

Wheat Straw as Alternate to Hardwood Pulp in Liquid Packaging Board

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Wheat straw makes excellent paper and board. Straw fibers are similar to hardwood fibers and straw can be used in most paper and paperboard as a substitute for hardwood pulp. Most of the Asian countries are using straw to manufacture corrugating medium paper and Test liner from unbleached straw pulp, and fine writing and printing paper from bleached straw pulp. As the chemical composition and morphology of straw is very similar to hardwood it can be easily used in place of hardwood pulp. Packages Ltd is a leading pulp and paper industry in South East Asia, by using its unique technology of straw pulping Packages Ltd is using straw as an alternate to hardwood pulp in manufacturing of liquid packaging board. In this paper comparison of straw with hardwood pulp is presented, also properties of liquid packaging board manufactured by Packages Ltd from straw are explained. Specially designed paper machine is used for manufacturing this liquid packaging board using straw. A blend of wood pulp is also used with straw to get better strength properties.

Keywords : Wheat Straw, Hardwood, Liquid Packaging Board

Application : This study will help to use wheat straw pulp for production of liquid packaging board.

INTRODUCTION

Straw is produced, as agricultural waste in Pakistan and it is abundantly available. For utilization of straw in paper and paperboard cellulose is the main component responsible for structure and stiffness. Cellulose content in straw is very near to hardwood whereas number of hemicellulose is higher in straw. Amount of lignin is quite high in hardwood as compared to straw. Chemical composition of straw and hardwood is given below.

Major problem with straw is silica; wheat straw contains around 8% silica as small crystals embedded in straw. During cooking silica dissolves into black liquor, which is then treated in chemical recovery

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plant to recover pulping chemicals. In hardwood pulp there is very low amount of silica i.e., less than 1%.

Straw is a bulky material with generally high handling and transport cost, Packages Ltd has developed a collection system and it purchases every year around 300,000 tons of straw from different locations of Punjab. Even after baling wheat straw its density remains very low as compared to hardwood so it requires very big

storage area. Straw usually needs to be chopped to a uniform particle size before further processing. The length of typical straw fiber is around 1mm and diameter is 15 um whereas hardwood fiber length is 1 mm and diameter is 10--12um.

Another property of wheat straw, which is very different from hardwood, is that the water retention capacity of straw is much better than hardwood fiber. This causes a significant problem during

Table 1 : Chemical Composition of Straw and Hardwood

Type	Wheat Straw	Rice Straw	Hardwood
Cellulose	45-55	43-49	57
Hemicellulose	26-32	23-28	23
Lignin	16-21	12-16	25
Ash	2-9	15-20	1
Silica	2-8	9-14	0.5

pulping and also on paper machine. Due to high water retention capacity of straw fiber each separation step requires about three times as much separation capacity as for hardwood processing. Typical yield of straw is 55-60%, which is an advantage of using straw as raw material. But the major reason of using straw as alternate to hardwood is price and availability, it is cheaper than hardwood and abundantly available in Pakistan.

Straw properties are very near to hardwood and it produces very fine quality liquid packaging board, which is used by different converters in country without any problem. Packages Ltd produces around 12,000 tons per year of liquid packaging board for local consumers. This board is produced by Packages Ltd paper machine, PM-1, having a capacity of 35,000 tons per year.

PULP PROPERTIES

Results for straw pulp produces in Packages Ltd. are plotted below with comparison to Phoenix Eucalyptus Kraft pulp.

Table 2 : Results of pulp properties

Properties	Wheat Straw Pulp	Hardwood Pulp
CSF	385	415
Burst Index (kpam ² /g)	3.2	4.7
Tensile Index (Nm/g)	66.0	66.1
Tear Index (mNm ² /g)	4.0	7.6
Bulk (cc/g)	1.70	1.53
Brightness (%)	81.5	89

It is seen from the results that straw tensile is similar to hardwood and bulk is better than hardwood. But burst and tear is good for hardwood as compared to straw pulp. But to compensate this weak burst and tear in straw pulp, wood pulp is used in production of liquid packaging board to compensate this weakness.

Table 3 : Packages Ltd Liquid Packaging Board Properties

Properties	Units	Values
Grammage	gsm	200
Thickness	Microns	255-285
Bulk	cm ³ /g	1.31
Roughness	ml/min	600-1400
Brightness	%	72-76
Tensile Strength	kN/m	MD:14-20 CD : 6.5-7.5
Stiffness	mN	MD:110-155 CD : 40-70

Brightness with straw pulp cannot be enhanced beyond a certain level, as the fiber strength starts to decrease, which is not the case with hardwood. At present Packages Ltd is using single stage bleaching sequence but Packages Ltd plans an expansion and relocation Greenfield Project, in which Packages Ltd will install new paper and board machines, and pulping and bleaching lines. In new bleaching line Packages Ltd is planning multi-stage bleaching sequence enhancing its pulp brightness up to 85%.

board. Some special chemicals are also used in furnish to get required strength properties. Straw usually comes with very high CSF so it is not refined in normal operations. The most important parameter for liquid packaging board is stiffness that is also under required range of Pakistani converters.

CONCLUSION

The results presented above show that the properties of wheat straw pulp are quite comparable with hardwood pulp. Hence, the above discussion confirms the suitability of wheat straw usage in place of

BOARD PROPERTIES

Properties of liquid packaging board produced by Packages Ltd by using wheat straw as alternate to hardwood pulp is shown below. This board is manufactured on PM-1 prime machine of Packages Ltd used for manufacturing of liquid packaging board and also cigarette

hard wood pulp for the production of Liquid Packaging Board.

REFERENCES

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