# Studies On Use Of Secondary Fibres For The Development Of Speciality Paper Board For Packaging.

**Ghosh S.K., Saikia D.C., Saikia C.N. and Sarma T.C.**


## ABSTRACT

*Laboratory investigations have been carried out on the potential utilization of waste fibres to produce speciality board such as solid toughened paper board. Based on the laboratory scale and pilot plant study, solid toughened paper boards have certain added advantages as packaging media over conventional corrugated fibre boards, especially for preserving cold storage and heavy duty packaging. Samples of board prepared in laboratory as well as in pilot plant are tested as per TAPPI standard methods and the results are presented in this paper. It has been found that high quality solid toughened boards with breaking load 120-135 kg, water absorption 11.62 - 11.80 percent, having satisfactory fire resistant properties, can be made from waste papers. There is a substantial scope for use of this type of boards in packaging industries.*


## INTRODUCTION

Various types of packaging media are used for packaging of different items of day to day use. These media include timber, plywood, paperboard, plastics etc. depending on the type of the product to be packed and the end use of the same. For example, tea packaging needs plywood whereas pharmaceutical need plastic and hardwares to be packed in paper board boxes.

Paper constitutes 46 per cent of all packaging materials in use at present and is expected to increase its share to 54 per cent by 2000 A.D. It is used mostly in the form of boxes in the packaging of garments, fresh fruits, vegetables and handicrafts. The recent phenomenon of using fewer forest resources which emerged after eco-groups mounted pressure, has compelled the industry to increase the use of recycled fibres.[1,2]

Cartons made from corrugated fibre boards and some solid fibre boards are conventionally used in packaging industry. But for export packaging and deep freezing products, these paper boards boxes do not perform well at all times. Because for such packaging, high impact resistance, water proofness, moth and termite resistence, high puncture resistance and high compression strength are some of the vital characteristics required.

Contribution of packaging acquires greater significance in case of exports due to longer and complex nature of export distribution chains. It has become impreative for export packaging units to protect the contents against multi-transport and repeated handing hazards to preserve the contents and finally present the product in a more acceptable manner to

**Regional Research Laboratory, Jorhat-785 006, (Assam) INDIA.**

ensure respectable brand credibility among consumers.

The current market for export packaging is around Rs. 2000 crores which has a potential to touch Rs. 6320 crore by the turn of the century. Our country loses foreign exchange (worth over Rs. 450 cores) every year due to rejections, spoilage and breakage arising poor packaging. Engineering products are the worst sufferers for poor packaging accounting for a loss of Rs. 194 crores. Garment packaging comes next with a loss of Rs. 108 crores followed by marine products, which account for Rs. 72 crores.

In India, packaging has not kept pace with the required standard of the developed countries. For packaging of heavy materials like automobile parts, deep frozen articles, export goods, solid toughened paper board may be a good substitute.

It is felt that if a toughened solid fibre board is developed from raw material like waste paper, which is ecofriendly and bio-degradable, at a considerable economic cost, this type of board may find use in packaging industry especially for export packaging. However, this type of boards can be used for roofing purposes also.[3,4] For the manufacture of packaging paper and board, jute waste can be blended with waste paper[5].

The Regional Research Laboratory, Jorhat, has worked on development of process technology for manufacture of water resistant heavy duty speciality boards by using mainly good quality waste papers and waste gunny bags. Chemical additives are incorporated to the pulp stock, so that the dried and finished paper boards possess adequate strength properties with good foldability without delamination and good compression strength during keeping in cold storage.

The solid toughened paper boards, in general, possess certain characteristics advantageous for use in packaging, which are sumarised below.

The solid toughened boards perform better than the conventional corrugated boards under wet or humid conditions.

Corrugated boards lose compression strength in humid conditions, whereas, solid toughened board can be used for packaging in humid climatic conditions and as such, are suitable for packing export commodities to humid countries or where storage on dock is involved or where boses are likely to come in contact with water, oil or grease etc.

Solid toughened boards possess better puncture resistance as compared to conventional corrugated boards. It is, therefore, suitable for packaging heavy articles that could damage the box or where careless handling could lead to puncture.

The flutings of corrugated boards provide a nice abode for insects, dirt and undesirables, whereas solid board is not so accommodating and should be preferred where prolonged storage or reuse is involved.

The heavy duty solid boards do not ignite as easily as corrugated board. Moreover, solid board containers are better suited for keeping in cold storage than corrugated board containers are better suited for keeping in cold storage than corrugated board containers as the later loses strength during long storage.

## EXPERIMENTAL

Waste paper and discarded gunny bags are used as cellulosic materials, while commercial grade chemicals and synthetic polymers are incorporated in various stages of manufacture of the paperboard.

## STOCK PREPARATION

### Processing of Waste Paper

Waste papers, in the form of press cuttings, office waste, packaging cartons and boards etc. are used for this developmental work. Waste paper as received from the market are sorted and foreign materials such as plastics, strings, clips etc. are separated. After that, it is soaked in water in a soaking pit for about 6 hours.

The soaked waste papers are put in a hydrapulper to defibrate. After running for 30 minutes, the slushed material is discharged to a hollander beater. Beating is continued for another 1 hour till the pulp attained a freeness of 450 cc CSF.

### Processing of Gunny Bags

The discarded gunny bags are cleaned and fed to a rag chopper for cutting to desired sizes. The dusts are separated by passing through a dedusting machine

The cut pieces (approx. 2 x 2.5 cm) are digested in a rotary digester adopting soda process maintaining the following conditions:

| | | |
|---|---|---|
| Material to liquor ratio | - | 1:5 |
| Chemical percentage $Na_2O$ on OD basis | - | 8 |
| Cooking temperature (°C) | - | 165±5 |
| Time to raise to maximum temp. (h) | - | 1 |
| Time at maximum temp. (h) | - | 5 |

After the digestion, pulp is washed throughly with fresh water to remove the unreacted chemicals.

## BEATING AND BLENDING

The pulp from above is put in a hollander beater and beaten at a consistency of 3-4% for about 1 h and waste paper pulp from beater chest is then added to it in the required perportion and the beating of the blended pulps is continued further until the freeness of 300-350 cc CSF is attained.

At the early stages of beating operation, chemicals imparting stiffness and such other desirable properties to the dried board, are added to the pulp stock. The pulp stock is them beaten to the required freeness and then synthetic polymeric substances are added to the beater and the beating is continued for about 15 min. for thorough mixing of the chemicals. Sizing chemicals are then added followed by fillers and additives in the beater.

Sizing chemicals are precipitated over the fibres with the help of alum solution at a certain pH. The stock is then, pumped out to a storage chest, fitted with agitator.

## REFINING

From the stock chest, the pulp is fed to a disc refiner, wherefrom refined pulp is transferred to the refiner chest.

## BOARD MAKING

The pulp from the refiner chest is then fed to the head box of the single cylinder paperboard making machine.

Multilayered boards are made, maintaining a thickness of about 5 mm. The boards are then pressed in a secondary smooth press. The final boards, coming out from the secondary smooth press, contained about 40 % moisture.

The boards are initially dried in the sun and then dried in a controlled temperature.

The dried boards are then treated further with surface treatment agents such as special type of synthetic resin in order to make the finished boards highly water repellant as well as smooth surfaced. Alternatively, the virgin boards are also waxed by hot melt coating composition consisting of wax, a synthetic resin and a rubber chemical to impart flexibility and high degree of water resistance.

## PRESSING AND DRYING

The multilayered boards with high moistutre content are then pressed in the hydraulic press to squeeze out excess water from the base boards. In the hydraulic press, first of all, gradual pressure of 5-10 kg/cm$^2$ is applied and kept for 30-40 minutes and again pressure is increased graduality to 10-20 kg/cm$^2$ and kept at that pressure for another 30 minutes and then released. After pressing in the hydraulic press the boards are dried in the sun or in a hot/air circulating oven. Care should be taken so that the dried boards remain flat without curling. The dried boards are kept flat under some weight and conditioned in the room for 3-4 days.

## CALENDERING AND COATING

the above conditioned boards are calendered in a standard calendering machine. The thickness of the boards after calendering should remain between 2.5-5.0 mm. The edges of the calendered boards are then trimmed for applying a coating solution to impart certain characteristic properties to the boards.

## COATING OF THE BASE BOARD

A polymer based coating composition is made and applied on both sides of the base board by spraying. A dry coating pick up of 15-20 gms/m$^2$ is applied.

The coated boards are dried in air or in a hot air circulating oven at 65-70 °C and then calendered to obtain uniform surface and gloss. The boards are then finally cut into different sizes, so as maintain the corners always at an angle of 90°.

TABLE -1

PHYSICAL PROPERTIES OF SOLID TOUGHENED BOARDS

| Properties | Sample I Laboratory made | Sample II Pilot plant | Sample III Imported |
|---|---|---|---|
| Basis wt. G.S.M. | 1000 | 1045 | 1045 |
| Thickness (mm) | 25 | 2.55 | 2.65 |
| Water absonbency (24 Hrs) | 11.62 | 11.62 | 11.8 |
| Water percolation | NIL | NIL | NIL |
| Breaking load (Metres) | 3185 | 2960 | 2624 |
| Fire retardance | Satisfactory | Satisfacotry | Satisfactory |
| Delamination | NIL | NIL | NIL |

## TESTING

The laboratory test results show that the boards made from the blends of waste paper and jute fibre pulps,, with specific chemical treatment are found suitable for use as a speciality packaging boards for the purposes mentioned elsewhere in the text. The boards so prepared possess adequate physical stength properties and other characteristics needed for such a product.

Results obtained from testing some of the physical properties of the board prepared on pilot plant are presented in Table 1.

## CONCLUSION

It is observed from the above experiments that an ideal toughened solid board useful for making containers for export packaging and for cold storage of articles can be made from the waste paper pulp blended with pulp from waste gunny bags. Waste paper and gunny bags as both of them are eco-friendly and bio-degradable source of cellulosic material, it is worthwhile to utilise them for manufacturing of such speciality boards which have a substantial scope for use in packaging Industry in the country.

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