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Efficacy of dispersion of magnesium silicate (talc) in papermaking



Vipul Singh Chauhan^a, Nishi Kant Bhardwaj^{b,*}

^a Department of Paper Technology, Indian Institute of Technology Roorkee – Saharanpur Campus, Saharanpur 247 001, India

^b Thapar Centre for Industrial Research & Development, Yamuna Nagar 135 001, India

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Abstract The understanding of the dispersion chemistry of papermaking grade fillers is as important as their effect on paper. Magnesium silicate (talc) is one of the major fillers used for papermaking. It is hydrophobic and chemically inert. The dispersion chemistry of talc of different particle sizes was studied with wetting agent (non-ionic triblock copolymer) and anionic dispersant (sodium salt of polyacrylic acid). Both wetting agent and dispersant were added in talc slurry separately and in combination. The dispersion behavior was studied through measuring the Brookfield viscosity. The wetted and dispersed talc was also added to paper to understand its effect on papermaking process and paper properties. Wetting and dispersion changed the colloidal charge chemistry of talc making it more anionic which reduced the talc retention in paper. Lowering the particle size of talc significantly improved the light scattering coefficient (LSC) of paper and decreased its retention. Controlling colloidal charge of papermaking suspension with cationic polyacrylamide polymer helped in protecting the retention of talc without affecting the LSC of both filler and paper.

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1. Introduction

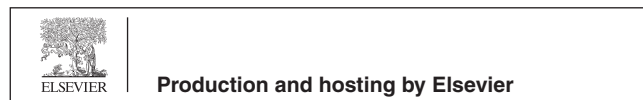
Paper consists of not only cellulosic fibers but also considerable amounts of mineral fillers. Fillers are highly desirable in print-

ing papers because they increase the light scattering, opacity and brightness, and generally improve printing properties. The mineral fillers for acid papers are talc, hydrous kaolin, calcined kaolin, precipitated silica and silicates, and titanium dioxide. For neutral and alkaline papers, layered magnesium silicate (talc), hydrous kaolin, calcined kaolin, ground calcium carbonate (GCC), precipitated calcium carbonate (PCC), silica and silicates, and titanium dioxide are used. The use of filler is important when opacity is needed at a low-basis weight; they are invaluable in packaging grades where low permeability is combined with opacity to protect food from light. The presence of fillers, however, affects fiber-to-fiber contact and reduces the paper strength (Wilson, 2006; Chauhan et al., 2012a). Other properties are improved rendering the paper useful for special

* Corresponding author. Tel.: +91 1732 292703; fax: +91 1732 292748.

E-mail addresses: nishikant_bhardwaj@rediffmail.com, dydirector@thaparpaperresearch.org (N.K. Bhardwaj).

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purposes. Filler also decreases the energy demand in pulp and papermaking process due to lesser usage of fibrous mass (Dong et al., 2008; Chauhan et al., 2011). Loading of higher filler content in paper is always desirable by the papermaker due to decreasing cost and increasing optical properties.

The filler particles added to fibers suspended in water are not easily retained in the forming sheet, as they are too small to be entrapped mechanically. Additionally both filler and fibers are negatively charged, so they repel each other (Al-Mehbad, 2004). The properties of filler are linked with the ability of the same to refract and backscatter light through the surface of the sheet. If the filler is not evenly dispersed and flocculates in small clumps, then the optical efficiency of the filler is reduced. No filler is capable of yielding high light scattering for the development of brightness and opacity without having any detrimental impact on wet-web strength and physical properties of paper. The filler used for the development of brightness and opacity debonds fibers because of its inherent high surface area (Wilson, 2006).

Filler is supposed to be well dispersed prior to its addition to papermaking slurry in order to get its impact on light scattering power of both filler and paper. The light scattering primarily depends upon the particle size and shape of filler. For the particles of same shape, the higher the particle size the lower is the scattering coefficient. The good dispersion of filler may help in increasing the light scattering for the same type of filler. The dispersion behavior of talc powders has been reported in few literatures (Charnay and Lagerge, 2003; Goaldard et al., 2006; Chauhan et al., 2012b). The role of dispersion science in pulp and papermaking process was reviewed by Rojas and Hubbe (2005). They explored the scientific principles that underlie the art of papermaking, emphasizing the state of dispersion of the fibrous slurries during various stages of the paper manufacturing process. The literature on dispersion of talc filler for use in papermaking is scarce.

The filler/pigment used in paper coating are dispersed well with suitable dispersing agents prior to their application on the paper surface, however they are added as such in paper. The effect of wetting and dispersion of filler in papermaking is not, so far, available in detail.

The most suitable wetting agent suggested in the literature is nonionic triblock copolymer. The triblock copolymer is having a central hydrophobic chain of poly(propylene oxide) flanked by two hydrophilic chains of poly(ethylene oxide) (Lee et al., 2010). It results in a complete removal of the bubble-induced attractive forces (Wallqvist et al., 2009). The widely used dispersing agent is sodium salt of anionic poly(acrylic acid) i.e. sodium polyacrylate. Sodium polyacrylate is a polymer with the chemical formula $[-CH_2-CH(COONa)-]_n$. It has the ability to absorb as much as 200–300 times its mass in water. Acrylate polymers generally are considered to possess an anionic charge. It does not adsorb to the basal plane of talc and affects the measured forces (Wallqvist et al., 2009).

Now-a-days calcium carbonate based fillers (GCC and PCC) are manufactured in situ and available in the pre-dispersed slurry form. They are mixed with some amount of dispersant to avoid the agglomeration of particles. This practice is not yet commercialized for talc ($Mg_3Si_4O_{10}(OH)_2$). This may be because of a comparatively higher particle size of talc fillers which is less favorable to particle agglomeration than the lower particle size calcium carbonate fillers. It is characteristi-

cally hydrophobic, generally inert and the softest mineral on earth. Because both sides of this structure expose an oxide surface, individual talc platelets are held together only by weak van der Waals forces (Fig. 1) (Trivedi, 1997). Compared to other silicates, talc is relatively hydrophobic due to the oxide surfaces (Trivedi, 1997; Ciullo and Robinson, 2003). The edge face is, however, hydrophilic as a result of the $-SiOH$ and $-MgOH$ groups where the surface potential is pH dependent (Målhammar, 1990; Fuerstenau et al., 1988). Being hydrophobic in nature, proper dispersion of talc might be required before its addition in papermaking slurry. This may affect the light scattering and opacity of paper through properly dispersed particles.

These considerations are used in the present study. Five samples of talc with different particle size distribution have been chosen in order to understand their dispersion chemistry and the role of dispersed talc in papermaking.

2. Experimental

2.1. Materials

The bleached mixed hardwood chemical pulp was collected from an integrated pulp and paper mill in north India. The pulp furnish was 50% eucalyptus, 35% poplar and 15% bamboo. The initial freeness of the pulp measured on Canadian Standard Freeness (CSF) tester (Tappi test method T 227 om-09) was 620 ml which was decreased to 430 ml through refining in the PFI mill following the Tappi test method T 248 sp-00. Dry powders of talc filler with five different particle sizes were sourced from a talc manufacturer in north India. The talc fillers were designated as Talc-1, Talc-2, Talc-3, Talc-4, and Talc-5 based on the decreasing particle size. The nonionic triblock copolymer having a central hydrophobic chain of poly(propylene oxide) flanked by two hydrophilic chains of poly(ethylene oxide) and nominal molecular weight of 6300 Da was used as a wetting agent to wet the surface and remove the air from the surface of talc particles. The sodium salt of poly(acrylic acid) based anionic polymer (sodium polyacrylate) having a nominal molecular weight of 5100 Da was used as a dispersant. Both wetting and dispersing agents were procured from a chemical supplier in north India. The commercial grade medium to high molecular weight cationic polyacrylamide (CPAM) was procured from a chemical manufacturer in India, and used for the retention of filler and fiber fines.

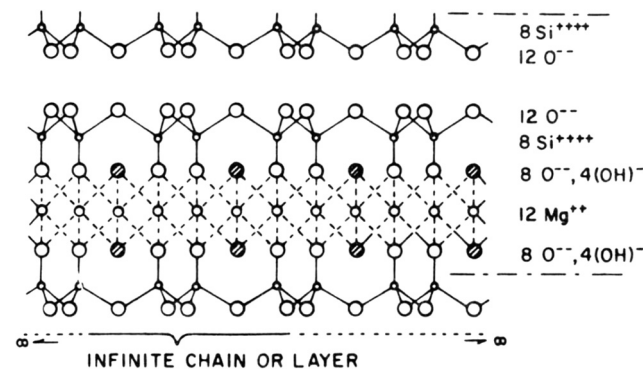


Figure 1 Molecular structure of pure talc mineral.

Table 1 Physico-chemical and optical properties of talc fillers of different particle size distribution.

Particular	Talc-1	Talc-2	Talc-3	Talc-4	Talc-5
ISO brightness, %	92.5	92.7	93.7	94.1	93.2
Ionic nature	Anionic	Anionic	Anionic	Anionic	Anionic
Colloidal charge demand, $\mu\text{eq/g}$	+1.1	+1.6	+2.0	+2.1	+2.1
Zeta potential, mV	-501	-373	-455	-410	-492
pH	9.0	9.2	9.3	9.1	9.1
Particle shape	Lamellar	Lamellar	Lamellar	Lamellar	Lamellar

2.2. Characteristics of talc fillers

The fillers were characterized for optical and physico-chemical characteristics; brightness, colloidal and surface charge, particle size distribution (PSD), and shape. The moisture free fillers were compacted in the dice with the help of arbor press. The filler dice was then used to measure the optical properties in brightness tester (Datacolor Spectraflash 300). Filler suspension (10% w/v) was filtered through a 300 μm screen and the pH of the filtrate was measured with the help of a pH meter. The colloidal charge or ionic behavior of 10% (w/v) slurry of fillers was examined on Mutek particle charge detector (PCD 03 pH). The surface charge on fillers was determined in the form of zeta potential on Mutek system zeta potential meter (SZP 06). About 500 ml filler sample (10% w/v) was taken and mixed thoroughly before measurement. The PSD of the fillers was measured using Laser scattering particle size distribution analyzer (Horiba LA950S2). The talc fillers were wetted with ethanol and then dispersed in deionized water to make 10% (w/v) slurry. In the case of Talc-3 filler, the particle size of filler was also measured after dispersing it in different manners i.e. in water only, with wetting agent, with dispersing agent, and with both wetting and dispersing agent. The measurement conditions in the analyzer were kept constant for all talc fillers. The particle shape of the fillers was determined by X-ray diffraction (Bruker AXS, D8 Advance, Switzerland) using Cu $K\alpha$ radiation. The micrographs of fillers were taken on Field emission scanning electron microscope (Quanta, FEI, Czech Republic).

2.3. Wetting and dispersion of talc filler

Initially, the effect of agitation time on dispersion of talc filler was studied. The talc filler was dispersed in deionized water (no wetting agent and dispersant) for different time periods of 30, 60, 90 and 120 min in an emulsifier at 2000 rpm speed. Secondly, the dosage of wetting agent and dispersant were optimized based upon the viscosity behavior of talc slurry. The talc filler was first diluted with deionized water at 50% solids (w/v). The slurry was agitated in high speed emulsifier for around 30 min. The wetting agent was added to the diluted filler slurry, agitated for around 5 min and the rheology of talc slurry was measured in terms of Brookfield viscosity. A graph between dosage of wetting agent/dispersant and viscosity of talc slurry was plotted to get the minima of viscosity. The dosage was selected based upon the lowest viscosity of talc slurry. The optimized dosage of wetting agent and dispersant were then used together to completely disperse the talc filler.

2.4. Handsheet preparation and testing

The fillers were dispersed in water to 10% (w/v) slurry prior to the addition in the refined pulp stock of 1% consistency (w/v). The paper handsheets of 60 g/m^2 with target ash content of around 15% were prepared as per the Tappi test method T 205 sp-02. The ash content in paper was determined at 525 $^{\circ}\text{C}$ as per the Tappi test method T 211 om-93. The ash content and first pass ash retention (FPAR) were calculated with the following formula:

$$\text{Ash content in paper, \%} = \frac{\text{o.d. weight of ash in paper (g)}}{\text{o.d. weight of handsheet (g)}} \times 100 \quad (1)$$

$$\text{FPAR, \%} = \frac{\text{Ash in paper (\%)}}{\text{Filler added based on pulp and filler (\%)}} \times 100 \quad (2)$$

The light scattering coefficient of paper was measured on brightness tester (Datacolor Spectraflash 300) as per the Tappi test method T 519 om-02. The scattering coefficient of filler was calculated from the following formula:

$$S_{\text{sheet}} = S_{\text{unfilled sheet}}(1 - L) + LS_{\text{filler}} \quad (3)$$

where S is the light scattering coefficient and L is the filler loading amount.

3. Results and discussion

3.1. Physico-chemical and optical properties of talc fillers

The filler characteristics are important for the optical and structural developments in the paper matrix. All talc fillers were having almost comparable optical properties. They were anionic in nature which was indicated by their cationic colloidal charge demand and anionic zeta potential. The cationic charge demand was indirectly proportional to the particle size of talc filler. It was increased on decreasing the particle size, due to exposure of more oxide surfaces. All mineral fillers were alkaline in nature with a pH of around 9.0–9.2 (Table 1).

3.2. Particle size distribution and shape of talc fillers

The particle size distribution (PSD) and shape of fillers are the important factors responsible for the retention of filler and light scattering in paper. The PSD of Talc-1 was the broadest among all talc fillers followed by Talc-2, Talc-3, Talc-4 and

Talc-5. The particles of Talc-1, Talc-2, Talc-3, Talc-4, and Talc-5 fillers less than 10 μm were 56.9%, 76.9%, 92.5%, 93.3% and 95.6%, respectively. Similarly, the particles of Talc-1, Talc-2, Talc-3, Talc-4, and Talc-5 fillers less than 3 μm were 0.5%, 1.3%, 2.8%, 6.4% and 7.9%, respectively. The median particle size of Talc-1, Talc-2, Talc-3, Talc-4, and Talc-5 fillers was 9.3, 7.6, 6.0, 5.7 and 5.4 μm , respectively (Table 2). The particle shape of talc fillers measured with X-ray diffractometer was lamellar (Table 1).

3.3. Wetting and dispersion of talc filler

In order to get the positive effect of the filler particles on light scattering coefficient, they were dispersed in a different manner prior to their addition to paper. In our previous study, the effect of wetting and dispersion of talc filler of medium particle size (i.e. Talc-3) on papermaking was studied (Chauhan et al., 2012b). In this study too, we have used the nonionic triblock copolymer and sodium polyacrylate as wetting and dispersing agents, respectively, and have studied their effect on the dispersion of talc fillers of different PSD. It is known that because of the amphiphilic structure of the poly(acrylic acid) based dispersant, it can be used to increase the water solubility of hydrophobic substances such as talc. Due to the anionic charge on both dispersant and platelet talc, the dispersant was not adsorbed on the basal plane of talc, rather it would

more likely be adsorbed on the hydrophilic edges of talc (Wallqvist et al., 2009).

Initially, Talc-3 filler was used to select the appropriate dosage of wetting and dispersing agent for the proper dispersion. As shown in Fig. 2, the viscosity of talc filler dispersed in water only was 234 cP (Chauhan et al., 2012b). The lowest viscosity of separately wetted and dispersed talc slurries was around 56 and 40 cP with the addition of 7 kg/t of wetting agent and 3 kg/t of dispersant in the talc filler, respectively. Thereafter, further increasing the dosage of wetting agent and dispersant did not affect the viscosity very much.

In order to analyze the combined effect of wetting and dispersing agent, wetting agent was first added in the talc slurry at a dosage of 7 kg/t on talc and agitated for 5 min. The dispersant was then added at three dosage levels, 3, 6 and 10 kg/t on talc. As shown in Fig. 3, it was observed that the combination of 7 kg/t of wetting agent and 3 kg/t of dispersant was sufficient enough to decrease the viscosity to its lowest level i.e. 24 cP (Chauhan et al., 2012b). The viscosity of talc slurry increased slightly on increasing the dosage of dispersant. Henceforth, the dispersion of talc filler was performed with the optimized dosage of both wetting agent and dispersant.

3.3.1. Micrographs of fillers

The literature shows that the talc has platelet/lamellar structure. This was further confirmed from the scanning electron micrographs of all talc fillers taken at 5000 \times magnification (Fig. 4). The micrographs also corroborate the difference in particle size of talc fillers measured through a particle size analyzer. The images of Talc-3 filler dispersed in water, wetting agent, dispersant, and wetting agent with dispersant taken from the Image analyzer are shown in Fig. 5. The images clearly indicated that there was no effect of dispersion method on the particle separation. The particles of Talc-3 filler were equally dispersed through using either of the dispersion techniques.

3.3.2. Particle size distribution of Talc-3 filler

It is obvious that the wetting and dispersion of mineral particles are always desirous to avoid the agglomeration of particles. It was observed that the PSD of Talc-3 filler wetted/dispersed in different manners was almost comparable. The median particle size of Talc-3 filler dispersed with water, wetting agent, dispersant, and wetting agent with dispersant was

Table 2 Particle size distribution of talc fillers.

Particulars	Abundance, %				
	Talc-1	Talc-2	Talc-3	Talc-4	Talc-5
< 20 μm	96.8	99.5	100	100	100
< 10 μm	56.9	76.9	92.5	93.3	95.6
< 7 μm	24.7	41.9	66.5	70.3	76.4
< 5 μm	7.1	14.5	29.7	36.2	42.9
< 4 μm	2.6	5.7	12.5	18.3	22.9
< 3 μm	0.5	1.3	2.8	6.4	7.9
< 2 μm	0.0	0.0	0.1	0.7	1.2
Median (D50), μm	9.3	7.6	6.0	5.7	5.4
Mean, μm	10.1	8.1	7.1	6.0	5.7

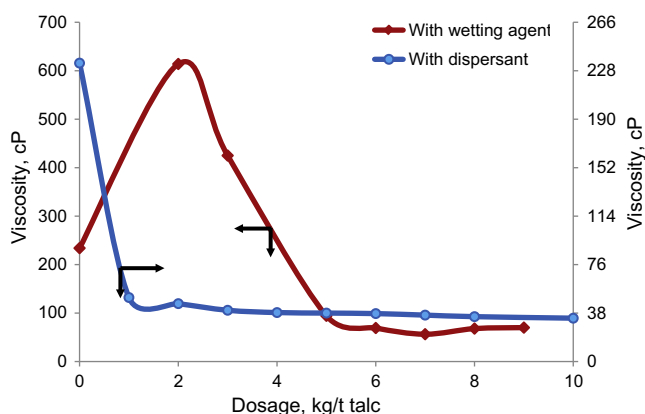


Figure 2 Viscosity behavior of Talc-3 filler treated with varying dosages of wetting and dispersing chemicals.

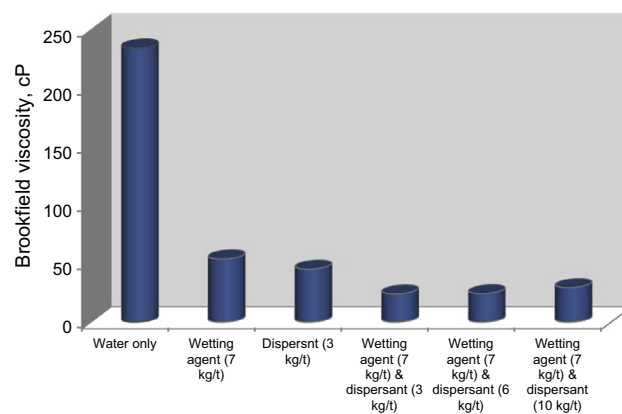


Figure 3 Effect of wetting and dispersing chemicals on viscosity of Talc-3 filler.

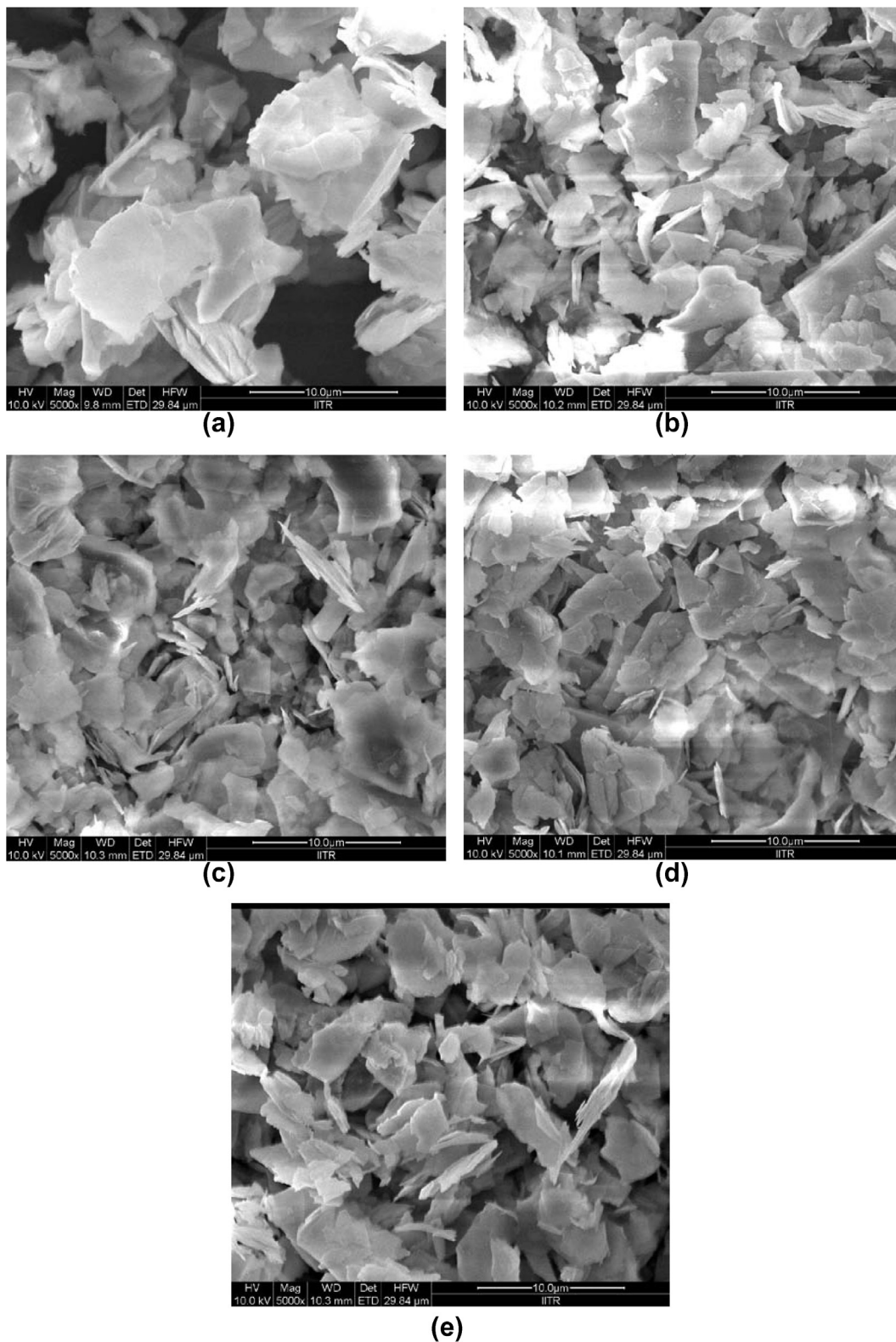


Figure 4 Scanning electron micrographs of talc fillers of different particle size distribution taken at 5000 \times magnification, (a) Talc-1, (b) Talc-2, (c) Talc-3, (d) Talc-4, and (e) Talc-5.

similar (6.0 μm) (Table 3). Under our experimental conditions, it was illustrated that the wetting and/or dispersion of talc filler did not accelerate the particle separation.

Similar results were presented by Wallqvist et al. (2009). They showed that the addition of poly(acrylic acid) did not affect the measured forces and it does not adsorb to the basal

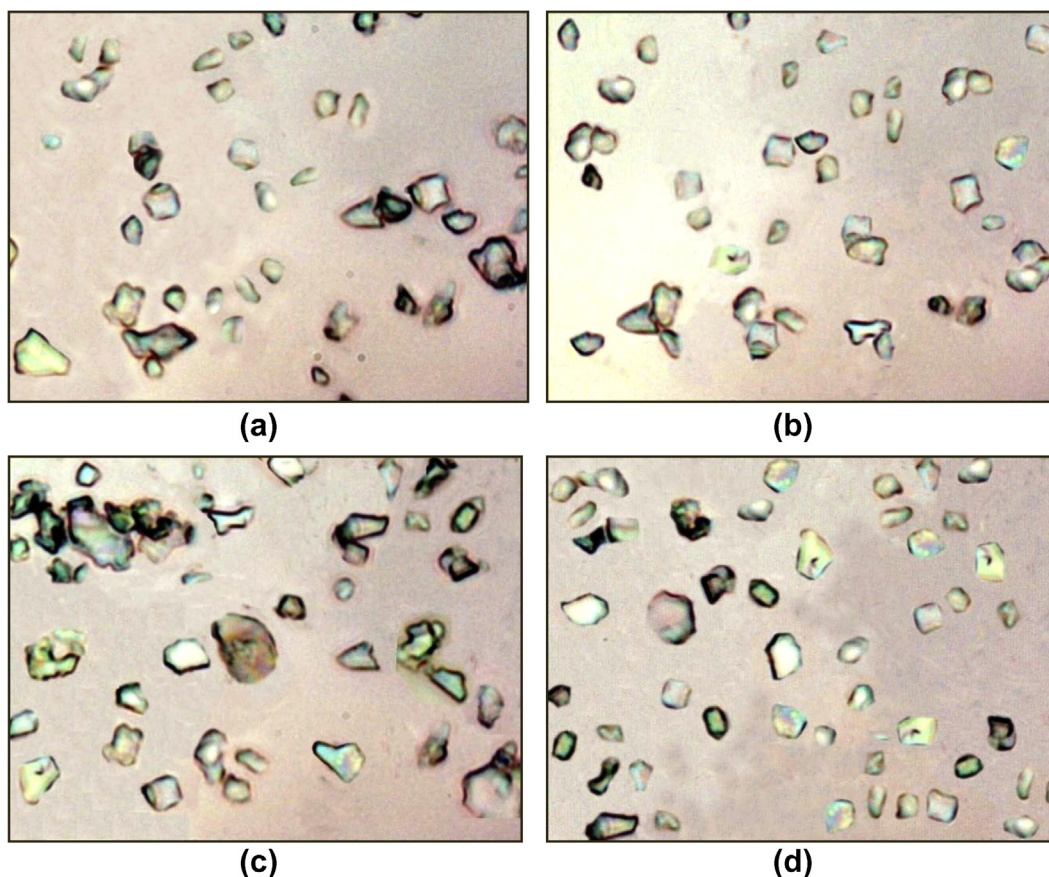


Figure 5 Micrographs of Talc-3 filler dispersed in different mediums taken from an Image analyzer at 1000 magnification dispersed with (a) water only, (b) wetting agent, (c) dispersant, and (d) wetting agent and dispersant.

Table 3 Particle size distribution of Talc-3 filler dispersed using different methods.

Particular	Abundance, %			
	With water only	With wetting agent ^a	With dispersant ^b	With wetting agent ^a and dispersant ^b
< 20 μm	100	100	100	100
< 10 μm	92.1	93.4	92.3	93.0
< 7 μm	65.8	68.3	66.8	67.6
< 5 μm	30.0	31.8	31.5	31.4
< 4 μm	13.1	14.0	14.2	13.9
< 3 μm	3.2	3.4	3.6	3.4
< 2 μm	0.2	0.2	0.2	0.2
Median (D50), μm	6.0	6.0	6.0	6.0
Mean, μm	6.4	6.3	6.4	6.3

^a Wetting agent, 7 kg/t filler.

^b Dispersant, 3 kg/t filler.

plane of talc. Moreover, the nonionic triblock polymer used as a wetting agent resulted in a complete removal of the bubble-induced attractive force.

Moreover, there was only one component affected by the wetting/dispersion that is colloidal charge of talc filler slurry.

As the pH has an effect on the colloidal charge demand of filler, the latter was measured at 9.0–9.2 pH. The cationic colloidal charge demand of Talc-3 filler dispersed in water only was 2.0 $\mu\text{eq/g}$ which increased slightly to 3.3 $\mu\text{eq/g}$ in the case of Talc-3 dispersed using wetting agent. The anionicity of Talc-3 filler increased substantially in the case of its dispersion with the dispersing agent; the cationic colloidal charge demand increased to 24.2 $\mu\text{eq/g}$. These results indicated that the anionicity of the talc filler increased on the addition of dispersant. The use of talc filler of higher anionicity will ultimately increase the anionicity of the papermaking slurry and will reduce the filler retention due to more repulsion of anionic–anionic particles. This effect was confirmed from the results of first pass ash retention (FPAR) of Talc-3 filler dispersed in different manners. The FPAR of Talc-3 filler dispersed in water only was 41.1% which decreased to 38.8%, 25.0% and 23.4% when Talc-3 filler was dispersed with wetting agent, dispersant, and both wetting agent and dispersant, respectively (Fig. 6).

3.3.3. Effect of dispersion time on retention and light scattering coefficient of Talc-3 filler

The Talc-3 filler was dispersed in deionized water and agitated in an emulsifier (2000 rpm) for different time intervals. The talc slurry was agitated for 30, 60, 90 and 120 min, and was then added to the refined pulp stock. Paper handsheets of 60 g/m^2 were prepared with the target ash content of around 15%. It was observed that the ash retention as well as scattering

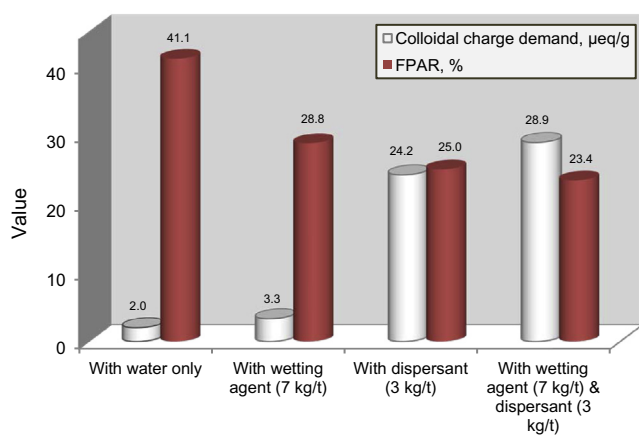


Figure 6 Effect of wetting and dispersing chemicals on colloidal charge and first pass ash retention of Talc-3 filler.

coefficient of both filler and paper were not affected by the change in the dispersion time. In all cases, the FPAR was 45.0–46.5%. The scattering coefficient of paper having 15.5% filler was 49.5 m²/kg. The calculated scattering coefficient of Talc-3 filler was 123.0 m²/kg (calculated using Eq. (3)). The scattering coefficient of paper sheet with no filler content was 36.0 m²/kg (Fig. 7).

3.4. Effect of particle size of talc filler on FPAR and scattering coefficient

The retention of filler particles increases on increasing the particle size of filler and vice versa. Our study also showed a similar trend. The filler retention decreased with decreasing the particle size of talc filler. It was highest in the case of coarsest filler i.e. Talc-1 followed by Talc-2, Talc-3, Talc-4 and Talc-5. The reduction in FPAR on wetting and dispersion of filler was also dependent upon their particle sizes. The rate of decrease in FPAR for Talc-1, Talc-2, Talc-3, Talc-4 and Talc-5 fillers was 18.8%, 35.8%, 45.4%, 44.8% and 45.0%, respectively (Table 4). There was an enormous difference in the rate of reduction in FPAR of Talc-1, Talc-2 and Talc-3 fillers whereas that of Talc-4 and Talc-5 filler was almost comparable to Talc-3.

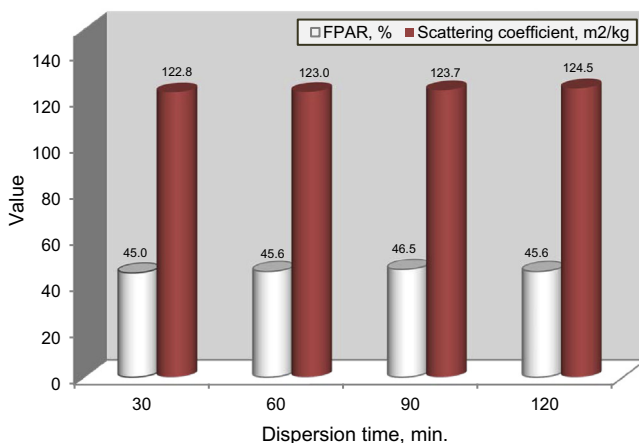


Figure 7 Effect of dispersion time of Talc-3 filler in water on first pass ash retention and scattering coefficient of talc.

Table 4 Effect of dispersion mechanism of different talc fillers on filler retention, and light scattering coefficient of talc filler and paper.

Particular		FPAR, %	Light scattering coefficient of paper, m ² /kg	Light scattering coefficient of talc, m ² /kg
Talc-1	A ^a	50.1	44.9	88.3
	B ^b	45.3	46.5	110.2
Talc-2	A ^a	42.9	48.8	126.8
	B ^b	41.7	50.1	137.5
Talc-3	A ^a	39.3	52.4	148.1
	B ^b	40.8	44.5	89.3
Talc-4	A ^a	29.1	47.4	108.9
	B ^b	23.4	48.2	127.1
Talc-5	A ^a	20.1	50.3	140.0
	B ^b	21.5	51.2	151.4

^a With water only.

^b With wetting agent, 7 kg/t filler and dispersant, 3 kg/t filler.

This showed that the particle size of filler has a great role in papermaking. If PSD of filler is broader, more fillers can be retained in paper however the light scattering will be decreased and vice versa.

The effect of PSD of talc fillers was examined through their dispersion with water only and the optimized dosage of wetting agent along with dispersant. In these experiments no retention aid was used. The reason was to observe the effect of particle size and dispersion medium on as such filler retention. The filler addition levels were selected to get around 15% ash content in paper. The FPAR vis-à-vis ash content in paper was lower in the case of fillers wetted and dispersed as compared to those dispersed in water only. The FPAR of Talc-1, Talc-2, Talc-3, Talc-4 and Talc-5 fillers dispersed in water only was 50.1%, 45.3%, 42.9%, 41.7% and 39.3%, respectively which decreased to 40.7%, 29.1%, 23.4%, 23.0% and 21.6%, respectively when the fillers were wetted and dispersed (Table 4). In order to get the same ash content in paper, the filler addition levels were increased in the case of fillers wetted and dispersed. Under our experimental conditions, there was no change in scattering coefficient of paper and filler in both the dispersion techniques. This was true for all talc fillers. The scattering coefficient of filler vis-à-vis paper increased on decreasing the particle size of filler due to more number of solid-air interfaces.

In order to observe the effect of retention aid polymer on the retention of talc filler dispersed using different methods, the Talc-3 filler was added in refined pulp along with cationic polyacrylamide retention aid (200 g/t pulp). The ash content in paper, FPAR and scattering coefficient of paper were measured. The target ash content in paper was around 15–16%. When no retention aid was used the FPAR of Talc-3 filler dispersed with water, and wetting and dispersing agent was 42.9% and 23.4%, respectively which increased to 49.2% and 50.0%, respectively with the addition of retention aid polymer. The cationic retention aid was helpful to maintain the charge chemistry of the papermaking slurry which, in turn, was helpful to maintain the same FPAR for differently dispersed Talc-3 fillers. Under our experimental conditions, the

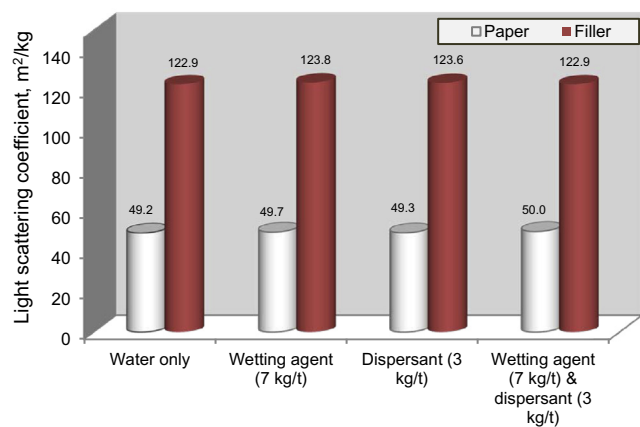


Figure 8 Effect of wetting and dispersing chemicals on scattering coefficient of paper and Talc-3 filler with addition of CPAM.

dispersion technique was not having any effect on scattering coefficient of filler which was comparable for all Talc-3 fillers (~ 50 m²/kg). As the scattering coefficient of filler was comparable and the ash content in paper was also same, the scattering coefficient of paper (~ 123 m²/kg) was comparable with the loading of differently dispersed Talc-3 fillers in paper. The dispersion technique was not having any effect on filler retention and light scattering coefficient of paper and talc filler (Fig. 8).

4. Conclusions

The amphiphilic structure of the sodium polyacrylate enhanced the dispersion of hydrophobic talc. The wetting and dispersing chemicals added in talc changed the rheology of talc slurry through reducing the viscosity. They also reduced the filler retention due to an increase in anionicity and cationic colloidal charge demand. The particle size distribution of talc was not affected with the addition of wetting and dispersing agents. The decreased filler retention could be compensated using poly(acrylamide) based retention aid polymer in the pulp stock. There was no effect of wetting and dispersing chemicals on the light scattering power of either paper or filler. Due to this behavior it may be concluded that the wetting and dispersing chemicals are not essential for the dispersion of talc for use in papermaking. The talc dispersed in water and agitation for around 30 min in the high speed agitator could be used efficiently for papermaking applications. The light scattering coefficient of both talc and paper was increased on reducing the

particle size of talc. However, the retention of talc of a lower particle size was critical and had an inversely proportional relationship with particle size. The decrease in the filler retention in paper was due to higher specific surface area of a lesser particle size talc filler. The retention aid polymer helped in maintaining the charge chemistry of papermaking slurry and increased the filler retention.

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