# Innovative shift of Packaging Board towards High Bulk by CPP – A Change Market requirement

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## Abstract:

In today's demand of greener environment, Global packaging market is favouring the renewable and recyclable materials. For this, Paperboard is emerging as most preferably packaging material around the Globe. The growth of the paper & paperboard market is primarily driven by the following:

- Growing consumer awareness for sustainable packaging
- Manufacturing by using Renewable raw material i.e. Wood which is continuously growing through structured plantation.
- Recyclability of paper & paperboard

The paperboard packaging market is marked with intense competition due to the presence of a large number of players. New product launches, mergers & acquisitions, partnerships, and expansions are the key strategies adopted by market players to ensure their growth in the market.

M/s.CPP is continuously working on innovative solutions for packaging board as per change market dynamics. In this direction, we have redesigned our specific product range through shifting towards high bulk. As a result of this, we succeeded in introducing sustainable high bulk FBB/SBS varieties under Plus series so as to offer low cost packaging option through lower grammage board with same board properties to cater FMCG, Pharma, Liquor and Cosmetic sectors. FBB and SBS bulk increased from 1.55 to 1.75 cc/gm and 1.45 to 1.55 cc/gm respectively under different varieties. Market has accepted the quality and volumes are rising month on month basis. This is achieved through innovative working approach as per change market requirements by blending of different pulp mix, technological advantages of Master jet dilution head box in middle layer, Shoe press and optimization of the process control parameters.

## Background :

Paperboard packaging has gained prominence in the last two decades, with the emergence of modern retail formats where visual appeal, shelf life and unique brand identity have taken the centre stage. Paperboard packaging offers all these advantages and more – it is consumer-friendly, provides excellent product protection, lightweight, easy to transport & stack and easy to dispose of due to its biodegradability & recycling. With increasing consumer awareness and focus on 'green packaging', paperboard is gaining ground in the packaging industry.

The paper & paperboard packaging market is end-user oriented. It has shown moderate growth

after the economic slowdown from 2007 to 2009. This market is mostly driven by the switch in packaging solutions from plastic packaging to paper & paperboard packaging. With the increasing problems of landfill and non-biodegradable or very slow degradation of plastic & metal packaging, paper & paper boards are the preferred manufacturers. The eco-friendly appeal of paper has helped in acceptance and penetration in the global market. A lot of innovations in designs & technological advancements have been witnessed by the industry in the last decade, which has helped in entering new segments such as, frozen foods, multi-pack beverage holders, recycled paperboard for packaging of dry food, and healthcare products.

The paper & paperboard packaging market is projected to reach $213.4 Billion by 2020, at a CAGR of 3.5% from 2015 to 2020. Asia-Pacific is estimated to grow the fastest in the review period, because of the increasing demand of convenience food, better health & personal care products. The developing economies also have a direct impact on paper & paperboard packaging industry because of the increasing disposable income of the citizens.

Paper Board is smooth and strong, light and bright, versatile and cost effective Product. A generous printing surface and superb print quality make paper board cartons as ideal information carriers and brand builders. Reliability in high-speed filling lines saves money and minimizes production downtimes. Renewable fibers also make a particularly well-founded choice environmentally.

The ultimate challenge, however, lies in using the full potential of the material intelligently and innovatively to create solutions and concepts that will have a competitive edge-in product protection, material savings, production and logistic costs, trade preference, consumer acceptance, shelf presence and recycling efficiency.

## Sustainable Packaging :

Sustainable development in packaging means solutions that satisfy present needs in an optimal way without compromising the ability of future generations to meet their own needs. Fiber based boards provide a powerful means of achieving those goals throughout the packages's life cycle.

Wood, a renewable and recyclable resource, is the main raw material in our packaging boards. We apply the principles of environmental and social responsibility for wood procurement and sustainable forest management.

Paper Board is produced at an integrated mill, using mainly renewal energy derived from the wood in the pulping process,

Versatile and light paperboard packages prevent product loss by effectively protecting packed materials against physical damage, contamination and light. Product in formation can be printed directly onto the surface of the paper board, so no extra labels are needed. Space saving designs are particularly economical in transportation. Efficient logistics reduce fuel consumption and emission to the atmosphere.

## Process Layout and Design :

M/s.Century Pulp & paper board plant BM-6 has started Production in 2012. The Complete machinery is supplied by Voith-Germany. The Stock Preparation has Six Pulping lines in which four lines (LBKP,NBKP, BCTMP & DIP) are using for the virgin grade boards production and other two lines are using for wastepaper treatment for producing the Grey back boards. In Every line of Virgin grade pulp processing the series of equipments like pulper, Dump tower, HD cleaning, Refining and Final chest are installed to blend the pulp for achieving the desired parameters.

In Wastepaper Street Complete screening, cleaning system has adopted to remove contaminants and fractionators are used for the separation of long and short fiber fraction. To Keeping back surface clean in grey back boards dispersion system has been

adopted for removal of inks and size reduction of contaminants.

The Machine has state of art technology in the wetend section to maintain the better formation, MD stability and CD variations. The machine consists of 4ply fourdrinier wire section with the width of 4300mm.The Middle ply has Module jet dilution Head box with Duo former D for better profiles ,better edges , faster grade changes and better formation.

In Press part 1st Press is nip roll press, 2nd Press is Nipcoflex press (shoe Press) and 3rd Press is nip offset press. In Dryer part, double tier dryer groups followed by MG cylinder, Speed flow sizepress, Hardnip precalender Eco cal, 2 Top coating, 1 back coating and Softnip post calendaring Ecosoft for topside.

Improvement of bulk in the coated virgin board varieties is essential demand in the market and it is changing the customer requirements day to day to reduce the total packaging board cost. In this drive M/s.CPP has taken initiative to shift from lower bulk to high bulk by selecting the right Mechanical pulp blending in different ratio and receipe/Process optimization in all the layer.

## Paper Board Grades :

Paper provides mainly the printing surface, Paper board Provides printing surface, stiffness, strength and other properties necessary in packaging and use for graphic enduses.Usualy basis weight, caliper and stiffness are higher than of paper. All most of all paperboard grades are multiply products.

## FBB (Folding Box Board) :

Virgin Paper board is a combination of Mechanical pulp along with chemical pulp in layers.

## Construction:

| | |
|---|---|
| | Double Coating |
| | Surface Sized |
| | Bleached Chemical Pulp |
| | Bleached Chemical Pulp |
| | Bleached Mechanical Pulp |
| | Bleached Chemical Pulp |
| | Surface Sized |
| | Single Coating |

In the Board construction middle ply is contributing major portion on total board grammage in which we are using of mechanical pulp for better bulk and stiffness. Mechanical pulp is basically Chemi thermo Mechanical Pulp (BCTMP).The toplayer, under top and back layers we are using bleached chemical pulp. The top and reverse side is Pigment coated.

## SBS (Solid bleached sulphate)

Paper board entirely made of bleached chemical pulp. The top and reverse side Pigment coated.

## Construction:

| | |
|---|---|
| | Double Coating |
| | Surface Sized |
| | Bleached Chemical Pulp |
| | Bleached Chemical Pulp |
| | Bleached Customized Pulp |
| | Bleached Chemical Pulp |
| | Surface Sized |
| | Single Coating |

## WLC (White lined chip board):

Multi-layer paperboard comprising at least one middle layer of mainly recovered fibers. The top layer is bleached virgin chemical pulp or white recovered pulps. Between the top layer and middle layer there can be a layer of chemical, mechanical or deinked recycled fibers. The reverse layer can be made from selected recycled fibers or bleached and /or unbleached virgin fibers. The top side coated with clay and ground calcium carbonate for better printability.

## Construction:

| | |
|---|---|
| | Double Coating |
| | Surface Sized |
| | Bleached Chemical Pulp |
| | Bleached Customized Pulp |
| | Bleached Customized Pulp |
| | Bleached Customized Pulp |
| | Surface Sized |
| | Single Coating |

LAB EXPERIMENT:

Lab study on Different BCTMP pulp (SW&HW) .

**Table** : 1

| Comparative Results of Different BCTMP-SW Pulps | | | | | |
|---|---|---|---|---|---|
| S No | Properties | UOM | SW BCTMP | | |
| | | | BCTMP SW-A | BCTMP SW-B | BCTMP SW-C |
| 1 | Mean Fibre Length | mm | **1.59** | **1.70** | **1.40** |
| 2 | Fibre Width | mm | 37.8 | 39 | 36.3 |
| 3 | Fines <0.2mm | % | 13.2 | 11.8 | 11.3 |
| 4 | Coarseness | mg/100m | 16.9 | 17.9 | 19.3 |
| 5 | CSF | ml | 390 | 380 | 380 |
| 6 | Brightness | % | 70.1 | 69.8 | 72.2 |
| 7 | Breaking Length | meter | 2390 | 2380 | 2310 |
| 8 | Bulk | cc/gm | 3.21 | 3.22 | 3.12 |
| 9 | Stiffness | mN | 285 | 247 | 227 |
| 10 | Ply bond | J/m2 | 113 | 115 | 113 |

Observations : (a) BCTMP SW - B is showing better bulk and bonding strength as compared to other pulps. (b) Mean fiber length & strength are better in BCTMP SW – B as compared to other pulps.

**Table** : 2

| Comparative Results of BCTMP-HW Pulps | | | | | |
|---|---|---|---|---|---|
| S No | Properties | UOM | BCTMP-HW | | |
| | | | BCTMP HW-1 | BCTMP HW - 2 | BCTMP HW-3 |
| 1 | Mean Fibre Length | mm | **0.84** | **0.75** | **0.71** |
| 2 | Fibre Width | mm | 29.6 | 28 | 22.8 |
| 3 | Fines <0.2mm | % | 12.7 | 9.1 | 12.9 |
| 4 | Coarseness | mg/100m | 13.2 | 11.4 | 12.8 |
| 5 | CSF | Ml | 420 | 390 | 400 |
| 6 | Brightness | % | 80.1 | 70.1 | 72.84 |
| 7 | Breaking Length | meter | 1280 | 1310 | 910 |
| 8 | Bulk | cc/gm | 3.21 | 3.01 | 3.31 |
| 9 | Stiffness | mN | 218 | 209 | 298 |
| 10 | Ply bond | j/m2 | 80 | 85 | 75 |

Observations : (a) BCTMP HW -1 has optimum bulk, strength as compared other imported fibers. (b) Fiber length and coarseness is better in BCTMP HW-1.

**Table : 3**

Blending of Different Sources of BCTMP-SW and HW by Keeping BCTMP –SW Source constant and varied the BCTMP –HW sources

| Blending of Different combinations of Fixed BCTMP SW and Different BCTMP HW Pulp | | | | | |
|---|---|---|---|---|---|
| S No | Properties | UOM | Blending of SW:HW | | |
| | | | BCTMP SW (C)-70% BCTMP-HW(2) -30% | BCTMP SW(C) - 70% BCTMP-HW(1)- 30% | BCTMP SW(C)- 70% BCTMP HW(3)- 30% |
| 1 | Brightness | % | 71.1 | 73.8 | 72.7 |
| 2 | Breaking Length | meter | 1990 | 1890 | 1820 |
| 3 | Bulk | cc/gm | 3.1 | 3.16 | 3.24 |
| 4 | Stiffness | mN | 225 | 235 | 249 |
| 5 | Ply bond | j/m2 | 109 | 106 | 100 |

Observations : (a) Based on the analysis, Case-3 combination is better for the bulk and stiffness.
(b) For bonding strength improvement, case-1 is suitable combination.

**Table : 4**

Blending of Different BCTMP SW sources by Keeping BCTMP HW Source Constant

| Blending of Different BCTMP SW sources by Keeping BCTMP HW Source Constant | | | | | |
|---|---|---|---|---|---|
| S No | Properties | UOM | SW : HW blend | | |
| | | | BCTMP SW(C)- 90% BCTMP HW(3)- 10% | BCTMP SW(B)- 90% BCTMP HW(3)- 10% | BCTMP SW(A)- 90% BCTMP HW(3)- 10% |
| 1 | Brightness | % | 72.3 | 70.6 | 70.8 |
| 2 | Breaking Length | meter | 1920 | 1950 | 1960 |
| 3 | Bulk | cc/gm | 3.19 | 3.28 | 3.26 |
| 4 | Stiffness | mN | 234 | 254 | 286 |
| 5 | Ply bond | j/m2 | 109 | 108 | 111 |

Observations : (a) When the BCTMP SW is increasing the strength and bulk is increasing trend.
b) Higher bulk, stiffness and strength Case-3 combination is better.

## Study of different Hardwood pulps domestic vs. imported fiber Morphology after refining (PFI Mill)

We have conducted a Lab study on different Hardwood fibers by using PFI mill and fiber Master analyzer to find out the better source of Hardwood fiber and in-house pulp strengths to prepare optimum receipe and cost effectiveness. Throughout the experiment the PFI revolutions are kept constant 5000rpm and observed the freeness levels corresponding strength properties and fiber morphology have been studied.

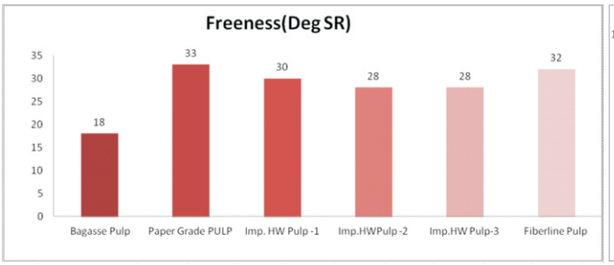
Basically pulp characteristics depend on refining,

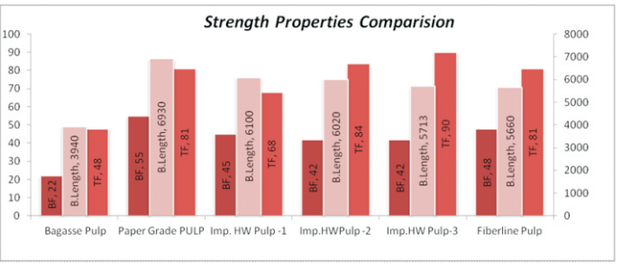
fiber length and coarseness. Shortening of fibers will give an improved formation. The beating will increase the surface area and flexibility of the fibers. The flexible fibers are more bendable to conform around each other. The increased flexibility is probably due to an increase of porosity or delimitation of the fiber wall. All the strength properties except for the tear index will increase during beating. This is because the tear strength depends on the individual strength.

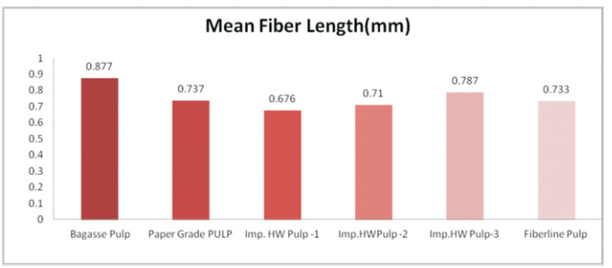
Fiber coarseness is defined as weight per fiber length and is normally expressed in units of mg/m or g/m. Coarseness depends on fiber diameter, cell wall thickness, cell wall density and fiber cross section. The coarseness value has a great influence for the paper structure. A high coarseness value indicates a thick fiber wall, giving stiff fibers unable to collapse. Thin walled fibers with low coarseness value give flexible fibers and a denser sheet.

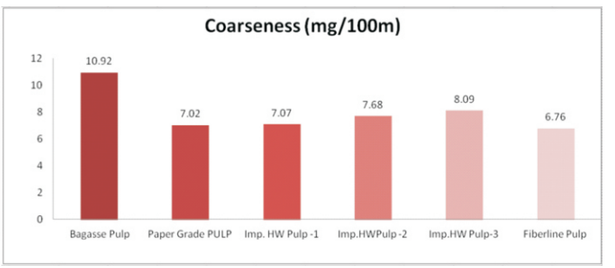
Hardwood fibers have lower fiber coarseness value than softwood fibers, because coarseness increases with the increase of fiber length and fiber wall thickness. Hardwood pulp fibers give better formation than softwood fibers, due to lower coarseness value. Fiber coarseness varies with wood species. The thick walled late wood or summerwood fibers have distinctly higher coarseness value than thin walled early wood fibers.

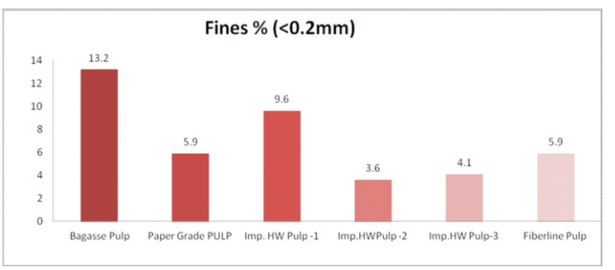
**The data of Different Hard wood pulps Evaluation and comparisions are furnished below**




## Observations :

a) Based on the analysis of Different Hardwood pulps and compared with the inhouse pulps. The results of In-house pulps strength is showing almost comparable with the imported pulps.

b) Inhouse pulp has less coarseness than the imported pulps which has resulting better sheet formation and bonding strength.

c) The fiber length of fiber line pulp has better as compared to imported pulps.

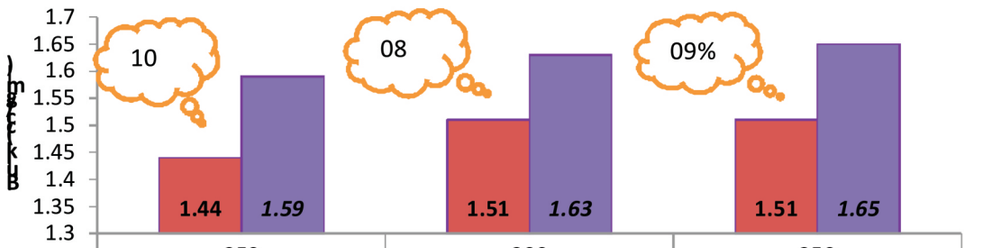
d) The usage of Inhouse pulp has increased in all areas consistently by substituting the imported hardwood pulps.

## Plant results of Bulk and stiffness in Folding Box Board:

In M/s.CPP, we are Producing FBB varieties like Optifold, Prima fold and Superia fold to cater the different enduser applications since last three years. To enhance the bulk is achieved through innovatetively working by optimizing the receipe as per the lab study and fine tuning of process parameters. Apart from this online drainage tester has been installed in under top and Middle layer to monitor and control the dry line line on wire instantly.

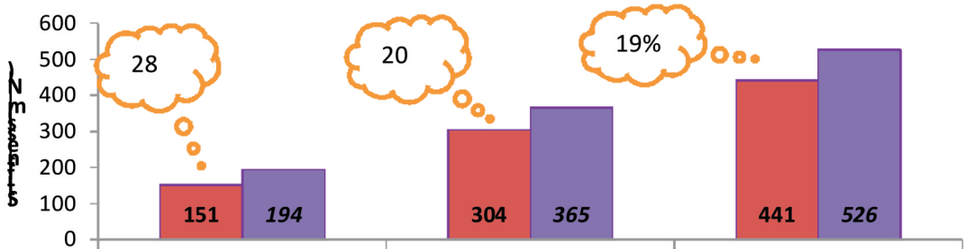
Bulk is considered as one of the important property of paper board whether it is FBB or SBS.Most of the commercial decision taken on board by keeping in view the bulk of the board. We were receiving the intense requirement for improvement in bulk.So, to achieve the Market requirement, We intensively carried out the various pulp studies which were having direct impact on bulk and finally manufacturing the high bulk paper boards consistently.

**Bulk enhancement in Prima Fold to Prima Fold Plus**



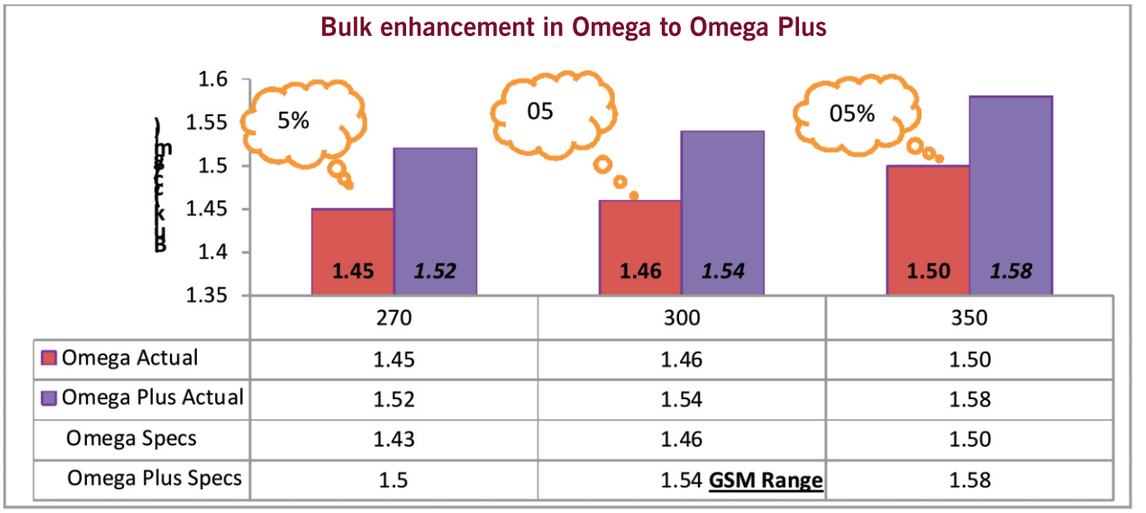

| | 250 | 300 | 350 |
|---|---|---|---|
| Prima Fold Actual | 1.44 | 1.51 | 1.51 |
| Prima Plus Actual | 1.59 | 1.63 | 1.65 |
| Prima Fold Specs | 1.42 | 1.48 | 1.50 |
| Prima Plus Specs | 1.58 | 1.63 GSM Range | 1.65 |

**Stiffness enhancement in Prima Fold to Prima Fold Plus**

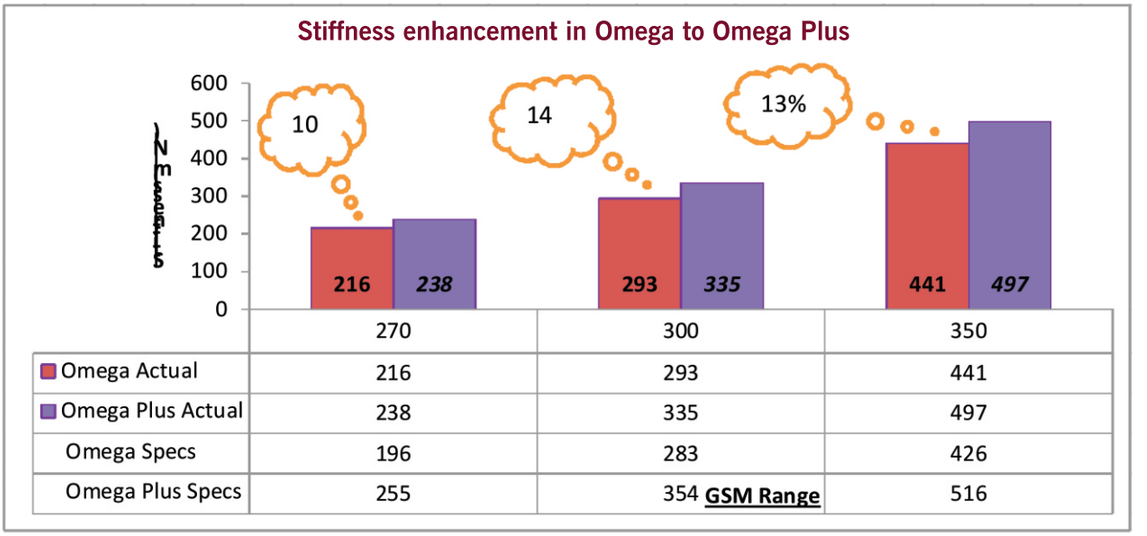



| | 250 | 300 | 350 |
|---|---|---|---|
| Prima Fold Actual | 151 | 304 | 441 |
| Prima Plus Actual | 194 | 365 | 526 |
| Prima Fold Specs | 145 | 283 | 408 |
| Prima Plus Specs | 196 | 390 GSM Range | 551 |

## Plant results of Bulk and stiffness in SBS board:




| | 270 | 300 | 350 |
|---|---|---|---|
| Omega Actual | 1.45 | 1.46 | 1.50 |
| Omega Plus Actual | 1.52 | 1.54 | 1.58 |
| Omega Specs | 1.43 | 1.46 | 1.50 |
| Omega Plus Specs | 1.5 | 1.54 GSM Range | 1.58 |




| | 270 | 300 | 350 |
|---|---|---|---|
| Omega Actual | 216 | 293 | 441 |
| Omega Plus Actual | 238 | 335 | 497 |
| Omega Specs | 196 | 283 | 426 |
| Omega Plus Specs | 255 | 354 GSM Range | 516 |

## Conclusion :

a) Different pulps have been evaluated to optimize the receipe based on the Lab study.

b) Plant trial has been taken with proposed receipe and process parameters are optimized to get the desired results.

c) A print trial has taken in different run's of material for the surface printability evaluation at actual press room conditions. Based on the print results, process optimization done in wetend and coating.

d) Standardize the receipe and process parameters to produce consistent quality and delivery.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