Determination of Mechanical Properties of Design Plywood Sheet from Vidharbian Agricultural Waste

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Abstract: Agricultural waste have becomes an increasing concern in recent years. As they may cause significant environmental problems. However they may use for several beneficial purposes. Agricultural wastes very much in morphological structure, anatomical structure, as well as chemical composition. In the following, the most common and most important agricultural residues are discussed.

Keywords: waste, sheet, residue, agriculture, problem etc.

INTRODUCTION

Agricultural waste have becomes an increasing concern in recent years. As they may cause significant environmental problems. However they may used for several beneficial purpose. Food and agricultural industry are among the oldest of human practice. As a source of waste it does not matter any exception from other industrial activities. In the near future the management of food and agricultural waste will play an important role in the conservation of the natural resources in India including Maharashtra region. The idea of using agricultural waste as a renewable source becomes an optimistic option to minimize this waste.

Growing concern for waste minimization led the construction industry to consider the use of agricultural waste in the production of building materials. The Philippines, being an agricultural country produces considerable amount of agricultural waste. As of 1999, generation of 40 million metric tons of agricultural wastes was documented by the Department of Energy. This includes wastes from sugarcane, coconut, corn, rice and logs. If such waste is not be utilized, it will cover a large area of landfill. Thus, the idea of using agricultural wastes as a renewable resource became an optimistic option to minimize this waste. Different types of agricultural waste are viable for a wide variety of products including paper, textiles, other fibre based materials and wood-based panels such as fibre boards and particleboards. Low-density insulating board, medium-density Fibre board, hardboard, and particleboard. More so, composite panel binders may be synthetic thermosetting resins or modified naturally occurring resins like tannin or lignin, starches, thermoplastics, and inorganic (Rowell 1996). Strength properties as well as other characteristics suited for their intended uses or application for various construction materials are prescribed by the Philippine National Standard (PNS). These are approved by the Bureau of Product Standards.

In 1954, the first author of this overview founded the Cellulose and Paper Department, National Research Center, Cairo, Egypt. Since then, extensive research work was conducted -for the first time- on agricultural residues (wastes) in this department. The mentioned work encompassed the use of agricultural residues (wastes) for manufacture of paper, board, and miscellaneous products. Several research works of the first author were transferred into successful industrial factories e.g. Rakta Paper Factory in Alexandria in Egypt, Edfo Paper Factory which is affiliated to the Egyptian Sugar Company, Frisker Board Factory in Egypt etc.

Types, Properties, and Characteristics of Agricultural Residues (Wastes)

Agricultural wastes very much in morphological structure, anatomical structure, as well as chemical composition. In the following, the most common and most important agricultural residues are discussed.

Cotton linters

After ginning i.e. removing the cotton staple fibers from the cotton seeds, some short fibers remain on the seed. These fibers are called cotton linters. They cause troubles while pressing the seeds for oil extraction. They absorb some oil and anyhow should be removed from the oil. Therefore, it is preferable to remove cotton linters from the seeds before sending them to oil refineries. This is done by delinting machines. Phenomenon, the fibers must be flexible and must be capable of swelling in water. One has to remember that paper is produced from a water suspension of fibers, called slurry. Not all fibers swell in water to the same extent. The swell ability depends upon the structure of the fiber wall i.e. cell wall of the fiber.

Cotton linters

Compared to woods and non woods - are loose fibers. Therefore, they can be easily transformed into pulp. Cotton linters represent a small morphological part of the cotton plant i.e. merely the seed hairs. If you take the rest of the plant i.e. the cotton stalks, you have then a whole plant consisting of stem s, branches, leaves and cotton bolls. Egyptian cotton species are characterized by low content of cotton linters. Cotton linters represent a costly agricultural waste.

Cotton stalks

Cotton stalks represent an important agricultural waste in Egypt. Here, the fibers i.e. the cells are held strongly together within the stem of the plant and are not lose as cotton linters.

Morphological structure

Cotton stalks are branched and carry leaves and unopened cotton bolls. They still retain the roots. The stalks consist of the bark and woody core. The bark constitutes about 25 % and the woody core about 75 % by weight of the whole stalk.

Anatomical structure

The average length of bast fibers in the bark amounts to 2.0 mm. The average length of woody fibers is about one half that of bark fibers (range 0.4 mm – 2.4 mm)

Chemical composition

The chemical analysis of cotton stalks varies from season to season and depends on species. The woody core contains about 42 % of alpha cellulose, 21% of lignin, 21 % of pentosans and 2 % of ash. The bark contains less lignin but more ash.

Wheat straw

Morphological structure

The whole straw, as purchased, is constituted of stems and leaves. The stem is made up of internodes and nodes, and carries rachis. The leaf is made of leaf sheath and leaf blade. Compared to wood, which is the most popular raw material for pulp production, straw is more heterogeneous. Wood arrives to the factory in form of logs. After debarking one gets a homogeneous material namely trunk or stem. In the case of straw one gets stems, leaves, rachis, dirt and dust adherent to straw. This is due to straw morphological nature, and mode of collection and baling.

OBJECTIVES

In agricultural waste management strategy. Factors influence the waste management are

- Waste Generated may be collection & separation
- Waste transportation
- Waste treatments
- Waste disposal
- Waste recycling.

- To collect samples of different agricultural waste material, like Wooden Dust, Soybean Waste, Cotton waste, Baggas, Tuwar waste etc.

- To mix collected agricultural waste materials in different proportions with the help of some binding material.

METHODOLOGY

In making of composite board wood waste, Tuwar waste, cotton waste, are Soybean waste, jute and sugarcane bagasse were used at different proportion of weight. The particles are prepared by cutting each of the section into 1cm or 15mm in lengths. Commercial Sirius-B and Fevicol is used as the composite binder added with 25grams by weight percentage. Wood particles and agro waste particles were mixed on final combination. They are placed in hot air dryer to remove moisture content present in raw materials for 60 minutes. During this project cost is main parameter was considered.

Equipments used

1) Coarse and fine grinder
2) Press machine
3) Digital weight machine
4) Moisture measurement machine
5) Compression test machine (UTM)

Material Used

Different agricultural waste materials taken at different proportions are given below.

1) Wooden Dust
2) Soybean Waste
3) Cotton waste
4) Bagas
5) Tuwar waste
6) Wheat straw

Agro waste from different farmers was collected from different village as follows.

1) Soybean Husk 30 kg.(soybean cutter)
2) Cotton waste 20 kg (Parathion)
3) Baggas of sugarcane 50 Kg
4) Tuwar waste 35 kg.
5) Saw Dust
6) Wheat Straw

Recommended agricultural waste was collected from different farms. All material is dried in to sunlight to make it dry and removed the moisture contents. All material is grinded in to small particle. Siras and chinchoka powder are used as binder. Packed into polythene bags separately to avoid addition of moisture content into the sample. A galvanized tray of size 300mm×250×25mm are manufactured from fabricator in Wardha. Different sample were prepared by mixing in different percentage of weight in grams.

Figure 3.1 Tuwar Waste

Figure 3.2 Cotton Waste

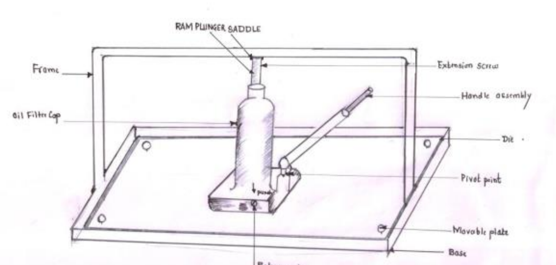
Figure 3.4 Sugarcane Baggas

DESIGN OF HYDRAULIC PRESS

Working Principle

A hydraulic press is a machine that uses pressurized liquid to create force. These machines are composed of a simple cylinder and piston mechanism. The press consists of a large cylinder, with a large piston, and a small cylinder and a small piston. The large cylinder and the small cylinder are connected to one another by means of a pipe. The two cylinders, and the pipe connecting them, are filled with a liquid. At this point, the function of the hydraulic press depends on Pascal's Principle. Pascal's Principle states that when pressure is added to a liquid at rest, there is an identical increase in pressure at all points.

Applying this principle to the hydraulic press means that any force that is added to the piston in the smaller cylinder will be transferred to the piston in the larger cylinder, in a proportionally increased level of force. This allows a hydraulic press to produce a great deal of force from the application of a small amount of force to the small piston. The increase of the force produced by the larger piston is proportionally larger than the force exerted on the small piston.



3.3 SAMPLE PREPARATION

Collected and grinded given agricultural waste was mixed in following proportions.

SAMPLE NO. 1 & 2

Sr. no	Material	Percentage	Mass in gram
1	Tuwar Waste	15%	100
2	Saw Dust	10%	66.66
3	Soyabean Waste	25%	166.66
4	Cotton Waste	25%	166.66
5	Baggase	25%	166.66
6	Binder	15%	100
		Total	766.58

Table 3.1 Combination of waste for sample 1 & 2

SAMPLE 3 & 4

Sr. no	Material	Percentage	Mass in gram
1	Tuwar Waste	15%	100
2	Saw Dust	5%	33.33
3	Soyabean Waste	10%	66.66
4	Cotton Waste	25%	166.66
5	Baggase	25%	166.66
6	Wheat Straw	30%	200
7	Binders	15%	100
		Total	**600**

Table 3.2 Combination of waste for sample 3 & 4

SAMPLE 5 & 6

Sr. no	Material	Percentage	Mass in gram
1	Tuwar Waste	20%	133.33
2	Saw Dust	10%	66.66
3	Soyabean Waste	20%	133.33
4	Cotton Waste	25%	166.66
5	Baggase	15%	100
6	Wheat Straw	15%	100
7	Binder	15%	100
		Total	766.65

Table 3.3 Combination of waste for sample 5 & 6

3.4 EXPERIMENTAL SET UP

PRESS MACHINE

The press machine was manufactured manually from welding shop. It consists of one tray of GI sheet of size 13”×19” and 1.5” deep. The tray is welded to M.S angle frame as shown in figure. The structure of the frame was such that the hydraulic jack can be placed at the middle of the frame.

Figure 3.3 Wheat S

Figure 3.7 Press Machine

Figure 3.8 Press Plate

Mixing Process

All the measured raw agricultural material at different proportions are taken and mixed together manually with molten Siras and Chinchoka powder for 15 minutes so that all the materials get mixed properly.

Figure 3.9. Manual mixing process

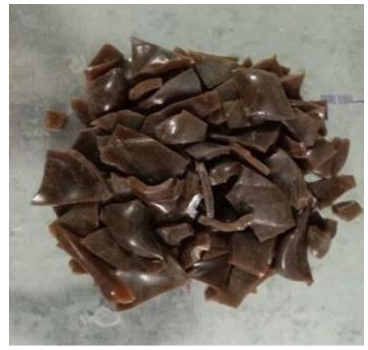


Figure 3.10 Siras

Figure 3.11 Chinchoka Powder

Figure 3.12 Putting formed mixture in to the

RESULT AND DISCUSSION

4.2 Effect of drying time on weight & drying rate for sample 1

Sr. No	W1	t	T	W2	MC	DR
1	420.18	30	0	420.18	3.56513875	0
2	420.18	30	30	405.2	8.66238894	0.004327485
3	405.2	30	60	370.1	13.4558228	0.014590643
4	370.1	30	90	320.3	13.9556666	0.029152047
5	320.3	30	120	275.6	20.065312	0.042222222
6	275.6	30	150	220.3	27.0086246	0.058391813
7	220.3	30	180	160.8	3.23383085	0.075789474
8	160.8	30	210	155.6	9.89717224	0.077309942
9	155.6	30	240	140.2	14.2796006	0.081812865
10	140.2	30	270	120.18	3.81095024	0.087666667
11	120.18	30	300	115.6	0.08650519	0.089005848
12	115.6	30	330	115.5	0	0.089035088
13	115.5	30	360	115.5	1.12554113	0.089035088
14	115.5	30	390	114.2	0.17513135	0.089415205
15	114.2	30	420	114	0	0.089473684
16	114	30	450	114	0	0.089473684
17	114	30	480	114	#DIV/0!	0.089473684

RESULT & DISCUSSION

Sample No.	Sample Content	Moisture content	Drying time	Strength
Sample 1	Tuwar Waste = 15% Saw Dust=10% Soyabean Waste=25% Cotton Waste=25% Baggase=25% Binder	72.86%	0-450 min.	
Sample 2		73.33%	0-420 min	
Sample 3	Tuwar Waste = 15% Saw Dust=5% Soyabean Waste=10% Cotton Waste=25% Baggase=25% Wheat Straw=30% Binder=15%	69.63%	0-390 min.	
Sample 4		68.26%	0-400 min.	
Sample 5	Tuwar Waste = 15% Saw Dust=5% Soyabean Waste=10% Cotton Waste=25% Baggase=25% Wheat Straw=30% Binder=15%	71.92%	0-450	
Sample 6		71.74%	0-420	
Existing Sample		83%	0-720 min.	

Table 4.1 Comparision of experimentally measured value

1) In sample 3& 4 drying rate reduces from 480 min. to 350 min. This indicate that sample 3& 4 takes less time and less heat for drying purpose.

2) Moisture content in 3& 4 is found to be 69.63% on WB.

3) The hardness of sample 3& 4 is better as compared to other sample but it is less than existing plywood.

4) It is observed that sample containing wheat straw increases strength of plywood.

5) Drying rate increases very fast as compared to sample 1, 2,5&6 and drying equation has better stability as compared to existing plywood R2 = 0.784, it is less than sample no. R2=0.854.

6) It is because of migration ratio containing soybean and cotton waste has more stability and drying rate.

7) Saw dust is not suitable for plywood, because it weeks the bonding strength

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