan. K
This paper describes various work and function of coir pith. The availability of this material is good and a research is carried out for making it a useful material. The experimental analysis shows good mechanical strength in coir pith.

"Performance Testing for Sound Absorption Coefficient by Using Impedance Tube"
J. Niresh, S. Neelakrishnan, S. Subharani, and R. Prabhakaran
The sound absorption characteristics of the single and multi-layered porous materials are studied with the help of the impedance tube. In Impedance tube standing wave and transfer function methods are used more for its accuracy and reliability. The standing wave method is simple and the transfer function method is accurate. The materials are tested for its sound absorption co-efficient. The standing wave method is used in this study. The results are compared with the existing tube. The two different samples are compared with the existing tube.

"Method of Testing of Sound Absorption Properties of Materials Intended for Ultrasonic Noise Protection"
Dariusz PLEBAN
It is proposed to carry out measurements of the sound absorption properties of materials in the free field by means of a tone-burst technique in the frequency range from 4 kHz to 40 kHz at angles of incidence varying from 0 to 60^0. The absorption coefficient of a material is calculated from the reflection coefficient obtained by reflecting a tone-burst from both a perfectly reflecting panel and a combination of this panel and the sample of the tested material. The tests results show that mineral wool and polyurethane open-cell foam possess very good absorbing properties in this frequency range

3. CONCLUSION

From the above paper studied about the coir and their properties shows that synthetic fibres can be replaced with natural fibres. The noise absorption panel made by coir will definitely give good results. The main objective of the study is to understand the properties of coir and the sound absorbing panel made by the natural materials. This paper helps to develop a sustainable and eco-friendly noise absorbing panel from coir.

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