Change of Filler from Talc to Wet ground Calcium Carbonate- A Noble way to reduce fiber consumption

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ABSTRACT

21st Century can be best described as the century of uncertainty. Whether it is economy, political stability, climatic change, there is always some element of uncertainty to go with it. Never the less, there are a few things which are very certain like changes happening at fast pace, customer expectations for better and cheaper products etc. Obviously, any manufacturing sector has to face this hard reality of high input cost, labour /man power cost and depleting resource etc.

Paper Industry is no exception. It is expected that the per capita consumption of paper will go past double digit by 2020 in India. Competing against inflow of imports with its quality and cost is a big challenge for the industry in addition to the ever-changing demand of the customers for better quality but at least price.

JK Paper Limited, a flagship company of JK Organization has taken up this challenge. The Mill is always on the lookout for opportunity to take a step ahead, so as to become the quality leader in the country. We believe in improvement and value customer perception for better quality but not adding to the cost. In the year 2006, it converted entire sizing from Acid to Alkaline across the board and from 2010, the conventional filler Soapstone Powder (Talc) was replaced with High bright Wet Ground Calcium Carbonate (WGCC). The path crossing was not easy but the mills could establish the whole change over process in a matter of few months.

This paper describes various measures taken up to stabilize this change over, machine productivity and up gradation of quality for the photo copy grade papers.

Introduction

JK Paper Mills, a unit of JK Paper Limited, is an integrated pulp and paper manufacturing plant producing high quality writing & printing papers such as Copier, Bond, Coated Art paper & board. ASA sizing in manufacturing process was adopted across the board since 2006 with conventional Soapstone powder as filler. Off late, there has been stiff competition from both domestic & international players on cost and quality front. Obviously, the customers start shifting towards quality available at competitive price. It was felt necessary to upgrade the existing quality without adding to the cost, though it was a very difficult proposition. While evaluating the quality parameters of some of the best products available in the market, the major difference was found to be brightness and good hand feel due to presence of Calcium Carbonate as filler. The detailed comparison is given in Table- No- 1

Table No-1(Comparative test results of JK Copier)

Sl No	Key Properties		Impact on Perfomance	Unit	JK Copier Test Results	Best in Bench Mark Samples	
						Brand Name	Test Results
A-Aeshetic Properties							
1	Brightness		Aesthetic & Contrast	%ISO	93.5	S1	99.4
2	Whiteness			-	132	S1	143
B.Physical Properties							
1	Bulk		Stiffness Hand feeling Customer perception	cc/gm	1.35	S2	1.36
2	Smoothness (Bendtsen)	Top	Machine runnability Print quality Hand feel	ml/min	200-240	S3	200-240
		Wire			240-280		220-250
3	Opacity		Print Quality in Duplex printing	%ISO	92.2	S4	94.2
4	Ash		Economy	%	11.1	S1	23.3

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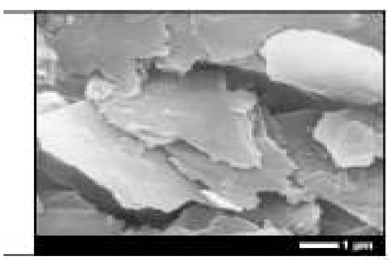
JK Copier was comparable or better in some of the critical properties but found deficient in Brightness, Whiteness and Smoothness. Machine performance wise JK Copier was found good while photocopying at variable speeds and conditions in different photo copying machines. Better Brightness, Whiteness and Smoothness of other products was primarily due to presence of different quality of filler, which was identified as Calcium Carbonate. Source of Calcium Carbonate could be PCC (Precipitated Calcium Carbonate), GCC (Ground Calcium Carbonate) or WGCC (Wet Ground Calcium Carbonate).

Calcium Carbonate as Filler

Different grades of calcium carbonate samples collected and analyzed in lab and compared against talc to find out the most suitable grade for our exclusive purpose. A detailed comparison of critical properties of Talc, Ground Calcium Carbonate (GCC) and Precipitated Calcium Carbonate(PCC) is given in Figure-1

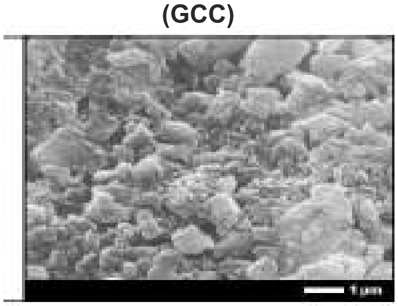
Figure No-1
(Source : M/s SMI)

Talc



Shape-Plate type
Abrassiveness-3-5 mg/cm^2
Particle size (APS in microns)-1.5-10.0
Particle size (< 2 microns)-5-7%
Brightness-82% ISO
Specific Surface Area(m2/g)-9-20

Ground Calcium Carbonate (GCC)



Shape- Rhombohedral
Abrassiveness-20-22 mg/cm^2
Particle size (APS in microns)-0.7-3.0
Particle size (< 2 microns)-10-12%
Brightness-90-92% ISO
Specific Surface Area(m2/g)-9-20

Precipitated Calcium Carbonate (PCC)

Shape- Scalenohedral
Abrassiveness-3-4 mg/cm^2
Particle size (APS in microns)-0.3-3.0
Particle size (< 2 microns)-45%(min)
Brightness-94-95% ISO
Specific Surface Area(m2/g)-3-25

The comparative properties indicate that PCC is a better choice in view of brightness, possibility to go for higher percentage of loading, maintaining bulk of the paper etc due to its scalenohedral structure. Besides, its low abrasiveness and controlled particle size distribution makes it a preferred choice over other fillers. However, issue still remains with its sustained availability at a competitive price in India. On the other hand, GCC was readily available and easy to handle.

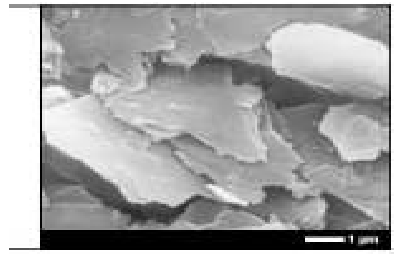
JKPM tried Ground calcium carbonate powder as filler in the year 2004-05. Due to high abrasiveness property, it resulted in wearing out of machine clothing, dewatering elements, doctors etc. Ultimately, it adversely affected machine runability, which resulted in loss of production and increase in machine down time. Finally use of this filler was discontinued after 6months of trial run.

This leaves one alternative i.e. WGCC. Once again, the material was analyzed and compared with Talc, particularly for abrasiveness and particle size distribution, which is depicted below. Detail comparison of Talc & WGCC is given in Figure No-2.

Particle size distribution of talc and Wet ground calcium Carbonate was also compared for further understanding which is given as Figure No-3

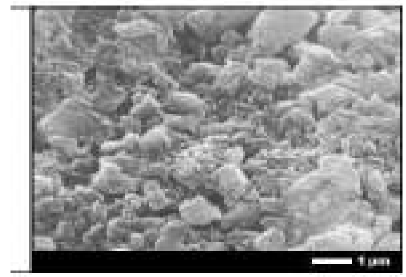
Figure No-2
(Source : M/s SMI)

Talc



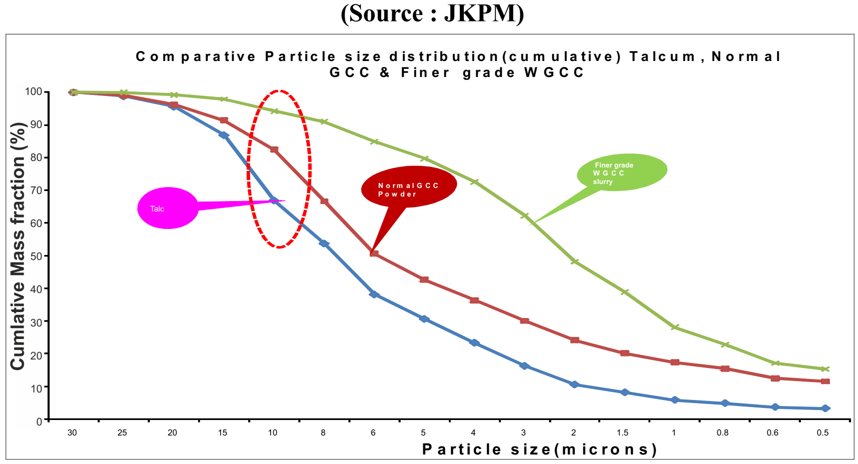
Shape-Plate type
Mohr Hardness-1
Absolute Hardness-1
Abrassiveness-3-5 mg/cm^2
Particle size (< 2 microns)-5-7%
Brightness-82% ISO

Fine grade WGCC Slurry



Shape- Rhombohedral
Mohr Hardness-3
Absolute Hardness-9
Abrassiveness-6-8 mg/cm^2
Particle size (< 2 microns)-45%
Brightness-94-95% ISO

Figure No-3
(Source : JKPM)



The above comparison indicates that WGCC has the advantage of high brightness. But, the cost of WGCC is 10-15% higher than that of traditional talc. It was realized that this additional cost is going to be a deterrent factor on its continuous use unless this is off set by some viable means. Additionally, there were some areas of concern like higher abrasiveness compared to talc that will have an adverse impact on machine clothing & stationary elements and low particle size which may lead to low retention. Therefore, it was a multifold challenge to contain cost as well as to overcome the adverse impact on machine as explained above. Also, its compatibility with ASA sizing needs to be established. Though apparently, WGCC does not seem to be incompatible, nevertheless, we have examined the chemistry of ASA i.e. its basic property and property of its emulsion.

ASA Chemistry

ASA is chemically an unsaturated hydrocarbon containing a pendant chain Succinic Anhydride. The anhydride group of ASA molecule reacts with hydroxyl group of cellulose to form an ester, which imparts sizing. Details of the esterification reaction with Cellulose & hydrolysis reaction with water are given as Picture No -4& 5

However, ASA being the highly reactive, during paper manufacturing process, the above anhydride group can also hydrolyze with water in the system to give ASA hydrozylate which is very sticky and generate unwanted problems like size reversion, runnability problem and deposits if not controlled properly. Additionally, it reduces the sizing efficiency of ASA by reducing the active anhydride group; Hydrolysis has another two adverse effects.

- The di-acid product reacts with similar chains on the attached ASA molecules. This enables the two polar carboxyl groups on the hydrozylate molecule to orient out ward and available for further reaction with water.
- The Magnesium (Mg^{2+}) & Calcium (Ca^{2+}) salts of the di acid are extremely sticky which contributes to the deposit formation and picking
- First pass retention has to be sufficiently high to retain the whole of ASA or at least most of it.
- To avoid any possible hydrolysis due to storage / standing of ASA for long, the emulsion was prepared only a few minutes prior to consumption.

Issues expected

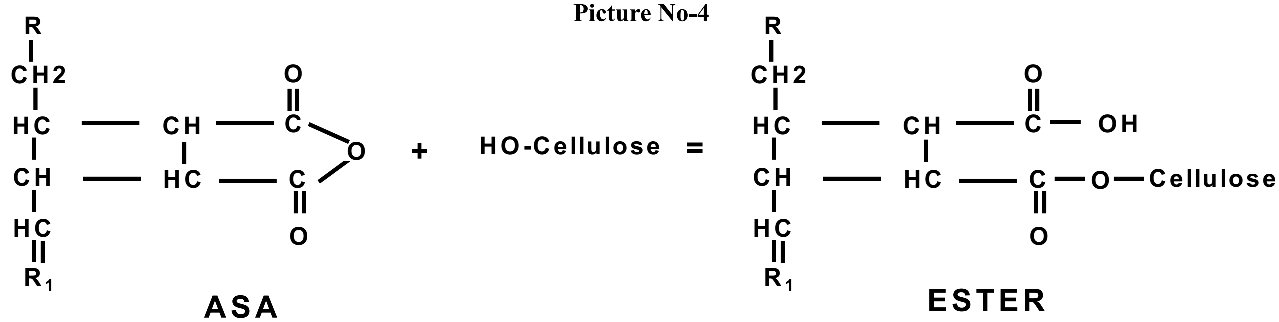
i. Compatibility with ASA
ii. Abrasive nature of WGCC resulting in more wear and tear of machine clothing
iii. Low particle size leading to poor retention
iv. Ways and means to increase loading and reduce fiber to off set the additional cost of WGCC

Trials at JKPM

Trial-I

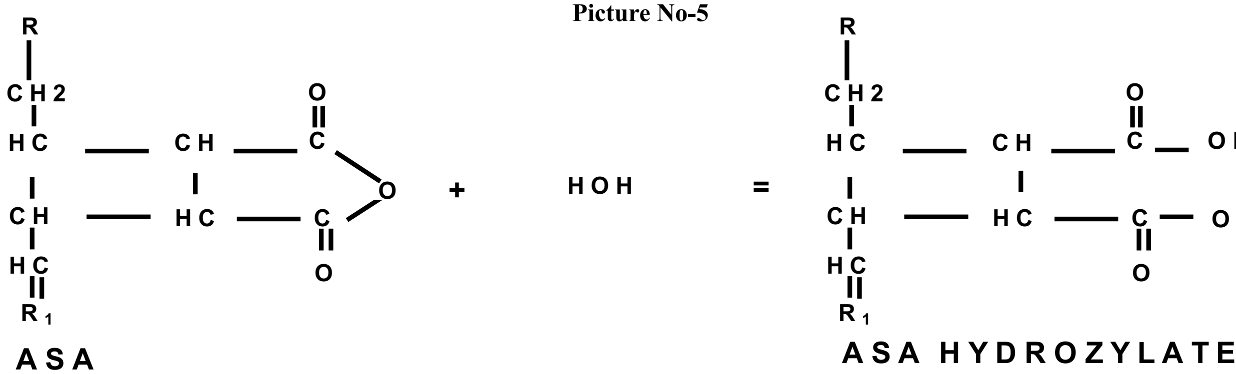
Prior to the machine trial, the compatibility of WGCC with ASA was established. There after, the first trial was taken for a period of 8 hrs to study the feasibility of CaCO3 as filler under existing conditions. The details of process conditions, paper properties and retention values observed during trial I are given in table No 2.a, 2.b & 2.c respectively.

Picture No-4



Esterification Reaction of ASA with Cellulose

Picture No-5



Hydrolysis Reaction of ASA with water

Table No-2.a(Process Conditions during Trial-I)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)
1	Machine Speed	mpm	290	290
2	Rate of Production	TPH	4.8	4.8
3	Filler type	--	Talc	WGCC
4	Steam Demand	T/T	2.5	2.5
5	Cobb Value before Size press(AS such)	GSM	45 - 50	45 - 50
6	HB Cationic Demand	Micro eq/Ltr	30-40	30-40
7	System pH	--	6.5 Ñ 0.3	7.2-7.4
8	W/W turbidity	NTU	180-250	1500-2000
9	Alkalinity	ppm	50 - 100	200-400
10	Press Load	kg/cm Ĩ	Normal	Normal
11	ASA Dosing	Kg/Ton	1.0-1.1	1.5-1.6
12	Flocculant	gm/Ton	20-25	50-100
13	NF Alum	Kg/Ton	3-5	3-5
14	Coagulant	gm/Ton	50	50

Table No-2.b(Paper Properties during Trial-I)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	Remarks
1	Brightness	%ISO	93.5	94.5	OWA could be reduced by 1.0 Kg/Ton to achieve the target brightness
2	Cobb	GSm	23-25	35-40	Sizing reversion observed i.e increase of cobb value on curing
3	Ash content	%	11-12	8-9	Ash% was low due to less retention on wire

Table No-2.c(Retention figures during Trial-I)

Sl No	Particulars	Unit	ASA+ Talc	ASA+WGCC (Trial -I)	Remarks
1	FPR	%	83-85	70-75	Low retention
2	FPAR	%	55-60	35-40	
3	Over All Filler Retention	%	78-82	60-68	

Observations

- Increase in white water turbidity from 200-300 NTU to almost 1500-2000 within an hour of start up.
- Reverse sizing
- Less FPR / FPAR

Discussion

- Hence trial stopped and on analysis, it was understood that the increase in turbidity as well as reverse sizing are more or less directly linked to very low retention on wire owing to less FPR & FPAR which has allowed the fine graded WGCC & ASA chemical into the white water system to increase the turbidity and also the unretained ASA recirculated in the system to create hydrolyzed ASA which has caused the reverse sizing problem.
- It was felt necessary to find out the ways to improve retention on wire without disturbing machine runnability.
- Immediate measure was to increase the flocculants dosage to increase fiber and filler retention. This led to deterioration in formation of paper, which was not desired.
- Other possible alternative to address the retention problem was use of wet end starch which will not only increase the retention on wire but also will improve bonding of fiber fines, fine particles of WGCC and ASA chemicals on the system.

- Hence different types of wet end starches were sourced and lab trials conducted. The lab results indicate that wet end starch with DS around 0.02 to 0.025 having a cationic charge density will be most suitable for existing conditions at JKPM as the system tends to be slightly anionic.

Trial-II

Accordingly, next trial was taken with cationic starch @ 4-5 Kg/Ton and accordingly the cationic coagulant which was used to impart cationicity (charge control) to the system was stopped.

Also we have increased flocculent (retention aid) further by 100 gm/Ton. The details of process conditions, paper properties and retention values observed during trial II are given in table No 3.a, 3.b & 3.c respectively

Observations

- Paper sizing could be stabilized around 30-35 gsm @ 1.3-1.4 Kg/Ton ASA dosage
- FPR & FPAR could be maintained around 78-82% and 45-50% respectively. The overall filler retention improved to 70-74%.
- Paper ash% could be maintained around 12-13% as per normal practice with WGCC. Other paper properties remained same or better than that with Talc and there was reduction in OWA consumption to maintain the same brightness, which was mainly due to higher brightness WGCC in use.
- White water turbidity reduced to 800-1200 NTU. This helped us the delayed backwater purging to avoid system build up with recirculated ASA and other fines.
- But occasional reverse sizing observed when ash % of paper increased intentionally.

Discussions

- It was felt necessary to increase the retention further to explore the feasibility of higher loading of ash % with WGCC with same in put as well as reduce the ASA consumption. Further trials on machine indicated that there was scope for increase in flocculent dosing further, which will definitely improve the filler and ASA retention.
- But still the use of ASA @ 1.3-1.4 Kg/Ton was a matter of concern because of its susceptible nature of

Table No-3.a(Process Conditions during Trial-II)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	ASA+WGCC (Trial -II)
1	Machine Speed	mpm	290	290	290
2	Rate of Production	TPH	4.8	4.8	4.8
3	Filler type	--	**Talc**	**WGCC**	**WGCC**
4	Steam Demand	T/T	2.5	2.5	2.5
5	Cobb Value before Size press(AS such)	GSM	45 - 50	45 - 50	45 - 50
6	HB Cationic Demand	Meq/Ltr	30-40	30-40	30-40
7	System pH	--	6.5 Ñ 0.3	7.2-7.4	7.2-7.4
8	W/W turbidity	NTU	180-250	1500-2000	800-1200
9	Alkalinity	ppm	50 - 100	300-500	200-400
10	Press Load	kg/cmI	Normal	Normal	Normal
11	ASA Dosing	Kg/Ton	1.0-1.1	1.5-1.6	1.3-1.4
12	Wet end starch(Catinonic)	Kg/Ton	Nil	Nil	4-5
13	Flocculent	gm/Ton	20-25	50	150
14	NF Alum	Kg/Ton	3-5	3-5	3-5
15	Coagulant	gm/Ton	50	50	Nil

Table No-3.b(Paper Properties during Trial-II)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	ASA+WGCC (Trial -II)	Remarks
1	Brightness	%ISO	93.5	94.5	**94.5**	-
2	Cobb	Gsm	23-25	35-40*	**30-35***	*Sizing reversion tendency reduced.
3	Ash content	%	11-12	8-9	**12-13**	Ash% was low due to less retention on wire

Table No-3.c(Retention Figures during Trial-II)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	ASA+WGCC (Trial -II)	Remarks
1	FPR	%	83-85	70-75	**78-82**	Filler retention improved with Cationic starch.
2	FPAR	%	55-60	35-40	**45-50**	
3	Over All Filler Retention	%	78-82	60-68	**70-74**	

hydrolysis. The literature scanning indicated the possibility of using surface size aid at size press, which will impart additional sizing to paper, and there by ASA dosage can be reduced.

- Based on the previous experience with surface sizing chemical (with SMA base) which was not convincing due to repeated problems of picking on our conventional pond size press roll, it was decided to go for non sticky natured Anionic Styrene Acrylamide Co Polymer based surface sizing agent for size press applications.

Trial-III

Trial conditions.

- ASA-1.3-1.4 Kg/Ton (with an aim to reduce further looking at the impact of surface sizing aid)
- Cationic starch-5 Kg/Ton
- Retention aid-150-200 Gm/Ton
- Surface sizing Agent-1.0-1.5 Kg/Ton of paper (at size press)
- NF Alum-3-5 Kg/Ton

Target

- To increase over all filler retention, FPR & FPAR
- Reduction of white water turbidity
- No reverse sizing
- Ash% on paper-15 %(min)

Trial conducted in June'2010under the above conditions. The details of process conditions, paper properties and retention values observed during trial

Table No-4.a(Process Conditions during Trial-III)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	ASA+WGCC (Trial -II)	ASA+WGCC (Trial -III)
1	Machine Speed	mpm	290	290	290	290
2	Rate of Production	TPH	4.8	4.8	4.8	4.8
3	Filler type	--	**Talc**	**WGCC**	**WGCC**	**WGCC**
4	Steam Demand	T/T	2.5	2.5	2.5	2.5
5	Cobb Value before Size press(AS such)	GSM	45 - 50	45 - 50	45 - 50	45 - 50
6	HB Cationic Demand	Micro eq/Ltr	30-40	30-40	30-40	30-40
7	System pH	--	6.5 Ñ 0.3	7.2-7.4	7.2-7.4	7.2-7.4
8	W/W turbidity	NTU	180-250	1500-2000	1000-1200	500-800
9	Alkalinity	ppm	50 - 100	300-500	200-400	200-300
10	Press Load	kg/cmĮ	Normal	Normal	Normal	Normal
11	ASA Dosing	Kg/Ton	1.0-1.1	1.5-1.6	1.3-1.4	1.0-1.1
12	Wet end starch (Catinonic)	Kg/Ton	Not in use	Not in use	4-5	4-5
13	Flocculant	gm/Ton	20-25	50	150	200
14	NF Alum	Kg/Ton	3-5	3-5	3-5	3-5
15	Coagulant	gm/Ton	50	50	Not in use	Not used
16	Surface Sizing Aid	Kg/Ton	Not in use	50	Not in use	1.3

Table No-4.b(Paper Properties during Trial-III)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	ASA+WGCC (Trial -II)	ASA+WGCC (Trial -III)	Remarks
1	Brightness	%ISO	93.5	94.5	94.2-94.6	**94.2-94.8**	-
2	Cobb	GSm	23-25	35-40	30-35**	**25-30**	**Sizing reversion tendency reduced to large extent.
3	Ash content	%	11-12	8-9	12-13	**14-15**	Ash% increased by 2-3% over blank

Table No-4.c(Retention Figures during Trial-III)

Sl No	Particulars	Unit	ASA+Talc	ASA+WGCC (Trial -I)	ASA+WGCC (Trial -II)	ASA+WGCC (Trial -III)	Remarks
1	FPR	%	83-85	70-75	78-82	83-85	Retention improved further.
2	FPAR	%	55-60	35-40	45-50	50-55	
3	Over All Filler Retention	%	78-82	60-68	70-74	78-82	

III are given in table No 4.a, 4.b & 4.c respectively

Observations

- With the use of surface sizing agent ASA dosing could be brought down to 1.0-1.1 Kg/Ton of paper. This reduction of ASA by almost 30% helped to avoid sizing reversion issue.
- Over all filler retention increased to 75-80% and also FPR & FPAR could be increased to 84-85% & 53-55% respectively
- Paper ash% could be maintained around 14-15 % without any major impact on machine runnability or final quality of paper

Based on the above, process conditions were freezed for regular run.

Other issues encountered & corrective action taken

Since the beginning of the trials till the validation points, we have experienced a few difficulties as listed below.

i) Sizing development & sizing reversion

Size reversion was possibly due to greater ASA reactivity leading to less un-reacted size in the paper sheet. The mechanism of reversion is as follows

- The ester linkage bonding to cellulose gets hydrolyzed and new free size molecule formed are able to overturn and reduce the water resistance of paper.
- Unreacted ASA residing on fiber surface hydrolyzed and converted to di acid, hence looses water resistance.

Probable reasons for the above are

a) Increase of fines in the system inform of filler, particularly due to low particle size
b) Less retention on wire
c) Increase in ASA dosage to impart sizing which on re-circulation, generated ASA hydrozylate to cause reverse sizing

The only solution was to increase the retention on wire so that white water turbidity can be controlled and subsequently ASA dosage can be further reduced.

Corrective actions

- Use of cationic starch at wet end @ 4-5 Kg/Ton of papers improved the retention as well as helped to reduce the ASA dosing to achieve desired cobb value.
- Increased flocculent dosing from 50 gm/Ton to 150-200 Gm/Ton. Hence FPR & FPAR could be maintained successfully around 83-85% & 53-55% respectively. This also improved the white water turbidity to the range of 500-800 NTU.
- Use of suitable surface sizing aid tremendously reduced the ASA consumption i.e. 1.3-1.4 Kg/Ton to 1.0-1.05 Kg/ton (almost 25-30% reduction).

With the above actions, difficulty in sizing development as well as size reversion could be eliminated.

b) Wire & Felt clogging

The clogging tendency of wire and felt increased dramatically with WGCC use as filler due to

a) Less retention filler and ASA on wire
b) Improper wire and felt cleaning.

Corrective actions

- The issues of less retention was taken care of by optimizing flocculent & wet end starch (cationic) and maintaining FPR & FPAR around 83-85% and 53-55 % on a consistent basis.
- Additional showers installed & operated at maximum possible pressure (for oscillating shower min. 17-18 Kg/cm^2 & for low pressure shower min. 3-4 Kg/cm^2) and complete coverage was ensured.
- Felt conditioning showers optimized w.r.t. Pressure and coverage and also the surfactant dosing increased by 30-40% to ensure better cleaning of felt.

c) Runability issues due to more no. of breaks at wet end

In additions to facts explained under felt and wire logging, there are some other issues for more no. of breaks at wet end due to

a) Uncontrolled dry line on wire due to higher dose of flocculants
b) Breaks due to fiber lumps and system deposits releasing as the system pH changed from 6.0-6.2 to 7.3-7.5 leading to increase in system washing frequency.
c) Biocide/slime control program in use was not effective.

Corrective actions taken

- Water drainage on the wire part improved by rectifying the alignment of drainage elements as well as the vacuum zones through which dryness could be maintained same as before
- As pH of the system increased from 6.0-6.2 to 7.3-7.5, this alkaline pH boosted the bacteria/slime growth very quickly. The TBC reading was jumping to 10^7 dilutions within a period of a week after system boil out. Hence it was decided to change over the existing slime control program (Iso thiozolene/DBNPA based) to Oxidizing organic biocide program, which seemed more effective at higher pH range. This resulted in a better control on slime growth, the TBC came to 10^2 range and system deposit reduced to a large extent. This reduction in TBC and system deposits also helped to increase the boil out gap.
- The boil out gap is fixed for 30 days for a perfect boil out maintaining right conditions for pH, Temperature and retention time etc. This helped in a big way to reduce paper breaks.

d) Increase in wear and tear of machine clothing

The wear and tear of machine clothing, particularly wire, has increased heavily. The wire life has reduced from 90 days to almost 20-21 days.

Reasons

- Higher abrasion of WGCC
- Frequent clogging of wire with WGCC fines
- Use of prolific dewatering elements on wire, which degrades faster creating unevenness in the drainage elements. This unevenness of the drainage elements aggravated the wire wear and tear with higher abrasive WGCC filler.

Corrective Action

- WGCC abrasion reduced by optimizing the wet grinding conditions to reduce the big particle sized material i.e. above 15-20 microns and also installed additional screening with finer mesh to reduce over all abrasiveness.
- As described earlier, the wire cleaning system strengthened to keep the wire clean from embedded higher abrasive WGCC particles inside the wire holes (Clogging).
- All the prolific drainage elements have been changed to ceramic for smoothness of wire movement on the drainage table with less friction.

- After consultation with wire suppliers, wire design changed to 2.5-layered STL wire, which was better in strength in comparison to previous 2-layered wire in use.

Wire life increased to 33-36 days after changing to ceramic drainage elements and setting right the wire cleaning system and further with the use of high strength STL wire , wire life increased to 40-45 days.

Cost impact

After running paper machine with WGCC as filler in ASA sizing for almost 3to 4 months, a detailed cost comparison done to evaluate cost benefits considering all the pro and cons of the change of filler from Talcum to Wet Ground Calcium Carbonate. The detailed cost sheet is given as Table No.5

Over all there is a saving of Rs.144/- per MT of paper which is over and above the additional cost incurred due to increase in wear and tear of machine clothing, use of new chemicals like cationic starch, surface sizing aid , Wet ground Calcium carbonate and usage of extra flocculent.

Conclusion

i. WGCC can replace conventional soap stone powder as filler with ASA sizing. However following care needs to be taken.
   - Retention on wire should be sufficient to handle the fine graded WGCC so as to keep ASA demand as low as possible i.e. a suitable retention program& Surface sizing program is required
   - Combination of suitable retention aid (flocculants) along with wet end starch will give desired results in retention and ASA demand.
   - Use of effective surface sizing aid & Micro particle retention system (bentonite) to control the requirement of ASA chemical for imparting required sizing to the paper.
   - Proper optimization of felt and wire conditioning as well as slime control programs

ii. Loading of Filler can be increased by almost 20-30% in comparison to the existing loading keeping the paper quality same or better than before.

iii. Paper Brightness can be improved further by 2.0% ISO with high bright WGCC with considerable saving in OWA to get the same brightness level.

iv. Due to increase in loading an equal amount of fiber can be saved which gives the overall cost benefit with an upgraded quality.

References

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2. The Sizing of Paper by Walter F. Reynolds
3. Wet End Paper Chemistry by C.O.Au and I.Thorn
4. Alkenyl Succinic Anhydride by Jerome M.ess and Dominic S.Rende(Vol-4 , Tappi Jounal-Sept'05)
5. Size Reversion By Robbert W.Novak and Dominic S.Rende (Tappi Journal-1993)
6. A review of Paper Sizing using AKD & ASA By Kevin T. Hodgson(Appita-Vol47-1994)
7. ASA SIZING A STEP CLOSURE TO GLOBALISATION By S.K.Mishra, A.K.Harichandan, P.K.Mohanty, S.K.Dakua (Paprex-2007)

Table No-5 (Cost sheet)

Sl No	Particulars	Unit	Normal JK Copier(Talc) Ash-11.5% (A)	Trial JK Copier(WGCC) Ash-14.0 (B)	Remarks
1	Fibre cost	Rs/Ton	25490	24899	Fibre cost reduced due in increase in Ash%
2	Filler cost	Rs/Ton	879	1088	Increased due higher usuage for maintaining high ash%
3	Optical w hitening agent cost	Rs/Ton	600	445	Reduced due to use of high bright WGCC as filler
4	Surface sizing cost	Rs/Ton	1264	1264	No change
5	Internal sizing cost	Rs/Ton	380	490	Increased due to additional use of flocculant and surface sizing chemcial **(Surface sizing aid cost included)**
6	Cationic starch cost	Rs/Ton	0	136	Additional cost
7	Biocide cost	Rs/Ton	35	58	Increased
8	Felt conditioning cost	Rs/Ton	45	60	Increased
9	Additional cost due to increse in machine clothing consumption	Rs/Ton		110	Increase due reductionof w ire life from 90 days to 45 days in comparsion to blank
10	Total	Rs/Ton	**28692**	**28548**	
11	Saving in comparsion to Blank (10.B-10.A)	**Rs/Ton**		**144**	

NB: Rate of production & utilities consumption remained more or less same