TJ SUMMARIES

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SEPTEMBER

COATING

Rheological characteristics of platy kaolin

Anthony V. Lyons

Platy kaolin can provide significant value in the coating of paper and paperboard. It can be used in multiple applications and can provide benefits such as titanium dioxide extension, smoothness improvement, improved print gloss or ink set rates, calendering intensity reduction, and improved barrier properties. It is not a pigment that can be simply substituted for traditional hydrous kaolin without some adjustment to the coating formulation. These adjustments can be as simple as reducing solids, but may require binder changes as well. The coater setup may need to be adjusted because of the unique rheological behaviors these pigments exhibit.

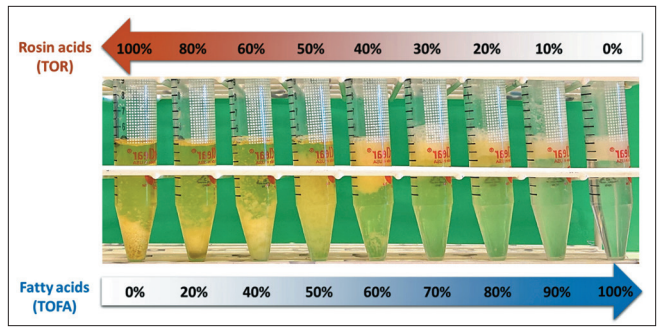
Measurements of the water retention of platy kaolin-containing coatings confirm that water retention is not reduced in comparison to more blocky kaolin pigments, despite the lower coating solids at which they need to be run. This means that the rheological characteristics are the most important in understanding the runnability. An extensive analysis reveals some unique behaviors that need to be understood when using these materials. The degree of shear thinning behaviors was investigated using the Ostwald de-Waele power law. The immobilization point was determined using the Dougherty-Krieger equation and related to the work of Weeks at the University of Maine on blade coater runnability. An indirect measure of particle shape and size synergy is also demonstrated using the Dougherty-Krieger equation parameters.

This paper on the rheological characteristics of platy kaolin includes techniques that can be used to determine how to run a coating on a coater after a change in the pigment package, without running on a pilot coater. The modeling techniques outlined can also be used to reduce dependence on benchwork to evaluate a formulation change effect on the coating rheology.

BYPRODUCTS

Critical parameters for tall oil separation I: The importance of the ratio of fatty acids to rosin acids

Ioannis Dogaris, Mikael E. Lindström, and Gunnar Henriksson



The tall oil solubility was highly dependent on the ratio of rosin acids and fatty acids.

Tall oil is a valuable byproduct in chemical pulping of wood, and its fractions have a large spectrum of applications as chemical precursors, detergents, and fuel. High recovery of tall oil is important for the economic and environmental profile of chemical pulp mills.

The purpose of this study was to investigate critical parameters of tall oil separation from black liquor. To investigate this in a controlled way, researchers developed a model test system using a "synthetic" black liquor (active cooking chemicals OH- and HS- ions), a complete process for soap skimming, and determination of recovered tall oil based on solvent extraction and colorimetric analysis, with good reproducibility.

The developed system was used to study the effect of the ratio of fatty acids to rosin acids on tall oil separation. When high amounts of rosin acids were present, tall oil recovery was low; while high content of fatty acids above 60 percent significantly promoted tall oil separation. Therefore, manipulating the content of fatty acids in black liquor before the soap skimming step can significantly affect the tall oil solubility, and hence its separation. The findings open up chemical ways to improve the tall oil yield.

PROCESS ADDITIVES

Flow characteristics of drag-reducing natural bamboo fiber suspensions with minimal environmental load

Satoshi Ogata and Takuya Kubo

The reduction of pipe friction loss by adding drag-reducing agents has attracted attention as an aid to energy conservation. Drag-reducing agents induce drag reduction (DR) effects and should have a minimal environmental load, with natural resource-saving potential.

This study demonstrates bamboo fiber as a drag-reducing agent that saves natural resources and has a low environmental load. Using pressure drop measurements, we report DR with suspensions of bamboo fibers with the average diameter of 13.3 μm and aspect ratio of 98.7. The maximum DR obtained in this experiment is 43 percent at the concentration of 4000 ppm and pipe diameter of 30 mm; DR is affected by the Reynolds number, suspension concentration, and pipe diameter. In addition, the bamboo fibers can be easily removed from the suspensions by filtration.

The researchers found that low-environmental-load bamboo fiber has DR effects like those of other fibers; its effects are greater than those of conventional synthetic fibers and wood pulp. Furthermore, it is resistant to mechanical degradation, recoverable, and recyclable. Therefore, DR effects can be selectively obtained by adding the fibers only when DR is needed; the fibers can then be collected when DR is no longer necessary. This method might greatly expand the application range of DR agents. The results demonstrate the usefulness of bamboo fibers as DR additives.

OCTOBER

RECOVERY CYCLE

Exergy and sensibility analysis of each individual effect in a kraft multiple effect evaporator

Jéssica Moreira, Bruno Lacerda De Oliveira Campos, Esly Ferreira Da Costa Jr., and Andréa Oliveira Souza Da Costa

The multiple effect evaporator (MEE) is an energy intensive step in the kraft pulping process. The exergetic analysis can be useful for locating irreversibilities in the process and pointing out which equipment is less efficient, and it could also be the object of optimization studies.

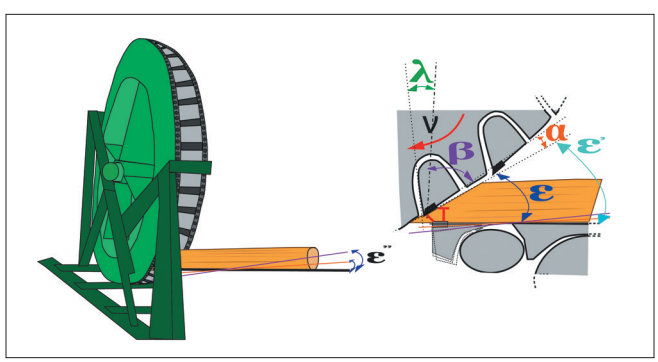
In this study, each evaporator of a real kraft system is individually described using mass balance and thermodynamics principles (the first and the second laws). Real data from a kraft MEE were collected from a Brazilian plant and were used for the estimation of heat transfer coefficients in a nonlinear optimization problem, as well as for the validation of the model. An exergetic analysis was made for each effect individually, which resulted in effects 1A and 1B being the least efficient, and therefore having the greatest potential for improvement. A sensibility analysis was also performed, showing that steam temperature and liquor input flow rate are sensible parameters.

The exergetic analysis results show that it is possible for mill personnel to determine which evaporators have the highest and lowest energy losses in the actual kraft pulp production process.

PULPING

Evaluation of novel drum chipper technology: pilot-scale production of short wood chips

Jessica Gard Timmerfors and Leif J. Jönsson



Simplified scheme of the pilot wood chipper and its angles (ε + α + β + λ = 90°). The chipper allows optimization of the cutting or spout angle (ε) without stopping the chipper and has the same cutting speed across the entire knife edge.

Impregnation of wood chips with acidic pulping liquors is improved when using short chip lengths. If the average wood chip length is too short, conventional chipping technology will generate excess small material, such as pin chips and fines.

OTHER RESEARCH APPEARING IN *TAPPI JOURNAL'S* SEPTEMBER 2019 ISSUE:

TECHNICAL BRIEF: PRINTING

A new technique for the measurement of show-through mottle of fine paper

Jean-Philippe Bernié, Julie Talbot, and Harshad Pande

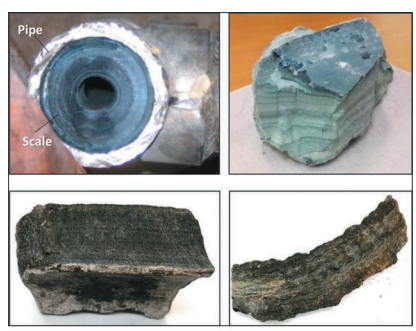
Researchers evaluated the possibility of using newly developed drum chipping technology to produce short-length wood chips, using a pilot drum chipper operating at different drum velocities and in-feed angles. With a drum velocity of 30 m/s, the average wood chip lengths and the combined fractions of pin chips and fines were 24 mm and 3.3 percent, 22 mm and 4.2 percent, and 17 mm and 8.5 percent. The highest fractions of total accept chips (large and small accepts), 89 percent to 90 percent without screening, were observed for drum velocities of 30–34 m/s and average wood chip\ lengths of 21–22 mm. The results indicate the potential of drum chipping technology for producing short wood chips with relatively high fractions of accept chips and tolerable fractions of pin chips and fines.

Mills can benefit from the use of new drum chipping technology to produce short wood chips from softwood that are suitable for acidic pulping processes.

RECOVERY CYCLE

The solubility of calcium carbonate in green liquor handling systems

Alisha Giglio, Vladimiros G. Papangelakis, and Honghi Tran



Examples of hard calcite (CaCO3) formed in green liquor pipelines of various mills.

The formation of hard calcite ($CaCO_3$) scale in green liquor handling systems is a persistent problem in many kraft pulp mills. The $CaCO_3$ precipitates when its concentration in the green liquor exceeds its solubility. While the solubility of $CaCO_3$ in water is well known, it is not so in the highly alkaline green liquor environment.

The authors conducted a systematic study to determine the solubility of $CaCO_3$ in green liquor as a function of temperature, total titratable alkali (TTA), causticity, and sulfidity. The results show that the solubility increases with increased temperature, increased TTA, decreased causticity, and decreased sulfidity. The new solubility data was incorporated into OLI (a thermodynamic simulation program for aqueous salt systems) to generate a series of $CaCO_3$ solubility curves for various green liquor conditions. The results help explain how calcite scale forms in green liquor handling systems.

Understanding how $CaCO_3$ scale is formed helps pulp mills develop viable strategies for mitigating the problem.