A Case Study Of PCC Use In Fine Paper Making

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ABSTRACT

Globally major Paper Industry is shifting towards new fillers for improving the quality of paper and to enhance the printability property of paper. In order to study the behaviour of PCC in paper making laboratory study was conducted and this paper describes the laboratory data and practical experience during change over from conventional filler to PCC in manufacturing fine paper.
Keywords: Fibre, Filler, PCC, talc, ASA sizing, Retention aid, acid and alkali boil out.

Introduction

Fillers have always been important raw material in paper making, and they are now used for various reasons in a wide range of paper products. Paper makers use filler to improve product quality with respect to sheet formation, surface and optical properties like Brightness and opacity, dimensional stability and printing properties. Fillers are normally added in the wet end operation of paper making along with fibre, retention aid and other sizing chemicals. Change over from conventional filler (Talc) to PCC in a running mill requires laboratory study to understand the charge , turbidity, conductivity, hardness, pH, selection of suitable retention aid and other wet end conditions. This study would help in changeover of filler from talc to PCC for smooth plant operations and to maintain the quality of paper.

Literature:

Filling and loading materials are added for several purposes, the main one being to fill the voids between the fibers in printing paper so as to smooth its surface. They improve the opacity and usually the brightness of the paper and also help to prevent a strike through of the ink(1).The electrostatic charge on papermaking materials play a key role in many important wet end chemistry phenomena and the measurement and control of these charges is a key element in wet end chemistry process control.

Types of filler available to the paper maker are:

Natural : Chalk(Calcite) and Limestone(Calcite)

Precipitated: Scalenohedral (Calcite), Rhombic (Calcite), Acicular (Aragonite), Spherical (Calcite) and Cubic(Calcite)

Calcium carbonate fillers fall into two different classifications, depending upon their process history- natural and precipitated. The natural calcium carbonates are produced by grinding

TABLE: 1A

Laboratory Study On Retention And Drainage Study With Various Grades Of Polymers

Pulp Used : Mill Pulp

PARAMETERS	HBC	BWC	%FPR	%FPAR	pH	BW–TURBUDITY, NTU
WITH TALCUM (Blank)	0.802	0.222	**72.3**	**39%**	6.0	650
Retention aid 1 - 50 gm/t	0.802	0.15	**81.3**	**55%**		553
Retention aid 1 - 100 gm/t	0.802	0.11	**86.3**	**67%**		
WITH PCC (Blank)	0.822	0.3	**63.5**	**26%**	7.5	950
Retention aid 1- 50 gm/t	0.822	0.253	**69.2**	**33%**		907
Retention aid 1- 100 gm/t	0.822	0.235	**71.4**	**40%**		871
Retention aid 1- 200 gm/t	0.822	0.22	**73.2**	**45%**		832
Retention aid 1- 300 gm/t	0.822	0.187	**77.3**	**55%**		710
Retention aid 2- 50 gm/t	0.822	0.228	**72.3**	**35%**		875
Retention aid 2- 100 gm/t	0.822	0.203	**75.3**	**44%**		721
Retention aid 2- 200 gm/t	0.822	0.185	**77.5**	**49%**		650
Retention aid 2 - 300 gm/t	0.822	0.171	**79.2**	**60%**		600
Retention aid 3- 50 gm/t	0.822	0.287	**65.1**	**30%**		950
Retention aid 3- 100 gm/t	0.822	0.267	**67.5**	**32%**		922
Retention aid 3- 200 gm/t	0.822	0.245	**70.2**	**35%**		836
Retention aid 3- 300 gm/t	0.822	0.231	**71.9**	**42%**		778
Retention aid 1- 200 gm+ Bentonite -1kg	0.822	0.2	**75.7**	**50%**		781
Retention aid 1-300 gm+ Bentonite -1kg	0.822	0.177	**78.5**	**59%**		670
Retention aid 1-200 gm+ Bentonite -1.5 kg	0.822	0.163	**80.2**	62%		600

Retention 1: Medium molecular weight with low charge density
Retention 2: High molecular weight with low charge density
Retention 3: High molecular weight with anionic charge

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limestone and are referred to as ground calcium carbonate. Precipitated calcium carbonate is produced by chemical reactions and the process is called as carbonation process. The carbonation process is the basis for the on-site production of PCC at many paper Mills(2)

Results and discussions:

PCC slurry was collected from satellite plant and preliminary laboratory experiments were conducted taking mill pulp and wet end chemicals to understand the difference in conventional filler Talc and PCC. Analysis was done to select the suitable polymer for retention of PCC and to analyse the FPR and FPAR values. Evaluation data are shown in the Table: 1A and Table 1B

It is evident from the above table that FPR and FPAR values with Talc are 72.3 and 39 % and with PCC 63.5 and 26%. This indicates that retention values are decreasing with addition of PCC and there is increase in Turbidity and pH values. Hence various retention chemicals are tried to see the behaviour of retention values with PCC and accordingly selection of polymer is made from the above study. Based on the dosage of chemicals plant trial was planned while switching from Talc to PCC. Switch over to 100% PCC was taken in a phased manner keeping all other wet end parameter constant and change in paper properties and machine conditions are closely monitored. Initially transition was smooth but due to low retention values there is a change in wet end parameter and back water turbidity after which the optimisation of chemicals and machine conditions are changed and then stabilised was done. It was observed that machine conditions are changed when PCC is introduced and due to lump formation in the system where alkali boil out with an acid boil out was done to overcome the problems .

Paper properties of TALC and PCC are tabulated in Table: 2

TABLE:2

PAPER PROPERTIES - TALC loading Vs PCC loading

Testing particulars	UOM	TALC	PCC
Grammage	**g/m2**	70.5 - 70.7	70.0 - 70.3
Thickness	**Micron**	97.2 - 98.5	98.0 - 101
Bulk	**cc/gm**	1.37 - 1.39	1.39 - 1.43
Smoothness (Top)	**ml/min**	150 - 250	140 - 240
Smoothness (Wire)	**ml/min**	170 - 320	160 - 300
Gurley Porosity	**Sec/100ml**	21.0 - 25.0	18.0 - 23.0
Brightness	**%ISO**	89.7 - 90.5	91.4 - 91.7
Opacity	**%**	90.5 - 91.5	93.0 - 94.0
Breaking length, MD	**mtrs**	4600-5500	4500-5200
Breaking length, CD		2400 - 2900	2200 - 2500
Tear Factor, MD/CD		46-50/50-55	47-51/52-56

Observations:

Bulk and Optical properties of paper found to be improved with remarkable change in opacity parameter. There is scope in improvement of Brightness with same dosage of OBA in PCC loaded paper. Due to high opacity printing properties are found to be more appealing and improved.

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References:

1. Pulp technology and treatment for paper by James d'A. Clarke.
2. Principles of Wet End Chemistry by William E. Scott.
3. Internal reports

TABLE: 1B
Chargte & Cat Demand Study Conducted With Different Filler & Furnish

Sample Details	Charge (mV)	Cat Demand (µ eq/ L)
Hard Wood	-310	24
Mill pulp	-608	130
BCTMP	-200	100
Refined pulp	-300	121
PCC Slurry (17% TS)	-10	0
TALCUM SLURRY (320 gpl)	-716	200
Refined pulp + PCC (20% addition)	-340	58
Refined pulp + Talcum (20% addition)	-360	75
Refined pulp + BW + All chemicals with PCC filler (Without retention aid)- Conc-0.8%	-143	7
Refined pulp + BW + All chemicals with TALCUM filler (Without retention aid)- Conc-0.8%	-219	8

Remarks: Cationic demand is more or less same with TALC and PCC