

STICKIES & ODOUR CONTROL IN PAPERMAKING



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Introduction :

Stickies

Waste paper is a repository of many materials of synthetic origin which behave as 'contaminants' in the recycled papermaking system.

Much of these are removed in the screening, cleaning, washing, and floatation de-inking processes.

However, some of the tacky forming material remain in the waste paper furnish which build up later to form 'sticky deposits' which hinder the runnability of the machine, adversely affect the quality of paper and also affect various parts of the paper machine.

Such deposits can lead to frequent 'paper breaks', affect life of felts and fabric, and also lead to enhanced downtime caused by frequent 'wash-ups' and 'boil-outs'.

Due to the complex nature of the 'stickies', chemical modification of the same has been of limited success.

The process of 'adsorption' of the sticky forming 'colloids' has been found to be more feasible.

'Speciality Bentonites', produced by chemical modification of raw bentonite have been found to be the most effective.

Odour

While 'Stickies' are the bane in the manufacture of W/P papers and Newsprint, 'Foul odour' is an emerging problem in the manufacture of kraft paper for packaging needs.

Like 'stickies' the odour problem is also attributable to 'contaminants'.

Although an effective Bio-control programme can eliminate 'odour' there are chances of it redeveloping over a period of time during storage or shipment.

This paper discusses about recent innovations in 'slow release' microencapsulated Biocides which can provide a long-time protection against further development of odour.

A. Stickies pose a problem mostly in the production of recycled paper for Writing and Printing. This is due to the contaminants inherent in waste paper furnish as well as chemical additives used in the production of Paper.

I. Source of Stickies

- Contaminants in waste paper.
- Wood derived pitch
- Adhesives especially PSAs
- Waxes
- Latex from CBS (white pitch)
- Microbiological growth
- Chemical additives like AKD
- Scale deposits

II. Nature of Contaminants

- Suspensions – Particles > 1 Micron
- Colloids – Particles between 10^{-3} and 1 Micron
- Solubles – Organic compounds of high MW Size : 10^{-2} to 10^{-3} Micron
- Ionic solutions : Inorganic compounds mostly in form of ions.
- Microbiological Growths : Bio-films contribute to 'stickies'.

III. Tackling the Problem

- Suspended Particles – These can be removed in the screening and washing processes.
- Microbiological Growths – Tackled with an effective Bio-control programme.
- 'Colloids and Solubles' – These require the most attention. In a closed water circuit the purely ionic products also partly precipitate to become part of 'colloids'.

The colloids are of diverse nature and can constitute of the following :-

Wood extractives, Hydrolysed Sizing agent, Soluble Adhesives , White pitch , ink , Bio-film, scale etc.

There is no direct measurement of colloidal concentration.

Turbidity is a relative measure (expressed in NTU units)

IV. Control Measures : Sticky Control requires a holistic approach

- Good screening / cleaning arrangement
- Timely Boil-outs
- Use of Coagulants
- Effective bio-control programme
- Wire passivation
- **Use of Scavengers.**

Due to the diverse constitution of sticky forming colloids, it makes practical sense to use 'scavengers' like a Bentonite.

Working Principle

- a) Bentonite works by 'Adsorption' and is largely independent of charge in the system.
- b) Bentonite is a natural clay product derived from various mines.
- c) It is activated by chemical treatment in order to impart specific functionality.
- d) Has property of ex-foliating ie. When dispersed in water under high shear , the clay opens up into nano-plates which provide a large surface area (1 gm of Activated Bentonite can produce 800 sq. m of surface area.)

e) The large surface area serves to adsorb all colloidal and potential stickies.

Bentonite Quality depending upon source. **All Bentonites are not the same !**

Fixation Properties of Different Bentonites

Bentonite Brands	Source	Fixation of Hydrophobic Particles %	Whiteness ISO
1	Bulgaria	17	45
2	Turkey	9	55
3	North Africa	34	72
4	Bavaria	19	55
5	England	17	60
6	Indonesia	5	62
7	China	12	53

For a Bentonite to function as an effective scavenger, it must be of right quality and must also be dispersed to ex-foliate fully.

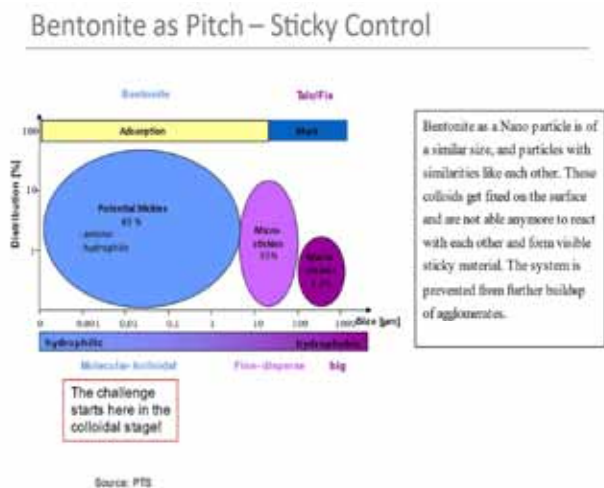
A. Mining & Activation

Mineral Sourcing, Activation, and Blending determines the right quality of Bentonite for Papermaking by the manufacturer.

B. Preparation

Dispersion of the Bentonite under high shear determines the right preparation at the users' end.

Bentonite As Pitch and Sticky Control



From the above diagram it is clear that compared to Talc, Bentonite is able to capture 65% of the potential stickies which are still in colloidal form. This is due to the fact that being a nano particle, it is able to attract particles of similar size.

Even after adsorption of the colloids, the Bentonite nano particles still remain below 1 Micron. So it is immune to shear forces in pumps, tanks and pipes. Hence it is inert to any destructive forces on its way to the paper machine.

B. Odour Problem in Paper

Foul odour is an undesirable aspect in recycled paper, especially in the packaging grades.

It affects the contents of the packaging especially food products and packaging of luxury items.

I. Source of Odour

- Waste paper contains contaminants leading to microbiological growth, the main cause of malodour.
- Closure of water circuit.
- Oxidation of wood extractives
- Degradation of chemical additives.
- Switch from Acidic to Alkaline papermaking.

Odour caused by Microbiological activity

- Anaerobic bacterial activity is the main cause of odour.
- These micro-organisms produce VFA (Volatile Fatty Acids)
- Sulfate Reducing Bacteria (SRB) evolve Hydrogen Sulfide gas.

II. Types of Odour

VFA

- Acetic Acid – Vinegar odour
- Butyric Acid – Rancid butter odour
- Propionic Acid – Odour of cheese

SRB

- Hydrogen Sulfide – smell of rotten eggs

Measure of **VFA** and **SRB** indicates presence of odour forming compounds, but as mentioned above it does not pinpoint the exact source.

Studies indicate that SRB bacteria suppresses the activity of VFA. Hence low VFA will not indicate low odour formation.

Testing for Odour: There are no chemical tests or equipment to measure odour.

The only available equipment is our Nose

Olfactory (smell) tests are the only conclusive tests for odour.

III. Measures to control odour

a) Bio-control

- Since microbiological activity seems to be the main source of odour, a good Bio-control programme is essential. This will comprise of following steps
- Periodic Boil-outs
- Use of Oxidising & Non-oxidising Biocides
- Monitoring effectivity of the programme using measurement tools such as ORP, Residual Oxygen etc.
- Using Bactaslydes to check presence of SRB, TBC and Fungal spores.

b) Use of Odour adsorbants

- Use of Bentonite and Zeolite

c) Use of Slow-release Biocides

Even with use of an effective bio-control programme, there is possibility of presence of fungal spores, which are persistent and even survive the heating zone of the Paper machine.

It is often seen that paper leaving the factory is odour free, but on prolonged storage of the paper or in overseas shipment, odour is again being reported.

On storage, the fungal spores develop into full blown fungi causing odour.

Slow-release biocides are micro-encapsulated products, used at the size press or coating.

These micro capsules are polymer based which are very ductile in the wet stage but become brittle when dry, have a tendency to slowly 'break' over time and release the biocide by diffusion.

This 'slow release' effect allows a longer duration of protection to the Paper, thereby controlling the problem of 'odour on storage'.

We have collaborated with a research based company with specialisation in **micro-encapsulation** technology.

Together we can offer tailor made products for Paper application.

These products have the following characteristics :-

- Micro-capsules of size 5 to 20 Microns, delivered in a water dilutable slurry.
- Outer shell made of thermosetting Polymer
- Heat stable upto 275 C
- Core contains the active Biocide
- Ductile in wet condition
- Brittle when dry and releases over time.
- Can deliver exceptional deposits on Paper and other surfaces over time.
- Applied by Size Press or Coating.
- Dermatologically safe : Safe to skin contact
- Prolonged biocidal activity upto at least 6 months.

Slow release Anti -Fungal Finishes

- Long lasting application of slow release fungicide
- Testing done using ISO 20743: any bacterial or fungal species can be used. Specific testing done using *Candida albicans* for anti-fungal activity
- Wide application on various substrates
- Tested at certified labs in India

Variants

- Carbamate chemistry: applicable for outdoor use, military applications, anti-mildew, anti-mould, marine fabric, carpets, very severe duty applications
- Ketoconazole active: applicable for personal clothing, skin contact
- As per our practical testing this is suitable for eliminating odour in kraft paper



Slow Release Anti -Bacterial Finishes : Paper

AATCC 147 : Antibacterial Efficacy Test

Sample Identification	Test Organism	Antibacterial activity		Conclusion	
		Zone of Inhibition	Growth under specimen		
Sample No. 01 - Treated with 95 GPL	Staph. aureus	No zone	No Growth	Bacteriostatic antibacterial activity	PASSES
	K. pneumoniae	No zone	No Growth		
Sample No. 02 - Treated with 10 GPL	Staph. aureus	No zone	No Growth	Bacteriostatic antibacterial activity	PASSES
	K. pneumoniae	No zone	No Growth		
Sample No. 03 - Treated with 50 GPL	Staph. aureus	No zone	No Growth	Bacteriostatic antibacterial activity	PASSES
	K. pneumoniae	No zone	No Growth		
Sample No. 04 - Untreated	Staph. aureus	No zone	Growth	No antibacterial activity	FAILS
	K. pneumoniae	No zone	Growth		

Poster Paper . Treatment carried out in Size Press Circulation with Capsule 2000 1 gpl and greater gave sustained antibacterial effect

Micro-encapsulation technology enables tailor made biocide products.

We have already introduced a product based on IPBC (Iodopropynylbutylcarbamate and Cinnamon oil extract (a natural biocide and aromatic masking agent)

This has been found to be effective in containing 'foul odour' in kraft paper even after one month storage in humid conditions, after dosing 0.5 g/L to 1.0g /L in Size Press starch solution.

CONCLUSION

'Stickies' and 'Odour' are two problems faced by paper makers while using waste paper furnish.

Among other solutions, the use of a montmorillonite clay like Bentonite is advocated by the Author. A fully ex-foliated Bentonite provides a large surface area for 'mopping' up all sticky forming colloids. However the 'source' as well as 'preparation' of the Bentonite are two important aspects to be taken care of.

Although 'odour' can be controlled by an effective Bio-control programme, some heat resistant fungal spores develop into odour forming colonies on storage . Micro-encapsulated Biocides when used in Size Press or Coating provide long term 'protection' due to 'slow release' of the actives.