

Keep Your Paper Machine Deposit-free

Gaining control of the concentration and size of hydrophobic particles in the wet-end of a paper machine can dramatically improve the efficiency of the machine.

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Many of the paper machine runnability problems that are difficult to detect, monitor, and control are caused by hydrophobic particles. These can be, for example, binder-rich particles in coated broke, wood pitch or stickies associated with recycled fiber. The most important characteristic indicating propensity for runnability problems has proven to be the size, or the increase in size, of hydrophobic particles.^{1,2}

The concentration of wood fibers and fillers at the wet-end of a paper machine is typically less than 1%. Hydrophobic particles move freely in diluted water loops but can agglomerate due to hydrodynamic forces. As the agglomeration of these particles proceeds in the wet-end of the paper machine, a critical size of agglomerate is reached. At this point, the larger particles may start to cause deposition on the paper machine.

Uncontrolled agglomeration often leads to poor runnability and defects such as holes or spots, in the finished paper. Hydrophobic agglomerates with diameters of up to 15 micrometers or more have been observed in the paper machine's water circuits. The agglomeration of four of these particles could make a hole in a 60 micrometer thick light-weight coated (LWC) sheet.

Controlling the concentration and size of hydrophobic particles in the wet-end of a paper machine can dra-

matically improve the efficiency of the machine. When the particle size is kept under control, the attachment, or fixation, of these particles to the fiber surfaces is stronger. The detrimental substances can then be removed from the process with the paper web, without the risk of re-deposition. The Kemira KemFlite* concept has been developed explicitly to monitor, and ultimately mitigate, the agglomeration of these hydrophobic substances.

TOOLS & MECHANISMS

The most important process survey tool in the Kemira KemFlite concept is Kemira Flyto.* This unique method is based on modified flow cytometry (MFCM), which measures the size,

quantity and even the degree of hydrophobicity of particles in samples taken from various points in the pulping and papermaking process.

MFCM is a technique that uses light scattering to determine the concentration and size of particles in a fluid. Both forward and side scattering are measured in a flow field in conjunction with the fluorescence of the population, to determine the size and to characterize each particle in the fluid, respectively.

Compared with traditional wet-end measurements, such as turbidity and cationic demand, Kemira Flyto offers a much broader and detailed view of hydrophobic particles at key process

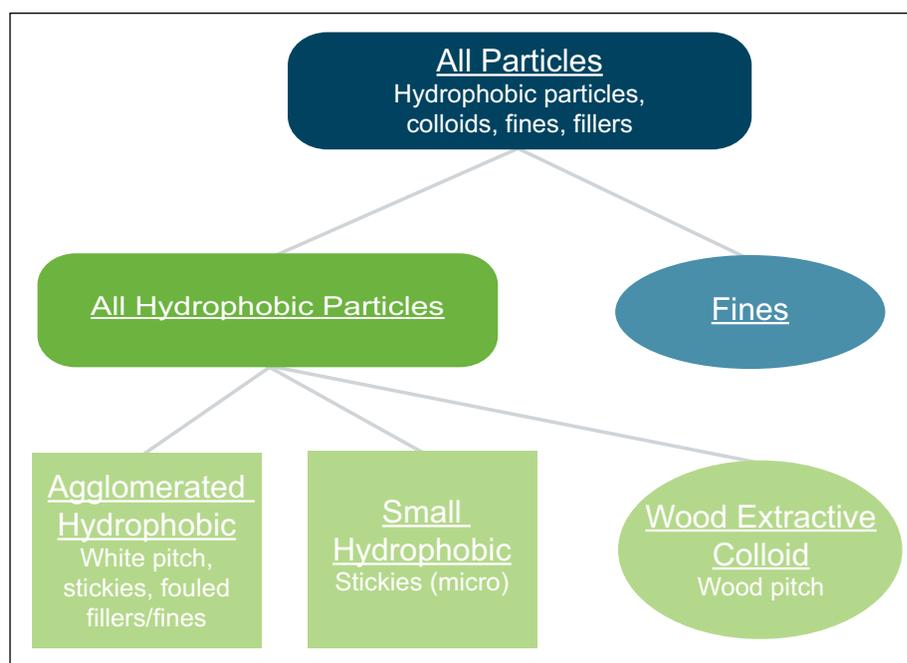


Figure 1: Particle populations and constituents measured by the Flyto method.

points. This includes white water and clear filtrate, which are pulp dilution sources typically used in the papermaking process. The impact of retention chemistry on agglomeration can also be measured, which can bring tremendous insight to deposit issues observed on the paper machine.

Kemira Flyto is both a tool for process analysis and product screening; it can be used to develop deposition control programs for coated broke, wood pitch and stickies.³ Figure 1 shows examples of particles that can be analyzed with Kemira Flyto.

Information about different particle populations - especially the particle sizes - is particularly interesting in the majority of deposit control cases. The effect of adding cationic chemicals, such as fixatives, on particle size can be studied. In doing this, the agglomeration related to and originating from overdosing of cationic chemistries can be understood and avoided.

Traditionally, turbidity has been the key, and often only parameter, used to develop and control fixative programs used for deposit control. The control strategy has historically been to reduce turbidity as low as possible. The limitation with this approach is there is no indication of what the application is doing to the particle size. Therefore, it cannot be determined if the hydrophobic particles have been fixed or agglomerated. Figure 2 demonstrates this phenomenon.

Figure 2 shows with increasing fixative application the turbidity expectedly decreases in a linear manner while the particle size stays constant. As the fixative is further increased, the turbidity continues to decrease, however there is a steep climb in particle size. This is the point of overdose, significantly increasing the propensity for deposition.

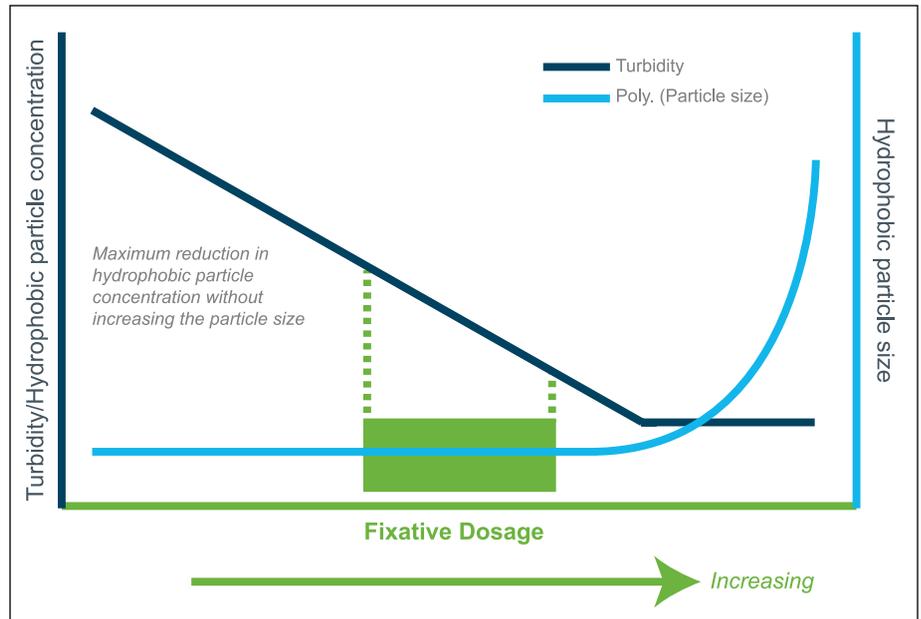


Figure 2: Turbidity and Particle Size vs. Fixative Dosage.

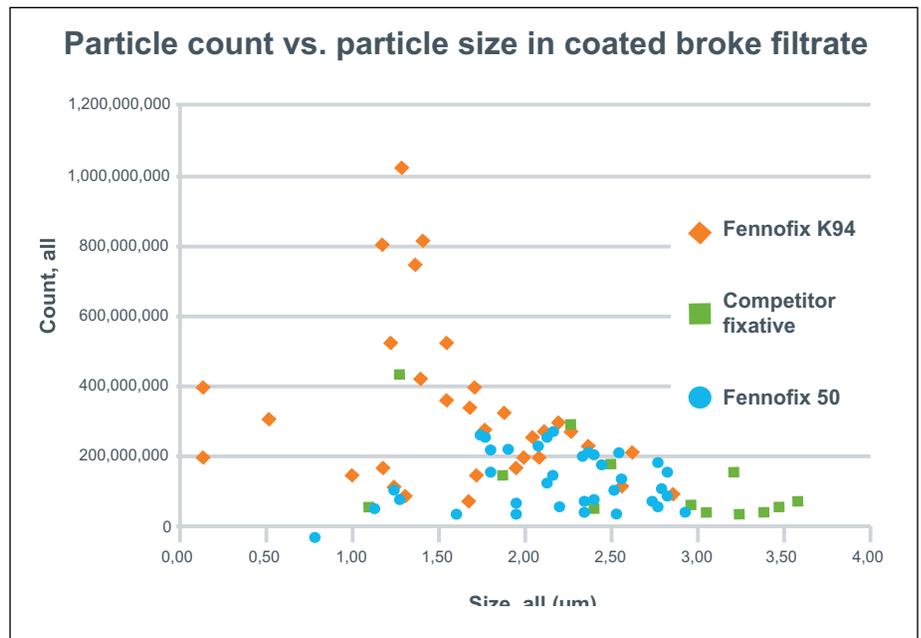


Figure 3: Flyto evaluation of fixative technologies.

CASE STUDIES

Kemira Flyto analysis has been used to support many wood pitch and coated broke applications at full scale. In order to manage concentration and mitigate agglomeration in the short loop, it is important to fix hydrophobic particles when they are small (before agglomeration).

Figure 3 demonstrates the effect of three (3) different fixative technologies on the quality of coated broke filtrate in a trial period. The fixatives were dosed after the coated broke tower, just before the coated broke thickener.

Fennofix K94, a low-charge fixative, showed no agglomeration tendency on the coated broke filtrate. Although

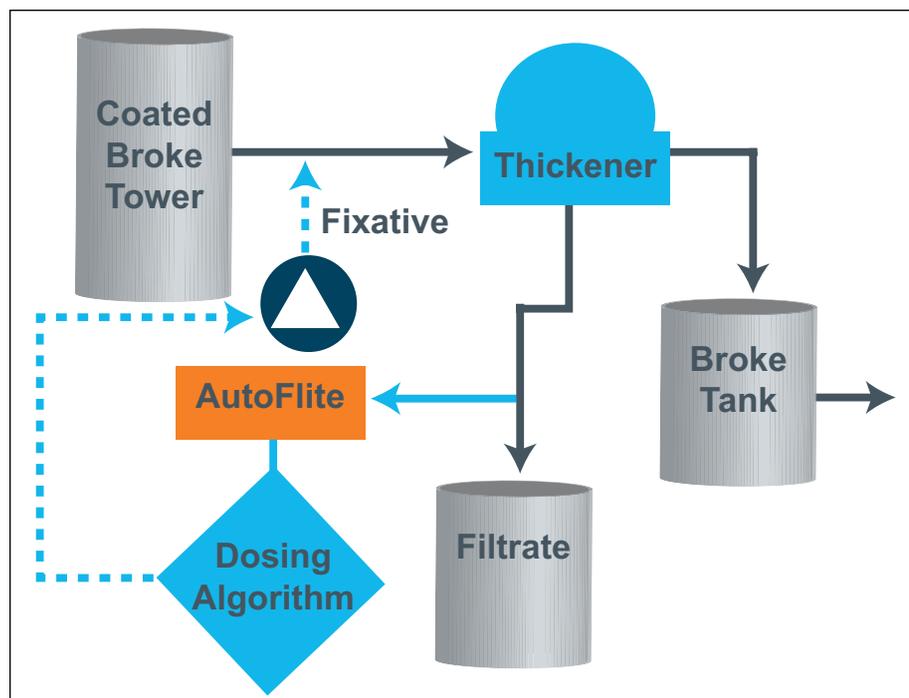


Figure 4: Monitoring of coated broke line using Kemira AutoFlite.

it showed significant residual particle concentrations, the average particle size was low. More aggressive chemistry such as a dimethylamine-epichlorohydrin (DMA-Epi), Fennofix 50, showed much greater particle concentration reduction (i.e. a lower particle count in the filtrate), but with larger average particle sizes at higher dosage.

The worst performer was the reference fixative blend, which was very aggressive in reducing particle concentration, but at the cost of dramatically increasing the particle size. Coated broke filtrate agglomeration, which was detected by the Kemira Flyto method, was present in the short loop circulation, where the white water exhibited agglomeration. This was the principle driver for causing defects in the finished paper.

When the reference fixative blend was replaced with the less aggressive fixatives, the agglomeration of hydrophobic particles in the coated broke

and subsequently in the white water was significantly reduced. When this occurred, the finished paper defects were no longer present.

KEMIRA AUTOFLITE

Kemira has continued to innovate in the area of hydrophobic particle measurement and management. A new online measurement has been developed. Kemira AutoFlite* can be used to monitor the agglomeration risk of different process waters, such as broke filtrate or paper machine white water.

The Kemira AutoFlite measurement has correlated accurately with the laboratory Kemira Flyto data and, most importantly, with paper machine runnability, including paper defect rates. The combination of Kemira AutoFlite and Kemira Flyto offers the fastest way to identify the optimal technology, application point and application rate, for preventing deposition in the paper processes. Figure 4 shows a schematic

of a Kemira AutoFlite installed on a coated broke line.

CONCLUSIONS

Kemira Flyto has been used in laboratory work to develop the optimal treatment program for pulps (such as pressure groundwood (PGW) and bleached Kraft) and coated broke, for mitigation of wood pitch and white pitch, respectively. It has also been used to measure the efficiency of such programs in full scale application.

Kemira Flyto analysis has been proven to be a highly effective tool for problem solving and trouble-shooting mill runnability and quality problems. In addition to the laboratory measurements, a novel on-line tool, Kemira AutoFlite, has been developed to monitor and control the dosage of deposit control products on paper machines producing light-weight coated (LWC) and coated free sheet (CFS) grades. ■

* Kemira KemFlite, Kemira Flyto and Kemira AutoFlyte are all registered trademarks of Kemira Oyj.

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