SA RESEARCH PAPER ON TO DEVELOP LOW COST PANELS USING AGRICULTURAL WASTE

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1.

Abstract— Panels help in constructing affordable and low cost construction. it's eco-friendly material and is advantageous over conventional building materials and avoids heavy weight building like with concrete. This paper shows the production of gypsum panels with using of agricultural waste such as rice straw, rice husk with glass fiber is very affordable and can easily be casted at sites.

Keywords— agricultural waste , low cost panels, affordable housing, gypsum, water absorption.

1. INTRODUCTION

Agricultural waste are often defined because the residues from the growing and first processing of raw agricultural products like fruits, vegetables, poultry, dairy products, and crops. an outsized demand has been placed on artifact industry especially within the last decade thanks to the increasing population that causes a chronic shortage of building materials. so on satisfy ever increasing housing demand, there's an exponential need of production of construction materials like bricks, cement, aggregates, steel, aluminum, wood, cladding and partitioning materials . The assembly of conventional building materials like cement, bricks and steel consume plenty of thermal and electricity and successively pollute air, water and land. the use of appropriate building materials has not received adequate attention. Disposal of solid waste generated from agricultural and industrial production activity is another significant issue in developing countries like India. the most quantities of wastes generated from agricultural sources are sugarcane bagasse, rice husk, jute fiber, coconut husk, cotton stalk, etc. Reuse of such wastes as a sustainable construction material appears to be viable solution not only to pollution problem but also to the matter of the land-filling and high cost of building materials. This paper shows the production of gypsum panels with using of agricultural waste such as rice straw, rice husk with glass fiber is very affordable and can easily be casted at site

2. LITERATURE REVIEW

Narayanamurti states that Hardboards and insulation boards with satisfactory properties are often produced from indigenous Indian staple , namely , areca - nut husk , bagasse , bamboo , tapioca stems , and therefore the wood and bark of varied conifers and hardwoods

Thole states the semidry process for the manufacture of gypsum - bonded particleboards was suggested by Kossatz . This process offers the likelihood of using annual plants (like bagasse , bamboo , cotton stalks , rice straw , and wheat straw) as additives . the utilization of those annual plants was investigated Besides phase analytical investigations regard ing the characterization of the binders , the efficacy of varied retardants , also because the influence of various plants on the hydration , were determined .Test boards of varying formulas and densities were manufactured from annual plants so as to guage their suitability . The considerably retarded hydration of the gypsum plaster induced by different extracellular substances doesn't necessarily cause boards with low strength properties ; nor does moderate impairment cause boards with high strength properties . As far as board strength cares , equal importance has got to be attached to the surface condition of the particles , their spraying behavior and pore structure , the fineness ratio of the particles , and therefore the portion of plant parts that can't be reduced to particle shaped structures

Mattone states that the behavior of thin panels of gypsum reinforced with either coconut or sisal fibers was investigated . Test pieces were produced through a vacuum process to scale back the water : gypsum ratio , increase the compaction , and improve the bond between fibers and therefore the matrix so on obtain a high - performance composite . Bending tests were performed on test pieces measuring 30 cm by 40 cm , and impact tests were performed on panels sized 80 cm by 80 cm . The behavior of the reinforced panels was compared thereupon of panels traditionally utilized within the building materials industry.

Hussin reports on the present research and developments on the utilization of coconut fibers as reinforcement for skinny cement sheets as roofing materials . Tests on 500 - by 500 - by 10 - mm flexural plates and on 1 , 220 - by 630 - by 10 - mm corrugated sheets are reported . The load deflection curves and cracking performance also are reported supported several curing regimes . Additional test results provided are water absorption , water tightness , and bulk density . Performance characteristics of the skinny sheets are shown to be a function of fiber concentration and method of specimen fabrication.

Shukla states that Binder - free standard hardboards were obtained by pressing a bagasse composition obtained by cooking bagasse for 1 . 5 h with 1 percent alkali (bath ratio 1 : 6) then tempering the boards for 4 h in air or 3 h in oil . Tempered boards were obtained from a composition cooked for 1 . 5 h with 2 percent alkali then tempered in oil for 3 to 4 h .

3. OBJECTIVE

The main objectives that refer and what I understood to the intent of my study of this topic are as follows:

To provide eco friendly and cost effective panels to the construction industry
To make more economical production at sites as compared to existing panels
To provide affordable and easy construction for rural

4. MATERIALS

Rice straw

Rice straw may be a rice by-product produced when harvesting paddy. Each kg of milled rice produced leads to roughly 0.7–1.4 kg of rice straw counting on varieties, cutting-height of the stubbles, and moisture content during harvest. Rice straw is separated from the grains after the plants are threshed either manually, using stationary threshers or, more recently, by using combine harvesters.
Rice straw, as a lignocellulosic biomass, is comprised of three components: lignin, cellulose, and hemicelluloses. These might be fractionated through pretreatment Cellulose and hemicelluloses are fiber organics, whereas lignin is that the cell membrane (Klass 1998).

Rice husk

The rice husk, also called rice hull, is that the coating on a seed or grain of rice. it's formed from hard materials, including silica and lignin, to guard the seed during the season . Each kg of milled polished rice leads to roughly 0.28 kg of rice husk as a by-product of rice production during milling.The moisture content ranged from 8•68 to 10•44%, and therefore the bulk density ranged from 86 to 114 kg./ m3. The results showed excessive volatile release of over 60%, high ash content starting from 15•30 to 24•60% (dry weight basis), and high silica content of the ash starting from 90 to 97%. The lower heating values ranged from 13•24 to 16•20 MJ / kg (dry weight basis). The ash fusion temperatures of all the varieties were found to be over 1600°C.


Glass fiber

Glass fiber (or glass fibre) may be a material consisting of various extremely fine fibers of glass. Glassmakers throughout history have experimented with glass fibers, but mass manufacture of optical fiber was only made possible with the invention of finer machine tooling. In 1893, Edward Drummond Libbey exhibited a dress at the World's Columbian Exposition incorporating glass fibers with the diameter and texture of silk fibers. Glass fibers also can occur naturally, as Pele's hair.Glass wool, which is one product called "fiberglass" today, was invented in 1932–1933 by Games Slayter of Owens-Illinois, as a cloth to be used as thermal building insulation. it's marketed under the brand name Fiberglas, which has become a generalized trademark. optical fiber when used as a thermal insulant , is specially manufactured with a bonding agent to trap many small air cells, leading to the characteristically air-filled low-density "glass wool" family of products.

Gypsum

The most common uses of gypsum powder are in building materials. Gypsum has been used for hundreds of years to decorative elements for buildings. Pure white rock gypsum is additionally referred to as alabaster and has been wont to make carved statues and sculptures. the traditional Greeks used translucent gypsum crystals to form windows. Gypsum powder mixed with water makes plaster of Paris, a molding material wont to make ornate fixtures to adorn buildings also as a coating for walls. Ancient builders also

used gypsum to reinforce pigments wont to paint structures. Nearly all modern homes and buildings use gypsum within the sort of wall board, also referred to as plasterboard , drywall or sheet rock. Americans homes typically contain plenty of gypsum within the sort of drywall. it's attached to wooden framing to form walls and ceilings. Gypsum powder mixed with water becomes hardened and rock-like when dried. The hardened gypsum is pressed between sheets of paper to makeslabs of drywall. Drywall makes a cheap artifact

5. QUANTITY OF MIX

Sample 1- Gypsum + Rice straw

name	quantity
gypsum	5kg
rice straw of 15-20cm	220gm

Sample 2- gypsum + rice husk

name	quantity
gypsum	4kg
rice husk	350gm

Sample 3- gypsum + rice husk +glass fiber

name	quantity
gypsum	4kg

rice husk	200gm
glass fiber	50gm

6. METHODS OF INVESTIGATION

Water absorption

Test Specimens - From each board selected from the sample, a specimen measuring 175 X 75 mm shall be cut• at least 150 mm from the edge of the board. The specimen shall be weighed to within 1 g and then stored at a temperature of 27 ± 2cC in an atmosphere having a relative humidity of 65 ± 2 percent. The specimen shall be weighed once a day until the mass has become constant to within 0'1 percent.

Measurement of dimension

Measurements of length and width shall be carried out on each of the full-size boards of the sample. The measurements for length and width shall be made separately by calipers, rule or other suitable means at three points on each board.

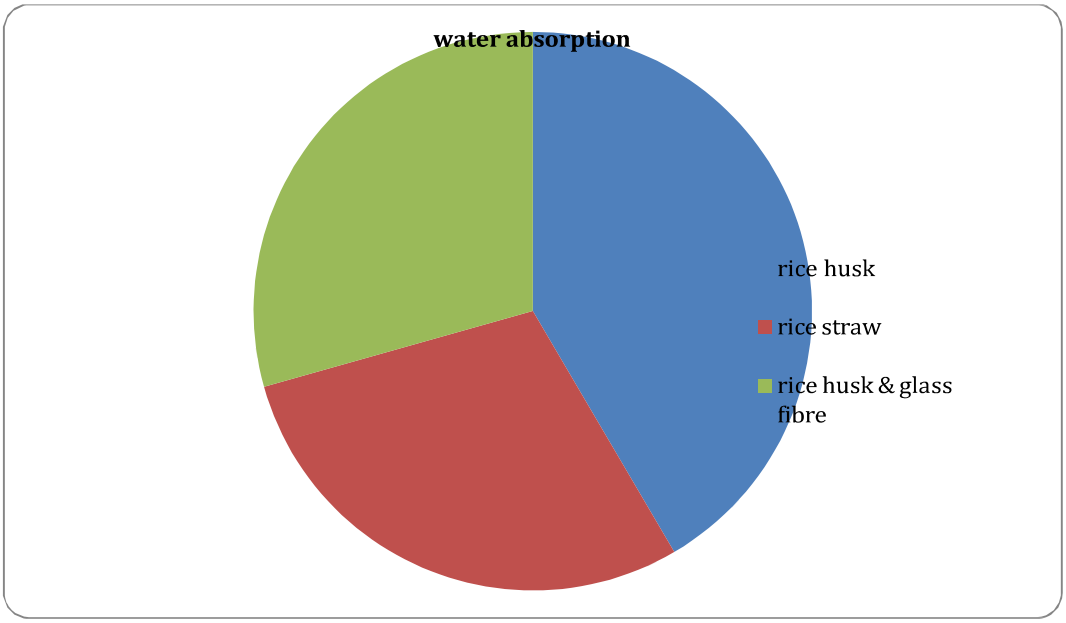
7. RESULT AND DISCUSSION

Water absorption (gypsum as binder with different fibers)

Sample type	**Rice husk**	**Rice straw**	**Rice husk +glass fiber**
Water absorption	14%	9.8%	9.9%

Measurement of dimension

Sample type	**Rice husk**	**Rice straw**	**Ricehusk + glass fiber**
Length and width(mm)	600 600	600 600	600 600
Thickness(mm)	12.5	18mm	12.5



Water absorption of different type of samples

8. COST ANALYSIS

Cost estimation of project:-

- Gypsum powder –Rs.5/kg
- Glass fibre- Rs.220/kg
- Rice husk hardly- Rs.1-2/kg
- Rice straw- no cost

A 2x2 size board/panel will cost around- Rs.35-40/ panel

- Cost per will be around –Rs.10/ sqr ft.
- Market gypsum board – Rs 15-18 / sqr ft.

9. CONCLUSION

The hand made gypsum boards is more cost effective than market available gypsum boards .These boards can easily cast at sites without special equipments. Gypsum and other components are easily available in rural

areas. These boards are very cost effective due to the use of rice husk , rice straw , glass fiber mixed with gypsum as a binder. By using these agricultural waste as a fiber the water absorption of these different fiber boards are under 10%.

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