Many of the runnability problems that are difficult to detect, monitor and control at the paper or board machine are caused by hydrophobic particles. These can be, for example, binder-rich particles in coated broke, wood pitch or stickies associated with recycled fibre. The most vital characteristic to describe the risk of runnability problems has proven to be the size, or the increase in size, of these hydrophobic particles.1,2

The concentration of wood fibres and fillers at the wet-end of a paper machine is typically less than 1%. Hydrophobic particles can move freely in diluted water loops, but can agglomerate due to hydrodynamic forces. As the agglomeration continues in the wet-end of the paper machine, a critical size of agglomerate is reached, at which point the larger particles may start to deposit on the wires, felts and dryers.

Uncontrolled agglomeration often leads to poor runnability and defects like holes, spots, specks and hicckeys in the finished paper or board product. Hydrophobic agglomerates with diameters of up to 15 micrometres or more have been observed in the paper machine’s water circuits. The agglomeration of four of these particles would, for example, 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 dramatically improve the efficiency of the machine. When the particle size is kept under control, the attachment of these particles on the fibre surfaces is stronger. The detrimental substances can then be removed from the process with the paper web, without the risk of redeposition. The Kemira KemFlite* concept has been developed specifically to monitor and ultimately mitigate the agglomeration of these hydrophobic substances.

**Tools & mechanisms**

The most important measurement and process survey tool in the Kemira KemFlite concept is Kemira Flyto.* This unique method is based on modified flow cytometry (FCM), 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.

FCM 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 fluorescence of the population to determine the size of and to characterise each particle in the fluid.

Figure 2 illustrates this application rate versus agglomeration phenomenon. From Figure 2a it can be concluded that all of the tested fixatives decreased the turbidity and cationic demand of the coated broke efficiently in a lab-scale fixation test. The reference product (the last one) was the most effective in that sense and it would have been selected without the information gained on particle amounts and average sizes observed on the paper machine. Kemira Flyto is both a tool for process analysis and a screening tool used to develop deposition control programmes for coated broke, wood pitch and stickies.3

Figure 1 shows examples of particles that can analysed with this tool.

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. By doing this the agglomeration related to and originating from overdosing of cationic chemistries can be avoided.

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

Kemira Flyto offers a much broader diagnostic view of the particles - especially the particle sizes - is particularly interesting in the majority of deposit control cases. The effect of any of the runnability problems has proven to be the size, or the increase in size, of these hydrophobic particles.1,2

**Figure 2 - Effect of different fixatives on turbidity & cationic demand (a) & particle amounts and average sizes measured by Flyto (b)**

![Figure 1 - Particle populations & constituents measured with Flyto method](image-url)

Henri Villanen and Mari Zabihian present Kemira’s new concept for controlling deposits in papermaking.

---


Figure 3 - Effect of different types of cationic fixatives on the quality of coated broke filtrate in a mill trial period

Case studies

Kemira Flyto analysis has been used to support many pitch or white pitch control applications at full scale. In order to keep the size and number of white pitch aggregates low enough in the short loop, it is important to fix them as small as possible and ensure a proper retention of these small hydrophobic particles. 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 also present in the short loop circulation, where white water exhibited similar agglomeration. This caused quality problems in the finished product. Complaints then followed from the printing customer.

Kemira AutoFlite

In addition to laboratory measurements, a new online measurement has been developed and Kemira has continued to work in the area of hydrophobic particle measurement and management. Kemira AutoFlite*, a new online monitoring tool, can be used to monitor the agglomeration risk of different process waters, such as broke filtrate or paper machine white water.

Kemira AutoFlite measurement has correlated relatively well with laboratory Kemira Flyto data and, most importantly, with paper machine runnability, including paper machine white water. Kemira AutoFlite measurement has correlated relatively well with laboratory Kemira Flyto data and, most importantly, with paper machine runnability, including paper machine white water. This can be combined with Kemira’s FennoDose system to optimise dosage rate of the fixing agent.

The combination of Kemira AutoFlite and Kemira Flyto offers the fastest way to identify the right technology and dosage, often preventing deposition in the paper and board processes. Figure 5 shows a correlation between data from an on-line AutoFlite unit and Flyto laboratory measurement.

Conclusions

Kemira Flyto has been used in laboratory work for treating chemically various pulps, such as for the mitigation of wood pitch in pressure groundwood and bleached Kraft and of white pitch in coated broke. It has also been used to measure the efficiency of such programmes in full-scale application. Technologies such as anionic and non-ionic dispersing agents, in addition to fixatives, have been evaluated to identify the best single or dual programme for the specific cases.

Kemira Flyto analysis has been proven to be a highly effective tool for problem solving and troubleshooting in mill runnability and quality problems. In addition to 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 LWC and coated free sheet grades.

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

References


Contact

Henri Villanen
Senior Specialist, Deposit Control, Kemira Paper, EMEA
Tel: +358 50 387 4203
E-mail: henri.villanen@kemira.com
Website: www.kemira.com