Use of Chemical Additives in Stickies Control

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Despite considerable research, stickies remain a problem in many wastepaper-using mills. There is no single answer to the wide range of difficulties that exist and although new control techniques have been devised and implemented, in many cases problems persist, due to inferior wastepaper quality and the increased use of synthetic adhesives. The present paper highlights the findings of the work carried out at CPPRI on evaluation of different stickie control agents both indigenous and imported, which has been tried for ONP/OMG furnish of a newsprint.

INTRODUCTION

The use of recovered fibres as raw material for the manufacture of paper and board presents several advantages from the economical and environmental point of view. However, it also has serious limitations due to the large number of contaminants that the recovered paper introduces into the process. The types of contaminants classified under the general term of "stickies" are especially important. They refer to either a single component contaminant or an agglomeration of several contaminants that stick to the paper machine, final product, or one another. Stickies can be generally classified as hydrophobic, deformable materials of various solubilities and melting points. Most stickies are relatively insoluble in water over a wide pH range and behave as solid particles in the system. The hydrophobic nature of stickies represents a driving force to escape the water phase and deposit onto other hydrophobic surfaces such as forming fabrics, press felts, and roll covers. A density similar to wet fibre prevents their efficient removal by centrifugal cleaning. The thermoplastic nature of these particles and their tendency to change shape and form with temperature limits their removal by screening.

Stickies comprise a wide variety of contaminant chemistry that include hot melt glues, pressure sensitive adhesives, waxes, thermoplastic resins,inks, UV lacquers and coating binders. They may exhibit their original physical and chemical characteristics, or be a combination of the aforementioned materials possessing new characteristics.

Stickies can generally be classified into three categories: Hot melts, Pressure Sensitive Additive and Lattices. Although wax is a contaminant, but it is an important ingredient of most Hot Melts as summarized in Table 1

The most important property of stickies is however the tacky temperature. It is the temperature at which the polymeric adhesive will stick to the paper. Polymers having a tacky temperature of 50 °C or less are prone to cause the adhesive to stick to fibres and equipment. It could also be malleable and not be removed by screens. Tacky temperature is more important for hot melts, which shows tackiness at high temperatures.

Table-1 Classification of Sticky Components

	COMPONENTS	APPLICATION
Hot melts and Wax	Primary component includes vinyl acetate polymers and copolymers, tackifiers and wax.	Used in applications such as book bindings, case sealings and moisture barrier.
Pressure Sensitive Adhesive	An important component is a rubber elastomer such as the widely used styrene-butadiene. A tackifier is also added to improve the wettability.	Used in applications such as labels, tapes and self-sealing envelopes.
Lattices	It contains a rubbery component and a tackifier.	Used in applications such as foil lamination, heat-seal and coating applications. Also used in labels for varnished furnishes.

Control of Stickies: Generally the strategy used for the removal of primary stickies is based on the principle that sticky contaiminants be kept large after pulping and removed as early as possible form the process line. To remove stickies a combination of screening & cleaning, flotation and chemical additives has to be used. For effective removal of stickies during screening & cleaning, flotation and chemical addivites, care needs to be taken to properly treat the pulp.

In the present paper the findings of an evaluation study conducted for two imported and two indigenous chemical additives for stickies control have been presented. The evaluation study was conducted at CPPRI on pulp samples collected from a waste paper based mill having stickies problem using ONP/OMG furnish for Newsprint production. The evaluation was based on quantification hot macrostickies and ot melts using Pulmac Master Screen followed by image Analysis.

EXPERIMENTAL

Materials

1. **Raw Material Furnish Used**

   - Mixture of Old Newsprint (ONP)/Old Magazine Papers (OMG) collected from.nearby mill.

2. **Chemical Additives**

   - All the chemical additives used were procured from indigenous suppliers.

3. **Pulmac Master Screen and Image Analyser for Quantification of Stickies.**

The studies were conducted using Pulmac Master Screen, a customized equipment for collection of stickies using 0.15 mm slot screen and quantified using image analysis. Total stickies count were calculated using TAPPI EBA method employing image analysis in Paprican Micro Scaner and counts for Hot melts (tacky at high temperature) and Stickies (tacky at room temperature were calculated manually.

Method

1. **Sample Preparation**

100 gm oven -dry pulp samples with the addition of the required dose of chemical was slushed in a hydra pulper at a consistency of 4% for ONP /OMG furnish in each case. The sample was slushed for 15 minutes at a temperature of 45°C

2. **Quantification of Macrostickies**

Pulp samples (100 gm oven -dry basis)were diluted to 1% consistency. The samples is then fed to the Pulmac Master Screen (shown in Fig.1), having a screen slot size of 0.15 mm. After the pulp is processed, the retained contaiminants are dischrged to a collection basked and collected on a white filter paper. The contaminants together with the filter paper are then oven dried and hot pressed with a silicone paper at a temperature of 135 °C and a pressure of 950 MPa. The non sticky contaminants are then washed in a tray with the help of a brush. Some of the sticky contaminants mainly the stickies appear as colored on the filter paper on drying and were manually counted. Other sticky contaminants mainly the hot melts were found a white blotches on wetting the filter paper, and were also manually counted (shown in Fig. 2). The non-sticky contaminants were collected separately and were also considered. The white blotches were marked with a marker and sent for dirt count using image analysis. The results of dirt count considered both colored sticky contaminants and white blotches marked with marker. The above procedure has shown good repeatability and hence followed as a standard procedure for macrostickies quantification.

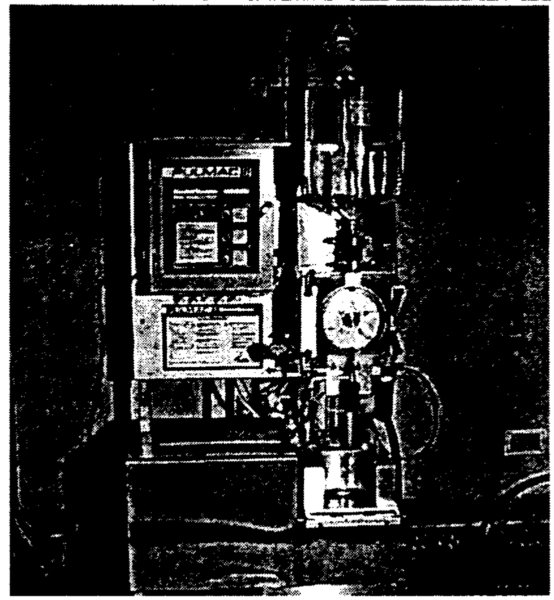

Fig. 1 Pulmac Master Screen at CPPRI for Macrostickies Quantification

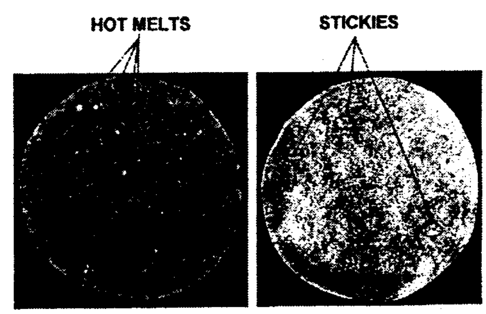

Fig. 2 Hand Sheets Showing Hot Melts and Stickies

RESUTLS & DISCUSSION

Optimization of Additive Dose for ONP/OMG furnish

1. **Dose Optimization for Additive A**

For optimization studies the chemical dosages of Additive A used were o.5%, 0.8%, 1.2% & 1.5% on o.d. paper basis. One control run was also conducted to quantify the initial stickies/hotmelts counts. The counts per Kg of o.d. pulp decreased from 3020 for control run to 1680 in the case of Total Stickies (EBA Method), 1220 to 640 in the case of Hot Melts (By Counts) and 1650 to 800 in the case of Stickies (By Counts) and the maximum reduction efficiencies achieved were 44.4%, 47.6% and 51.5% respectively at an optimum dose of 1.2% A graphical representation of the reduction efficiency are depicted in Fig. 3A, 3B, 3C below.

2. **Dose Optimization for Additive B**

For optimization studies the chemical dosages of Additive B used were 1.0%, 1.5%, 2.0%, 2.5% & 3.0% on o.d. paper basis. One control run was also conducted to quantify the initial stickies/hotmelts counts. The counts per Kg of o.d. pulp decreased from 3020 for control run to 580 in the case of Total Stickies (EBA Method), 1220 to 250 in the case of Hot Melts (By Counts) and 1650 to 320 in the case of Stickies (By Counts) and the maximum reduction efficiencies achieved were 81.5%, 79.5% and 80.6% respectively at an optimum dose of 2.5%. A graphical representation of the reduction efficiency are depicted in Fig. 4A, 4B and 4C below.

3. Dose Optimization for Additive C

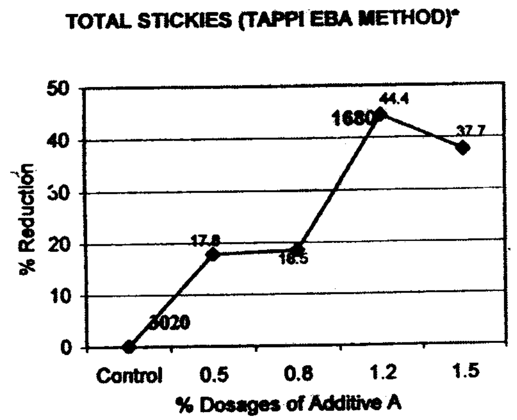

Fig. 3A

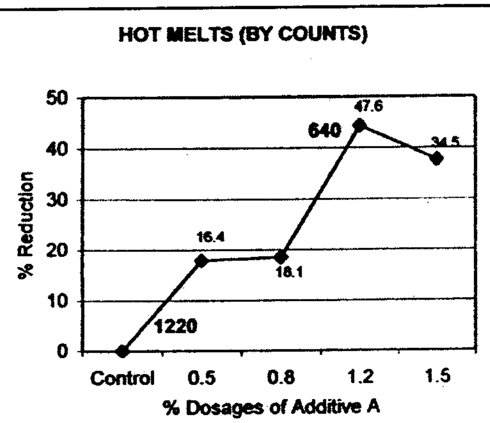

Fig. 3B

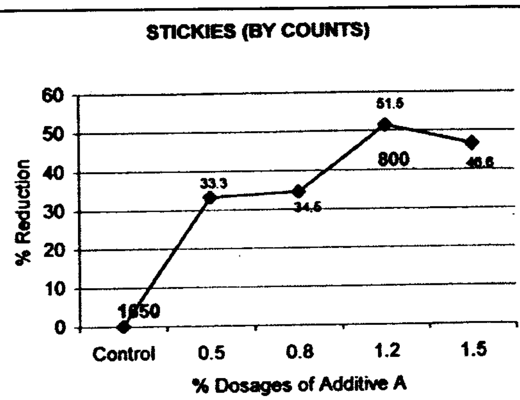

Fig. 3C

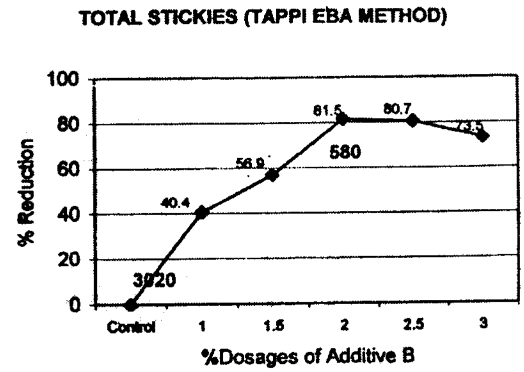

Fig. 4A

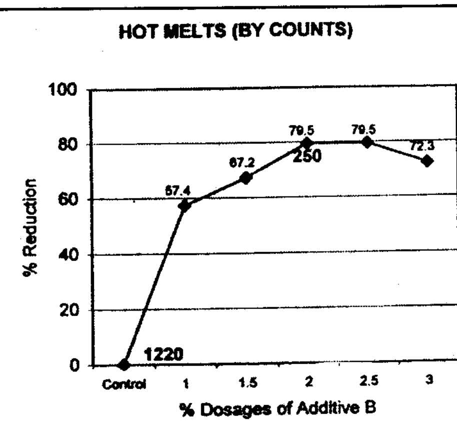

Fig. 4B

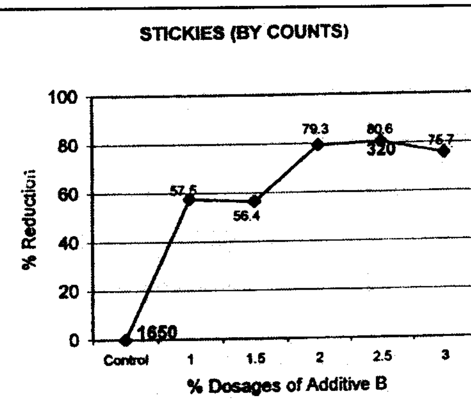

Fig. 4C

For optimization studies the chemical dosages of Additive C used were 0.08%, 0.15% & 0.2% on o.d. paper basis. One control run was also conducted to quantify the initial stickies/hotmelts counts. The counts per Kg of o.d. pulp decreased from 3020 for control run to 1100 in the case of Total Stickies (EBA Method), 1220 to 360 in the case of Hot Melts (By Counts)and 1650 to 600 in the case of Stickies (By Counts) and the maximum reduction efficiencies achieved were 63.6%, 70.5% and 63.6% respectively at an optimum dose of 0.15%. A graphical representation of the reduction efficiency are depicted in Fig. 5A, 5B and 5C below.

4. Dose Optimization for Additive D

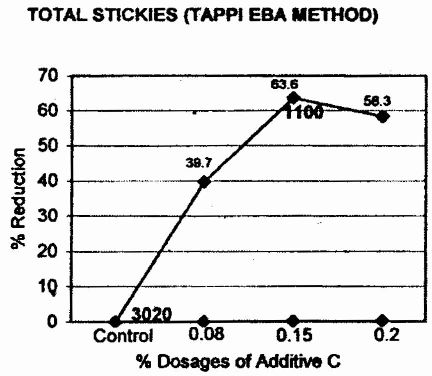

Fig. 5A

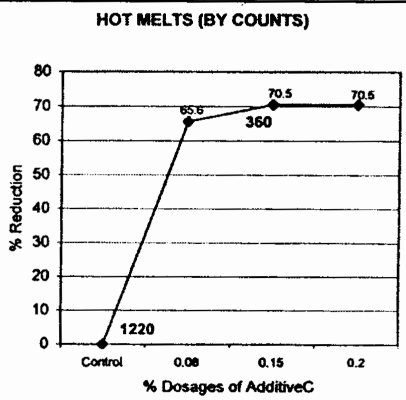

Fig. 5B

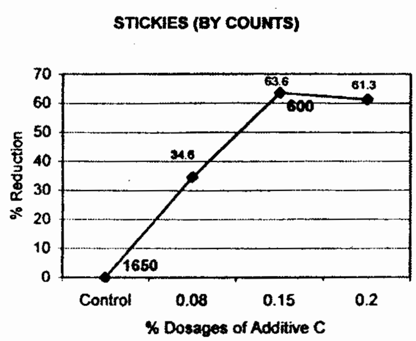

Fig. 5C

For optimization studies the chemical dosages of Additive D used were 0.05%, 0.08%, 0.15% & 0.2% on o.d. paper basis. One control run was also conducted to quantify the initial stickies/hotmelts counts. The counts per Kg of o.d. pulp decreased from 3020 for control run to 660 in the case of Total Stickies (EBA Method), 1220 to 260 in the case of Hot melts (By Counts) and 1650 to 420 in the case of Stickies (By Counts) and the maximum reduction efficiencies achieved were 78.2%, 78.6% and 74.6% respectively at an optimum dose of 0.15%. A graphical representation of the reduction efficiency are depicted in Fig. 6A, 6B and 6C below.

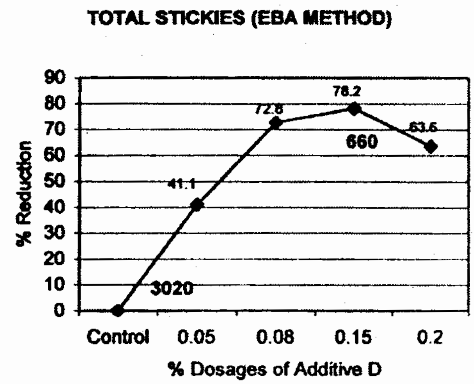

Fig. 6A

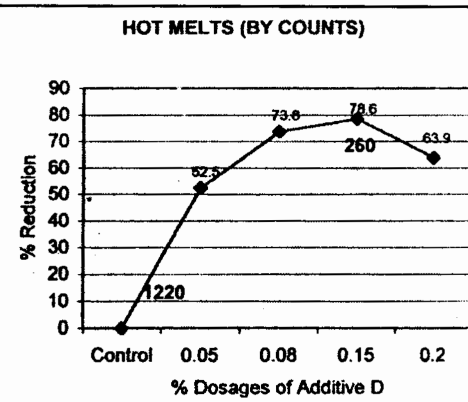

Fig. 6B

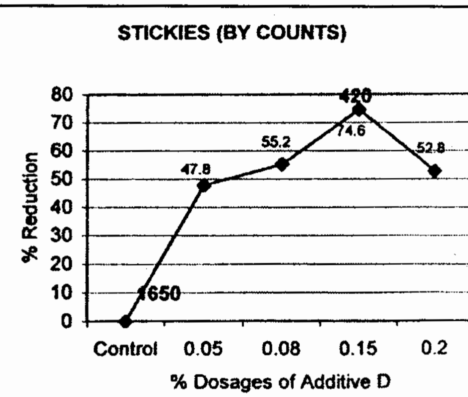

Fig. 6C

The comparison of reduction efficiency of different additives at their optimum dosage has been shown in Fig. 7 below. The Fig. shows the effectiveness of different additives at their optimum dosage for total stickies, hot melts and stickies count.

It has been found that in all the above cases the reduction efficiency achieved is in the tune of 44% to 80%. The table below shows the nature and source of the different

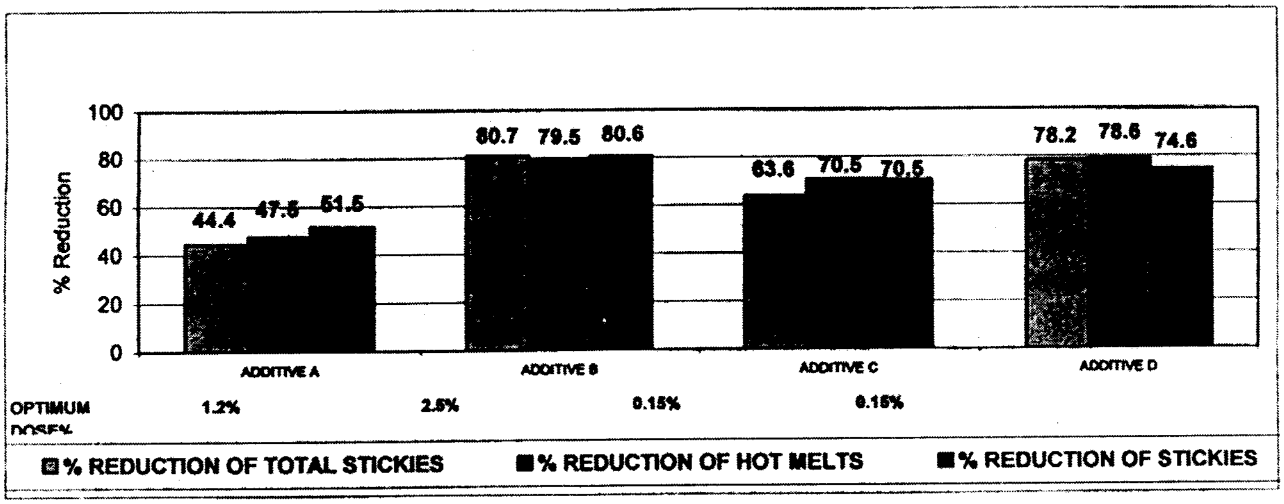

Fig. 7 Comparison of Efficiency of Different Additives at their optimum dosage

additives used.

Form the above table it is concluded that to achieve the optimum efficiency of a particular additive the dosages are higher for indigenous chemical compared to imported one. However the advantage with indigenous additive are that they are relatively cheaper and easily available. The most effective additive in reducing stickies count has been detackfiers, which have shown reduction efficiency to the tune of 80%. Another important thing that the additives have shown in common is that they are equally efficient in reducing hot melts and stickies. The chemicals have been effective in reducing stickies, wich are tacky at room temperature and causes deposition on paper machine dryers and cylinders and also those, which are tacky at higher temperature and results in blotches in the finished product.

Table 2

Additives	Nature	Source
Additive A	Dispersant	Indigenous
Additive B	Detackifier	Indigenous
Additive C	Dispersant	Imported
Additive D	Detackifier	Imported

About the chemicals

The chemical additives used in the study were provided by indigenous suppliers, the details of which are available with CPPRI. CPPRI has acquired a complete know how of the subject and with required facilities available for quantification of macro and micro stickies and can provide service to the interested parties to undertake the studies on mill-to-mill basis. Mills/ chemical suupliers interested to know the details about the chemicals and its effectiveness for their furnish can contact CPPRI.

CONCLUSION

1. Four additives (two imported and two indigenous) were evaluated at CPPRI as chemical additives for control of stickies. The results have shown substantial reduction efficiency the tune of 44% to 80% depending upon the effectiveness of the additives.
2. Among the four additives used Aditive B and Additive C have shown the maximum reduction efficiency to the tune of 80% and 78% respectively.
3. Despite the fact that with additives alone high reduction efficiencies can be achieved still there is a need to have an integrated approach including fine slot screening, flotation and then chemical addition to maximize the removal/control of the problem of stickies in order to eliminate the runnability problem.

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