MANUFACTURE OF INSULATION-TYPE BOARDS FROM GOLPATA AND RICE-STALK.

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A. GOLPATA (NIPA FRUTICANS.)

Introduction :

Golpata is a gregarious palm with a large number of 15 to 30 ft. long pinnate leaves arising in tufts from a stout creeping rhizome. The species is available in abundant quantities in the tidal estuaries and canal banks in the Sunderbans and on the coasts of Chittagong.

The leaves are extensively used for thatching purposes. Toddy is obtained from the spathe. The young fruit, as large as a jack-fruit is edible.

The uses that are being made of the plant at present is not commensurate with the plentiful abundance of the species. The study was taken to find a better use of the plant.

Material :

A consignment of leaves (devoid of the leaf-stalk) was obtained from Sunderbans. Attempts were made to fiberize the leaves after cutting to 2"-3" length without any success. The leaves, excepting only the mid-rib have no fibres in them and as such are not suitable for making boards.

A second consignment of only leaf-stalks(devoid of leaves) was brought from the Sunderbans. The pith inside the leaf-stalks are as devoid of fibres as the leaves are. Only the epidermis of the leaf-stalk was found to have fibrous raw material. The stalks were depithed and cut to 2"-3" lengths.

Experimental procedure and results :

Fibre Dimension :

Fibre study of the leaves and the leaf-stalks were made by maceration with a mixture of chromic and nitric acids. The results are given below :

FIBRE DIMENSION.	LEAVES ONLY.	LEAF-STALK ONLY.
Max.fibre length.	0.234 m.m.	1.43 m.m.
Min. fibre length.	0.039 m.m.	0.98 m.m.
Av.fibre length.	0.117 m.m.	1.17 m.m.
Fibre diameter.	0.00146 m.m.	0.0195 m.m.
Cellwall thickness.	0.0003 m.m.	0.0195 m.m.
Lumen diameter.	0.00086 m.m.	0.0112 m.m.

Pulping experiments : -

a) A sample of leaves only was attrition milled for defiberization.

b) A second sample of leaves was milled after soaking in water for an hour.

c) Another sample of leaves was steamed in a rotary digester for 15 minutes at 100 lbs/sq. inch pressure and then attrition-milled.

d) A pulp was made by employing hot soda process. The pulp became messy like bovine viscera and was very slow draining.

Attempts were made to make insulation, semi-rigid insulation and medium density boards with the 4 pulps made. No boards could be made successfully from any of the above stocks.

Boards made by drying the mat in the hot press or in the forced-draft oven were of very inferior quality and did not develope any strength.

The leaf-stalks (without leaf-blades) were chipped in green condition in a chipper machine. The chips produced were divided into three parts and pulped in three different ways (cook Nos.5a, 5b and 5c). In Cook 5a, the green chips (both pith and epiderims) were milled in an attrition mill. Good boards could not be made out of the pulp because of the presence of pith. In cook 5b, chips were treated with cold-soda solution and then fiberized in the attrition mill.Boards produced were very stiff in nature and as such had very poor insulation properties. Some chips were steamed under 100 P.S.I. pressure and pulped in an attrition mill (Cook 5c). A rigid insulation board could be made out of this pulp by hot-pressing the cold mat at 5 P.S.I. pressure, but the strength properties of the boards were not upto the mark. In all the cases only rigid insulation type of boards materialised, even though the goal was to make semi-rigid insulation boards.The fibreless pith acted as fillers in between fibres and consequently the boards became stiff.

Some leaf-stalks were depithed. The pith tried for insulation type of boards were found totally unsuitable for the purpose. In fact, having very little fibre in the pith, it would not yield any type of board.

The epidermis, cut into small pieces and attrition milled, yielded rigid insulation type of boards (Cook No.6b). Hot soda pulps made from the epidermis (Cook No.6c) produced intermediate density boards. Some pulps were made from the epidermis by coldsoda process. Boards were made either by cold pressing and drying in the oven (Cook 6d) or by cold pressing and then hot-pressing at 5 P.S.I. pressure for 15 minutes with a one-minute breather (Cook No.6e). The former yielded rigid insulation board and the latter medium density board.

Cook No.	Thickness.	Sp.Gr.	M.of R.	Remarks.
5a	.25 inch	.28	100 PSI	Rigid insulation type boards.
5b	.25 "	.33	500 "	"
5c	.35 "	.45	500 "	Intermediate density board.
6a	-	-	-	No boards could be made.
6b	.50 "	.25	200 "	Rigid insulation board.
6c	.29 "	.41	1100 "	Medium density board.
6d	.40 "	.35	600 "	Rigid insulation board.
6e	.30 "	.50	1400 "	Intermediate density boards.

No semi-rigid insulation board could be made from Golpata. Rigid insulation boards made would be poor in insulation properties. Intermediate density boards made from the epidermis were quite good in strength properties, specially when dried in the hot-press.

Conclusion : Golpata blades have been found to be unsuitable for making any type of board. Similarly, the pith of the leaf-stalk is also not suitable for board making. Only the epidermis of the leaf-stalks have been found to yeild good quality intermediate density boards. Though it yeilded medium quality rigid insulation boards, yet it did not yeild any semi-rigid insulation board.

B. RICE-STALK (ORIZA SATIVA.)

Introduction :

Insulation board is a low-density building fibre board which finds use in acoustic and heat insulation installations. The insulation boards come in different thicknesses, density and sizes. The most common varities are semi-rigid and rigid insulation boards. The former has a specific gravity range of 0.02 to 0.15 and comes in half to one and a half inch thicknesses. The rigid insulation board comes in .15 to .40 specific gravity range and 3/8" to 1" thicknesses. Semi-regid insulation boards are used primarily for heat insulation. These do not have much structural strength. Regid insulation boards are used in housing and many allied applications where their economy, structural strength, insulation and sound absorbing qualities satisfy particular use requirements. Of the various sub-classes of this type of boards, general-use-boards, roof-insulation boards, interior-boards and sheathing-boards are more important ones.

Most, of the districts of East Pakistan produce rice. Some of the districts has vast acreages of rice cultivation. In these areas, paddy stalk which remains in the field after hervesting is over, is available in abundant quantities. A project was taken up to find out the probable use of this vast raw material which at present serves no useful purpose. These are either burnt in the field or used by the poorer sections of the people as fuel or cheap fencing material. The raw material was procured from Dacca district. This came in about 15' length.

Manufacture of boards :

The paddy stalk was cut into 2" lengths. The resulting material was treated variously for converting this into fibres for making insulation type of boards.

Five batches of fibres were made by soaking the batches in water for 72 hours and then attrition milling them at various plate clearnces. Further 4 batches of fibres were prepared by the same process but soaking time was reduced to 12 hours only. Besides these, 5 more batches of fibrous materials were prepared after soaking the batches for 20 hours in 1% NaOH solution. Mats were made in the freeness tester and were pressed in a cold press and then dried in a forced draft oven. Better results, however, were obtained when the mats were press dried in a hot press.

Some of the boards were tested for modulus of rupture and water absorption values. Modulous of rupture values were taken according to ASTM Standard. Water absorption values were taken after soaking for 24 hours under 1" inch water at 22°C. The boards prepared according to the specification of rigid insulation boards were found to have moderate modulus of rupture values but good water resistance properties. The boards made by hot pressing had higher modulus values than the boards made by cold pressing. Our results compared favourably with those of standard and commercial boards. Commercial boards tested hadan average of 340 P.S.I. modulus of rupture value whereas the standard boards vary according to density from 250 to 700 P.S.I. It can be concluded that this vast raw material can be used profitably for making insulation boards.

TABLE - 1.

Board formation data of Water soaked chips.

No.	Time of water soaking hours.	Plate clearance of milling.	Freeness second.	Specific gravity.	Average thickness.	Mode of formation.
1	72	.015"	29	.35	.313	Cold pressed oven dried at 100°C for 2 hours.
2	72	.01"	56	.21	.719	As above but dried for 72 hours.
3.	72	.007"	48	.38	.263	Dried for 22 hours.
4.	72	.01"	45	.318	.316	As above.
5.	72	.012"	20	.21	.333	Hot pressed for 15 minutes at 190°C.

TABLE-2.

Test data of some boards made from water soaked chips.

						M of R P.S.I.	Water absorption % change in thickness.	Mode of formation.
11.	12	.01	29	.244	.479	348	16	Cold pressed at 500 PSI and oven dried for 3 hours at 150°C.
12.	12	.01	26	.255	.356	400	18.5	"
13	12	.015	15	.217	.358	413	19.1	"
14.	12	.015	18	.219	.424	383	14.9	"

TABLE -2.

Board formation data of alkali-soaked chips.

No.	Time of soaking in 1% alkali hours.	Plate clearance of milling.	Freeness seconds.	Specific gravity.	Average thickness.	% thickness change after soaking in water.	Mode of formation.
6.	20	.01	51	.309	.308	22.3	Hot pressed at 5 P.S.I. for 15 minutes at 190oC.
7.	20	.01	58	.244	.470	15.3	"
8.	20	.01	36	.241	.334	11.9	"
9.	20	.015	14	.212	.334	9.7	"
10.	20.	.015	19	.222	.439	11.0	"

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