Studies on the Stickies Deposition and Suppression of Stickiesin Industrial Papermaking Process

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ABSTRACT

Paper industry in Taiwan uses massive amounts of recycled secondary fibers in order to reduce production cost. Environmental and cost considerations also demand recirculation of process water to reduce clean water consumption. These lead to accumulation of stickies in the system, causing problems such as depositions on paper machines, web breakages, and blocked wires and felts which harm production efficiencies. Spots, holes and other paper defects that lower paper quality are often the results of stickies accumulation as well. Therefore, in this study, we proposed to find strategies of adding control (fixing) agents before stickies formed deposits and evaluate their efficacies. In addition, various potential stickies sources were collected and a set of spectra database was established to facilitate subsequent analyses and understanding of the stickies problems.

The study was conducted in 3 stages. In the first stage, deposit control agents were added to a paper machine, and the top-, middle-, and bottom-layer stocks and white waters were collected and through a Ciba contaminant analyzer (CCA) and wet end analysis to evaluate the efficiency of the agents. In the 2nd stage, 6 different binders where added at 7 different cationic addition regimes to establish 4 deposit-causing binders based on their greater aggregation tendencies. Subsequently, the 4 binders were separately added to a sample stock together with 4 fixing agents in order to find the corresponding agents for the binders. In the 3rd stage, known potential deposit-causing chemicals were collected for their FTIR spectra analysis to determine their functional groups and establish suitable spectra database for later comparisons with the deposits found at mill sites and probable source determinations.

The on-site study carried out at a collaborating paper mill gave results indicating that when a suitable fixing agent were added separately to the top and bottom stocks at 600 and 300 ppm, respectively, the white water turbidities and COD at the wet end decreased by 30~40%, and 30~50%, respectively. CCA analysis of the top stock found that in a 24 h dosing period, the number of colloidal particles in the system markedly reduced by 90%, while maintaining similar particle size distributions. Even 8 h after stopping of dosing, the number and size of colloids in the blank group still retained the results as during active dosing. Analysis of the bottom stock white water indicated there were no significant changes in turbidity and COD charge, yet the CCA analysis suggested that after adding the fixing agent, the number of colloidal particles in white water reduced 50~60%, whereas there was no significant reduction in the particle sizes.

The study on the effects of different binder additions on the deposit formation and at a dosage of 1.4% to pulp suggested that deposit forming tendency decreased with the sequence of SBR, PSA, PVA and EVA, with 189.3, 174.2, 151.6 and 137.2 mg, respectively. When different fixing agents were applied to an SBR binder system, or a PSA system, polyDADMAC showed the best reduction in turbidity of 78.1% in the former and 71% in the latter system; and COD removal of 30% in the former and 30.5% in the latter. When these were applied against the EVA binder system, polyamine resulted in an optimal 75.5% reduction in turbidity and 28.3% reduction of COD. In general, the stickies removal rate was not only dependent on the charge of the fixing agent, their compositions and structures also played a role. Thus, the surface charge on a fixing agent was not the sole indicator of their stickies removal effectiveness.

The deposit sources were deemed to originate from commercial chemical additives, thus, we analyzed known polymers with FTIR at wave numbers 450 to 4000 cm-1 and established database for potential deposit forming polymers. Qualitative determinations of deposits collected from press section of a brown paper mill indicated they are likely originated from PVA, EVA, and PVAc. Deposits on doctor blades of a brown paper mill, on the other hand, were likely derived from SBR, PVA, and PVAc. The database has proven effective in providing clue to the source of deposits in a papermaking system.

Keywords : stickies、deposit、paper defects、fixing agent、dissolved and colloidal substances、the Ciba contaminant analyzer 、FTIR.

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