Proven alternatives to multi-point kappa analysers for enhanced pulp mill process control

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Introduction

Residual lignin concentration, also expressed as kappa number, is the most important process measurement for estimation of the operational efficiency of cooking, oxygen delignification and bleaching stages. Kappa analysers with multi-sampling options, which were developed in the 1980's, became an alternative to laboratory kappa measurements. To fulfill the needs of today's pulp makers, new inline sensors can replace multi-point kappa analysers, providing fast and accurate results directly from any selected sampling point for enhanced process control and low cost of ownership.

Technology

The single point kappa analyser SPK-5500 uses the same optical measuring principle as a multi-point kappa analyser but is mounted directly to the pulp processing pipeline and measures continuously the kappa number of pulp suspensions. As a result of this simplification, complicated and costly auxiliaries such as remote pulp samplers, associated water valves and transport lines become redundant.

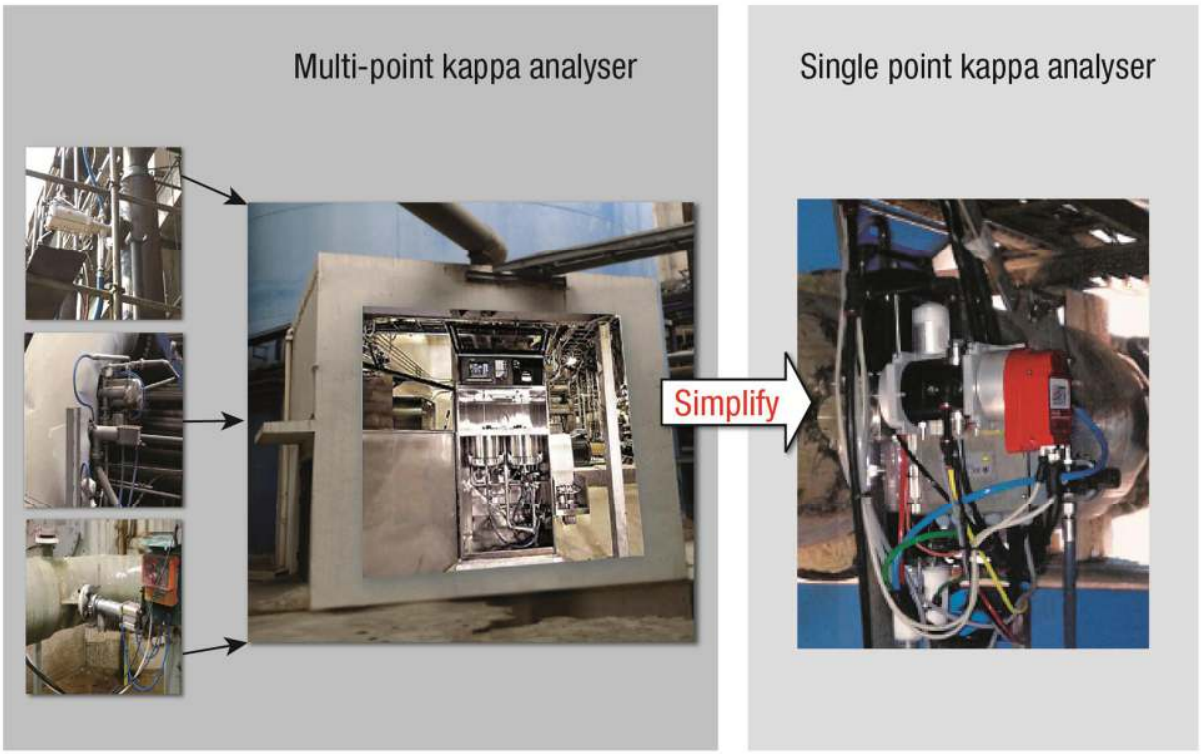

Figure 1: Implementation of a single point kappa device versus a multi-point kappa analyser

Results

The accuracy of the SPK-5550 was tested by comparing its kappa number measurements with results obtained from kappa measurement in the laboratory. The comparison proved that single point kappa technology provides at least the same accuracy as do laboratory results (Fig. 2).

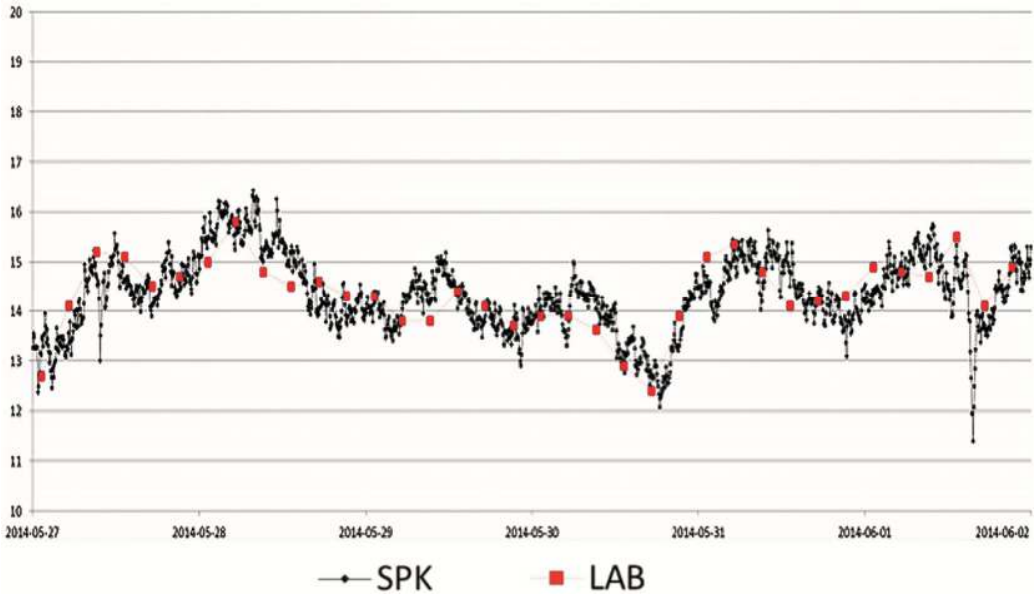

Figure 2: Accuracy of SPK-5500 compared to laboratory kappa measurement

With accuracy affirmed, the SPK has been installed in several mills in Asia, Europe and Americas. Trials of the SPK in comparison with a multi-point kappa analyser reveal continuous real-time results at a much higher update rate (Fig. 3) which is crucial for efficient process control.

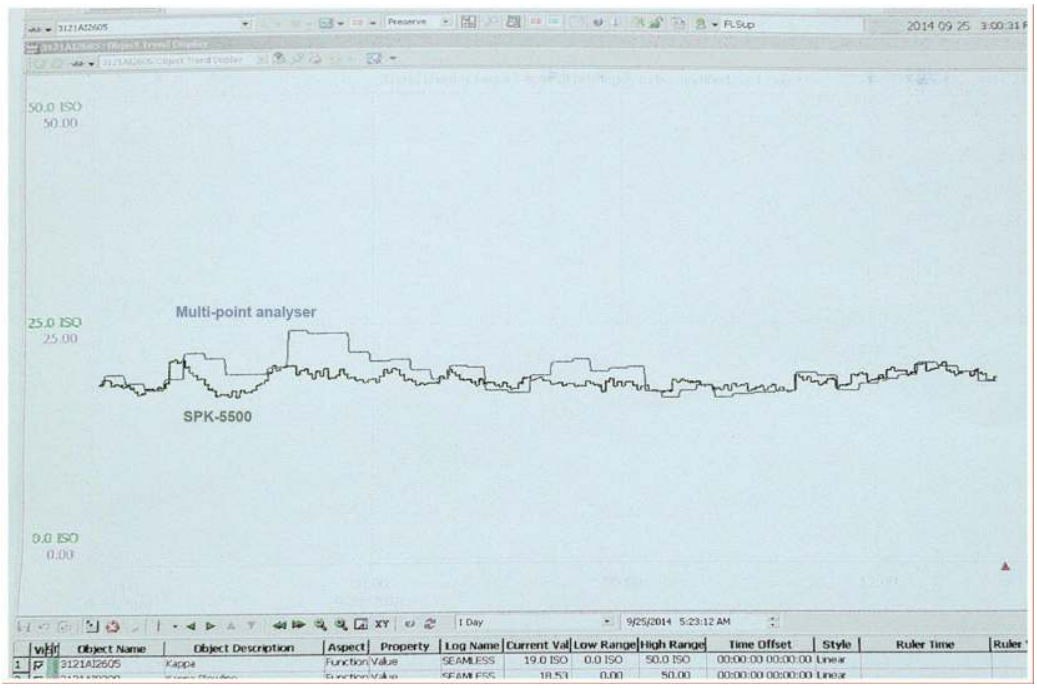

Figure 3: Measurement frequency of SPK compared to a multi-point analyser

Advances in Measurement and Control

Developments in optical inline sensors have enabled a differentiated and accurate measurement of lignin concentrations in pulp suspensions in various forms such as filtrate kappa and fiber kappa or total kappa, summarizing both. These contemporary sensors are more specific, smaller and smarter and allow for significantly improved process control in bleaching and pulping operations.

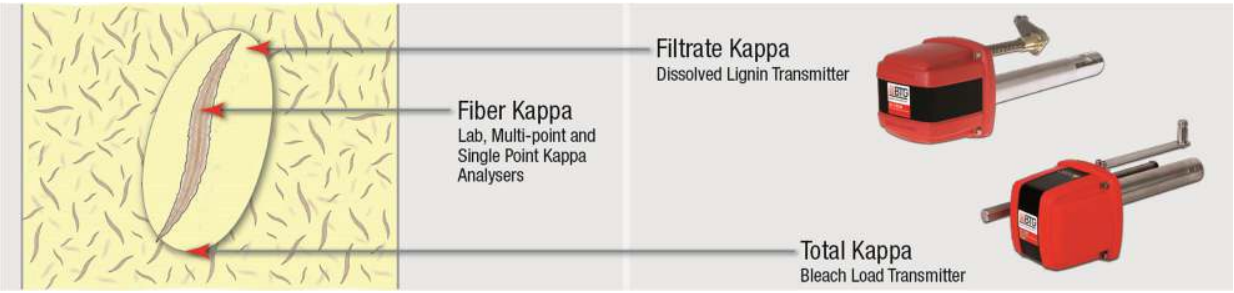

Figure 4: Different kappa numbers and available instruments

The inline dissolved lignin transmitter DLT-5500 can directly and continuously measure dissolved lignin concentrations, also known as filtrate kappa. Filtrate kappa can contribute between 10-50% to the total kappa number but has a much higher variability compared with fiber kappa. The DLT is successfully applied to optimize brown stock washing and oxygen stage control.

In feed lines to bleach plants the combined fiber and filtrate kappa, referred to as bleach load, can be measured by implementation of a bleach load transmitter BLT-5500.

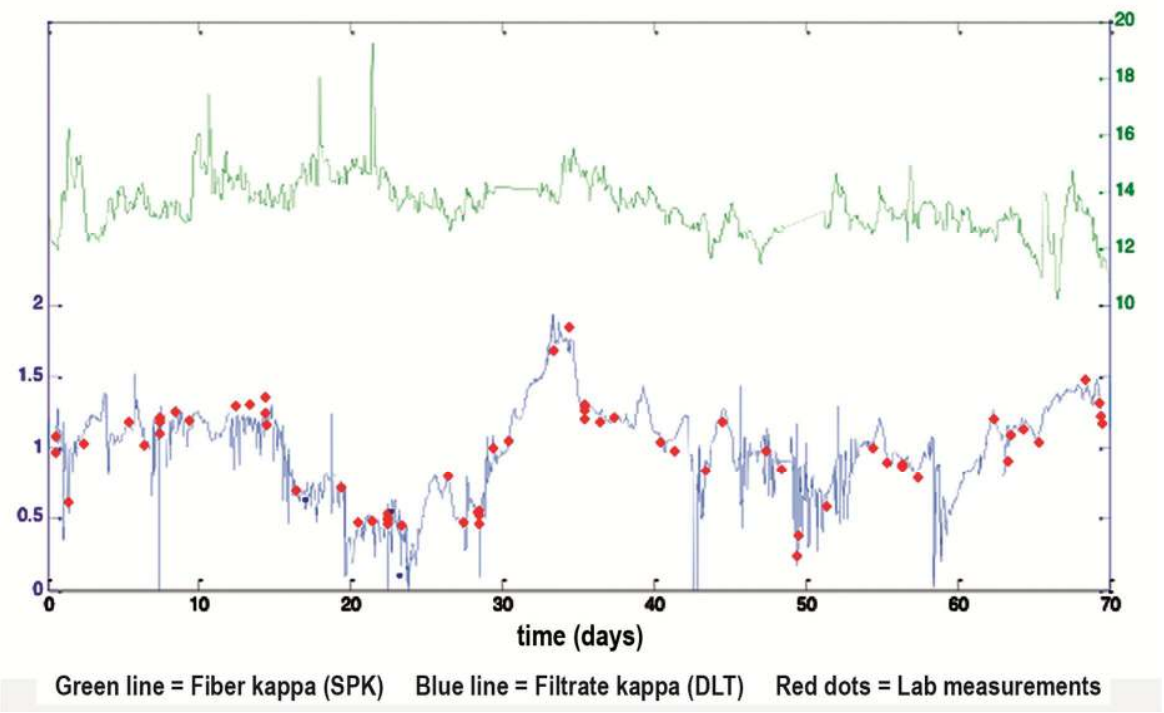

Figure 5: Filtrate Kappa measured with a DLT-5500 and fiber kappa with SPK-5500

As a result of these new technological advancements, pulp makers have now choices of measuring lignin concentrations in various forms. These measurements can be successfully utilized to optimize cooking, brown stock washing, O2 delignification and bleaching with minimum operator bias. The pay back for these capital investments comes from increased yield, reduced chemical costs, stable pulp quality through enhanced process control.

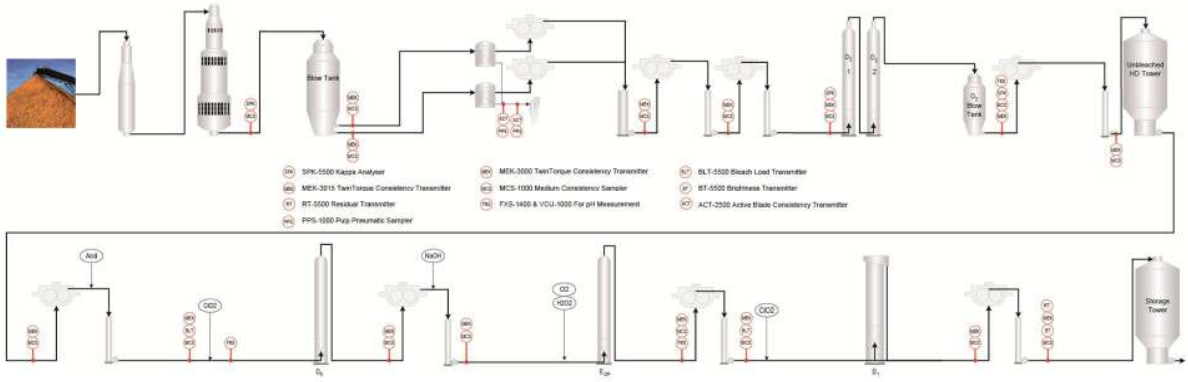

Figure 6: Fiberline with state-of-the-art instrument set-up

Conclusions

- The new single point kappa analyser increasingly replaces existing multi-point kappa analysers as it provides very accurate kappa number results at a high frequency allowing enhanced process control.
- Measuring and controlling lignin concentrations in various forms by means of specific inline sensors reduces the complexity of fiberline process control formerly using only fiber kappa.
- Additional new inline sensors are capable of measuring dissolved and total lignin creating new control opportunities at lower cost.
- Pulping and bleaching processes benefit from such developing technology trends as the new sensors are easy to install, smaller, lighter, measure inline and fast at best suited measuring points.