Development of Pink News Print From 100% Recycled Fiber By Indigenous Technology

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ABSTRACT

Imported Pink news print is being manufactured from thermo mechanical pulp or mixture of de-inked & thermo mechanical pulp and small amount of sulphate pulp is added for strength. On the request of leading news paper publishers of country, detail R & D studies were carried out with the help of indigenous dye suppliers to develop pink news print paper of International quality from 100% deinked pulp. Suitable dyes were developed by dye supplier for making pink news print of required shade. A complex logistic system developed to ensure that pink news print at PM#3 & white news print at PM#2 simultaneously can be manufactured by taking pulp from same de-inked plant. After successful plant trial it was commercialized in April, 2009 & well accepted by market.

Introduction

Emami Paper Mill is one of the largest news print & writing printing paper manufacturer in India producing 400TPD at Balasore unit & 50TPD at Gulmohar unit from 100% recycled fiber. We are manufacturing International quality news print paper on paper machine#3 which is being supplied to leading news papers. Emami paper mill is certified for ISO 9001: 2008, EMS14001:2004 & OSHAS 18001:2007 and TPM.Emami is the 1st waste paper based paper mill in India which has been awarded TPM EXCELLENCE AWARD IN 2006 & EXCELLENCE IN CONSISTENT TPM COMMITMENT AWARD IN 2008 BY JIPM, JAPAN.

Financial times, one of the world's leading business news paper, which has been printed on pink paper for more than a century. The financial times distinctive Pink color was first adopted in 1893. The pink news print for financial times is being manufactured in one of the Swedish mill by using 40% deinked pulp & 60% thermo mechanical pulp, comprising virgin spruce wood fiber & small amount of sulphate pulp to strengthen the paper. Dye is added to the pulp to produce the pink color.

Emami Paper Mills has the single largest operating capacity De-inking plant in India and equipped with latest technology and automation**.** We are able to produce superior quality clean (dirt and specks free) de-inked pulp of 60 to 61% (ISO) Brightness. It takes considerable training and experience to produce the correct color shade and consistency. There is a good deal of logistics planning required, too as we have to switch from white to pink, or pink to white, which is more complicated process, without excessive down time. Emami is producing de-inked pulp from 100% recycled fiber & this pulp is being supplied to PM#2 & PM#3 machine for making News Print paper. We take all necessary precautions to manufacture white news print in PM#2 and, Pink News Print in PM#3 simultaneously from deinked pulp supplied by same deinking plant. Back water of PM#3 during manufacturing of pink news print is being used in DIP as usual without affecting the optical properties of white news print at PM#2.

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Literature:

Color has a definite functional significance in paper. It is used for identification, to attract attention, and to emphasize distinguishing characteristics in papers. Pink is distinguished color for financial news paper. Color is often discussed in terms of shade. Shade or hue refers to the color of the paper. Shades are described on the basis of three primary colors "Red, Yellow & Blue". In the paper industry the Hunter L*, a*, b* scale has been widely adopted and provides an easily understood system for specifying how one sample differ in color from another. Hunter L*. a*, b*, tristimulus system is derived from the CIE system. The L* value represents the mathematical approximation of the black white response of the eye. A perfect white has an L value of 100, while black has an L value zero. A plus value of a* indicates redness & a minus value, greenness. A plus value of b* indicates yellowness and a minus value, blueness. In the L*, a*, b* color system, the total color system between standard and sample can be computed with the equation i.e. $\Delta E = \Delta L^2 + \Delta a^2 + \Delta b^2$. The goal in color matching is to reduce ΔE in the figure to the point where the sample & the standard appear to be the same color to a human observer.

The spectrophotometer is the basic instrument of color measurement & gives completely objective results.

Direct dye is most important for paper coloring; it is most suitable for manufacturing of pink news print as direct dyes have strong affinity for cellulose. The affinity of direct dye can be attributed in part to the low solubility of the materials. In fact, aqueous solution of the dyes are often highly colloidal rather than true solution, and some direct dye may even gel when a solution is left standing. In case of powder dyes, higher temperature improves dye solubility, which can also translate into improved dye performance.

They are superior in light fastness. They are all linear and coplanar in structure i.e. long, flat molecules. They contain groups such as OH and NH_2 which are capable of hydrogen bonding to cellulose hydroxyl groups. In addition, Vander Waal's forces play significant role in bonding dye molecules to a fiber surface.

In case of attachment of direct dyes to

cellulose fibers, many physical and chemical factors are involved at the same time and entire process is governed by equilibria and is therefore in a continual state of change at a molecular level. There are several models for diffusion of the dye into the fiber; two of them are described here.

A- Pore Model:

It is assumed there are hollow spaces and channels in the fibers filled with water, into which the dye can diffuse. Some of these pores are produced by the swelling action of the water and close up on drying. These pores have been verified experimentally and are of the order of magnitude of less than 1/1000 mm. This model can be thought of as a sponge in which the pores are filled with water and the dye penetrates the fiber by diffusing along these water filled channels.

B-The Free Volume Model:

Paper fibers consist of cellulose chains held together in rope-like bundles by hydrogen bonding. These rope like structures contain amorphous (30-50%) and crystalline (50-70%) regions, only the amorphous regions are easily penetrated by water and there for dye stuff. The free volume is the volume which is not occupied by the chains of the volume of the cellulose. The larger this free volume the greater is the probability that sufficiently sized gaps will open into which the dye can move. There are no more solvent filled pores; rather the whole bundles are a mixture of cellulose and water.

There are three main types of interaction between fiber and dye in dyeing of paper;

1. Yoshida forces-These are electron sharing forces between the cellulose and the dye.
2. Hydrogen bonding- It is type of Yoshida force where hydroxyl and amino groups in the dye bond with hydroxyl groups in the cellulose.
3. Vander Waal's forces-these are intermolecular attracting forces between the dye and the cellulose chains.

Experimental

We received two types of Imported Pink News Print samples from leading News paper publisher for development of similar shade. Detailed analysis of both the samples was done in our R&D section. The color of the paper samples measured as per TAPPI standard using Datacolor Spectrophotometer Elrepho 070 manufactured by L & W (Table No 1). The base pulp of 1st sample was mixture of thermo mechanical & de-inked pulp having the brightness about 65 % (ISO). The base pulp of second sample was mainly thermo mechanical pulp having the brightness about 60% (ISO). Shade of the imported pink news print - 2 was approved as Emami is producing de-inked pulp having brightness about 60% (ISO). We approached three leading indigenous dye suppliers to supply suitable direct dye as per our requirement. Several experiments were conducted to develop required shade. Out of three suppliers, one supplier with their technical expertise was able to supply suitable dyes to match required shade. Further extensive studies were carried out along with supplier representative and we were able to get the required shade in laboratory by using orange & yellow dyes in proper ratio.

Results & Discussion

Emami is making standard news print paper from 100% de-inked pulp and all properties (Physical, strength and optical) are similar to International quality. Hence Physical strength properties of pink news print can be maintained easily by using 100% de-inked pulp. However it is important to develop pink shade in indigenous paper similar to imported pink news print. Summary of experimental results for developing pink shade is given below.

1. Color properties of approved shade of imported pink news print paper have been given in Table No. 1
2. We could develop a* value by using orange dye nearer to approved shade (Table No-2).
3. Required shade developed by using combination of orange & yellow dye in proper ratio. In the developed shade L* a*, b*, & yellowness are similar to approved shade.(TableNo-3).
4. We are able to maintain consistent quality in terms of shade in our entire commercial run (Table No-4).
5. Strength properties are better than imported pink news print (Table No-5) and in case of color properties except L* value which is almost nearer to imported pink news print paper, a* & b* values are similar to the pink news print. However L* value is slightly lower as our base pulp is 100% de-inked pulp in comparison to 100% thermo

Table No-1
Color properties of Imported Pink News Print

Particulars	Imported Pink News Print - 1	Imported Pink News Print - 2
L	82.2	79.5
a*	6.4	8.6
b*	18.4	18.2
Yellowness, Index	42.3	44.5
Furnish	Mixture of Thermo mechanical & de-inked pulp	Thermo mechanical pulp

Table No- 2
Development of a* value by using Orange dye

Particulars	Set No. 1				Set No. 2		
	Orange Dye 1.2 kg/MT	Orange Dye 1.5 kg/MT	Orange Dye 1.7 kg/MT	Orange Dye 2.5 kg/MT	Orange Dye 1.2 kg/MT	Orange Dye 1.5 kg/MT	Orange Dye 1.7 kg/MT
L	81.39	81.05	80.15	77.6	79.06	78.89	77.73
a*	5.79	6.7	7.89	9.59	5.45	6.65	6.87
b*	12.34	13.3	14.89	15.94	11.57	12.92	13.77
Yellowness, Index	30.88	33.67	38.08	38.35	29.76	33.6	35.85

Factors Influencing Dye Performance

pH	Consistency
Temperature	Furnish components
Interfering Substances	Freeness (refining degree)
Water hardness	Stock recirculation
contact time	Broke addition

mechanical pulp of imported pink news print.

Conclusion:

1. Pink news print paper is being used in financial paper by leading news print publishers.
2. Pink news print paper is mainly imported. It is made from thermo mechanical pulp or mixture of thermo mechanical and de-inked pulp & small quantity of chemical pulp is being added for better strength.
3. Extensive R&D studies were conducted along with the dye supplier to develop the shade of approved imported pink news print sample given by leading news print publisher.
4. Required shade sample was developed by using direct dyes exclusively developed by the dye supplier for Emami pink news print.
5. Successful plant trial was taken in April'09 and dye consumption in subsequent trial was optimized.
6. A complex logistic system developed for manufacturing pink news print paper.
7. Pink news print paper manufactured from 100% deinked pulp is well accepted in the market.
8. Imported pink news print paper is replaced by Emami pink news print paper.
9. Consistent color & other properties are being maintained in all our commercial run of pink news print.

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Table No 3
Development of Shade by using Orange & Yellow dyes (exclusively for Pink News Print)

Particulars	Imported Pink News Print - 2	Base Pulp	Orange 2.6kg/T Yellow 300g/T	Orange 2.4kg/T Yellow 200g/T	Orange 2.3kg/T Yellow 250g/T	Orange 2.4kg/T Yellow 220g/T	Orange 2.7kg/T Yellow 300g/T	Orange 2.5kg/T Yellow 200g/T	Orange 2.3kg/T Yellow 220g/T	Orange 2.3kg/T Yellow 200g/T	Orange 2.5kg/T Yellow 250g/T
Ð	79.5	84.53	79.5	79.83	80.05	80.82	79.7	79.98	80.6	80.24	80.21
a*	8.6	-1.54	9.12	8.17	8.18	7.3	8.72	8.35	7.11	7.24	8.55
b*	18.2	5.26	20.61	18.77	18.58	17.44	19.38	18.19	16.91	17.06	18.8
Yellowness, Index	44.5	9.72	49.89	45.6	45.16	71.98	47.24	44.66	40.92	41.46	45.84

Table No 4
Average Color Properties of Emami Pink News Print

Period	Finished Production	L*	a*	b*	Yellowness
April'09	1110.7	77-78	9.2	19.3	48.2
Jun'09	1248.0	77-78	8.7	18.6	47.0
Sept/Oct'09	1301.0	77-78	8.7	18.2	43.1
Jan'10	1192.0	77-78	8.9	18.5	47.2
April'10	1517.0	77-78	8.8	18.3	46.6
May'10	2135.0	77-78	8.9	18.3	46.8

Table No. 5
Comparative Evaluation of Emami Pink News Print with Imported Pink News Print

Properties		Unit	Imported Pink News print	Emami Pink News Print
Substance		g/m2	44.4	44.5
Tear Index	MD	mNm^2/g	4.1	5.0
	CD		5.6	8.1
Tensile Index	MD	Nm/g	35.6	48.3
	CD		16.8	16.6
L*			79.5	77-78
a*			8.6	8.8
b*			18.2	18.3
Yellowness		Index	44.5	46.6
Opacity		%	92.1	94.4
Smoothness	Top	ml/min	110	165
	Bottom		130	135
Ash		%	0.3	6.0
Moisture		%	7.9	7.76
Wax Pick			9A	11A
Furnish			Thermo mechanical	De-inked pulp