Industrial analyser for monitoring & controlling **white water in paper manufacturing**

KEIT spectrometers

Recycling white water is at the heart of economical and environmentally friendly paper production. By measuring the quality of the recycled water, the IRmadillo allows the on-line and real-time analysis and control of the process – reducing costs and improving efficiency.

Introduction

Paper manufacturing is becoming increasingly complex and the need to deal with recycled paper as a feedstock brings its own challenges. For example, the inks and glues used in paper-product manufacturing can present problems as contaminants in recycling newsprint and other materials. They can cause significant quality and production problems in the paper machine which may lead to down time and reduction in profit. Monitoring and controlling the build-up of contaminants ("stickies") in white water is a real challenge in the industry.

What's the solution?

Traditional analysis tools – such as pH or temperature probes – are not able to measure stickies or other contaminants. Off-line analysis shows some promise, but is a very labour-intensive process, slow, expensive and difficult to perform.

The best solution for this problem is spectroscopy! This is because spectroscopy measures chemicals directly rather than physical properties, but does so on-line and in real time rather than using a laboratory method. There are many different sorts of spectrometers, such as near infrared (NIR), Fourier transform mid infrared (FTIR), Raman, fluorescence and UV-visible spectrometers. Each type of spectrometer has a different niche and strength, and it's important to pick the right tool for the job.

The IRmadillo is a static-optics FTIR spectrometer (mid infrared), that can be calibrated as a universal process analyser – able to measure a very wide range of properties, processes and applications across the paper-making space – especially in white-water chemical makeup.

What applications can it measure?

The IRmadillo can be calibrated to measure a wide range of chemicals, including:

- **Organic chemical additives** (such as epichlorohydrin or PAEA)
- **Inorganic salts** (such as nitrates, phosphates and sulphates)
- **Peroxides, chlorates and other bleaching additives**

The IRmadillo can also be used to run qualitative classification models (such as SIMCA, PLS-DA and SVC). These chemometric models can be converted into simple outputs for the process engineer on shift to read such as "In specification", "Drifting outside of specification" and "Take action". It alerts production staff to the buildup of stickies, giving the production team enough warning to fix issues before they become problematic.

Keep in mind the IRmadillo is an FTIR not an NIR instrument

There has been a lot of work trying to bring NIR instruments to the manufacturing floor, and various attempts to use NIR for process measurement and control in paper manufacturing.

Unfortunately, the fundamental physics behind NIR means it's not an ideal solution for the challenges faced in paper manufacturing, and struggles to provide meaningful information. The IRmadillo is an FTIR, not an NIR so has substantially more information available for interpretation!

IRmadillo™

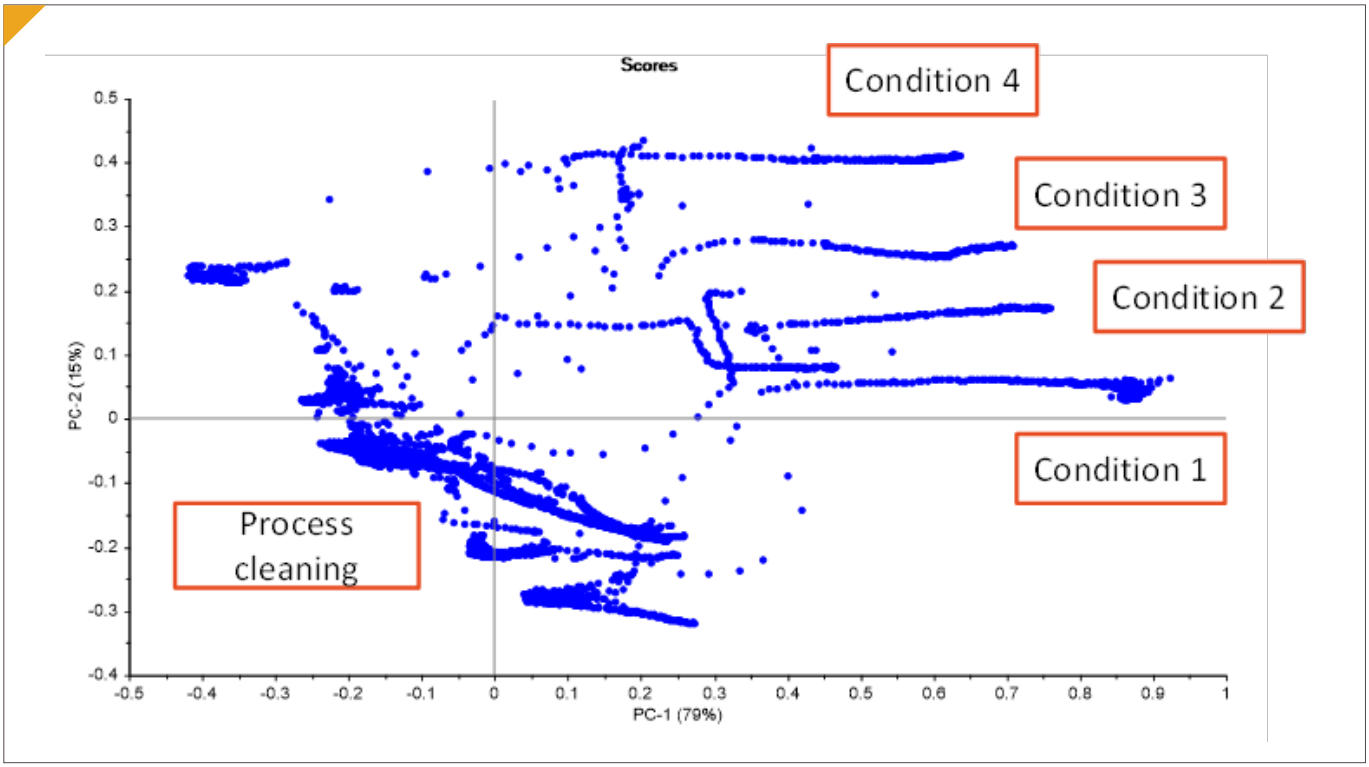

Figure 1: Example principal component analysis (PCA) plot of different process conditions and a cleaning step

How well does it work?

The IRmadillo can provide highly accurate quantitative and qualitative analyses.

Quantitative calibrations – i.e. concentration measurements

This depends on the process you wish to measure, and the typical chemicals present. For quantitative measurements, the IRmadillo typically has detection limits of 100 ppm for a range of different organic and inorganic chemicals. In some situations it's even possible to achieve a detection of < 1 ppm!

Qualitative calibrations – i.e. process classification

Again this depends on the process you wish to measure, as well as the different process conditions that are possible. The picture above gives an example output of a process with 4 different process conditions and a cleaning step. It's clear to see the different process conditions clustering together with a common x-axis, but different y-axis steps. A computer algorithm can easily read the output of this plot and convert it into meaningful classifications for the production engineer to act on.

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