

Application Note AN-PAN-1004

ABC Titration: Analysis of alkali, carbonate, hydroxide, and sulfide in pulping liquors

The breakdown process from solid wood to paper involves quite a number of preparative steps. The main process which converts wood into pulp is named the **Kraft process**, which utilizes white liquor (a mixture of sodium hydroxide «NaOH» and sodium sulfide «Na_2S») to break down the lignin and cellulose linkages.

In the Kraft pulping process, the wood chips are saturated with white liquor and cooked at high temperatures in pressurized digesters, forming a liquid stream consisting of pulp and black liquor. After a washing step, the resulting pulp is sieved, washed, and bleached to produce paper; and the now weak black liquor continues to the chemical recovery loop into the evaporators.

After passing through multiple evaporators, the now

concentrated black liquor enters the recovery boiler, where sodium sulfate «Na_2SO_4» is reduced to Na_2S. Then, the green liquor (containing mostly Na_2S and sodium carbonate «Na_2CO_3»), is sent to the causticizing plant to react with lime «CaO» and regenerate white liquor for the pulping process. Here, the recovery cycle is completed.

In the Kraft recovery cycle, the constant monitoring of residual effective alkali «REA» of black liquor, total titratable alkali «TTA», active alkali «AA», and effective alkali «EA» of green and white liquor, are necessary for maintaining the optimal recovery process, improving reaction yield, and enhancing process optimization. However, these streams are very hot and corrosive (like white liquor), thus there are risks of accidents when sampling manually.

It is also important to consider that variations in one part of the cycle will disturb downstream unit operation. In turn, these disturbances can create further variations, causing a downward spiraling effect. Conventional laboratory analysis leads to long response times between the sampling and the analysis in case of process changes, undermining the recovery efficiency.

A great choice for online monitoring alkali, carbonate, hydroxide, and other such important parameters in pulping liquors is the 2060 Process Analyzer from Metrohm Process Analytics. Save time, avoid spillages, and increase efficiency without manually sampling process points.

APPLICATION

The 2060 Process Analyzer is used to determine alkali (AA, EA, and TTA), carbonate, hydroxide, sulfide, and causticizing degree «CE%» online in pulping liquors. The analyzer is suitable to analyze white, green, black, and wash liquors with multiple sample lines, outputting results for closed loop control. This method conforms to the standard method SCAN-N 30:85, the pulp and paper industry standard.

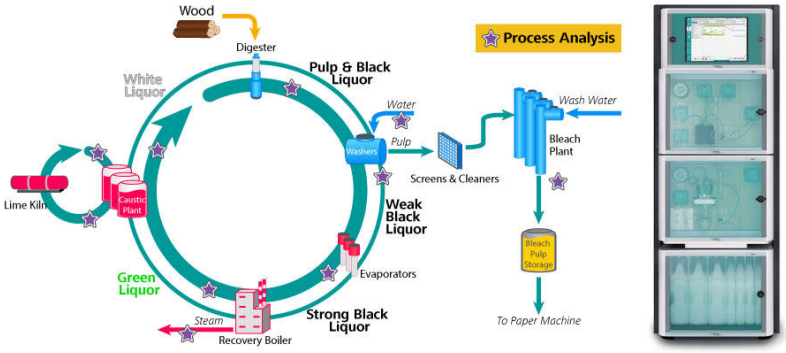


Figure 1. (left) Typical Kraft sulfate pulping and recovery process. (Right) 2060 Process Analyzer for ABC titration measurements for the pulp and paper industry.

TYPICAL RANGE

0.1–3 mol/L CO_3^{2-} and S^{2-}, 0.1–6 mol/L OH^-, alkali 0.1–8 mol/L. Higher and lower ranges are possible with the use of special preconditioning systems.

REMARKS

Additionally, the **sulfate concentration** can be measured online with thermometric titration in the same instrument. In combination with the ABC titration, this gives a perfect indication for the **degree of reduction** and information about the recovery boiler efficiency, which acts as a reactor. The thermometric titration gives a faster response and avoids the use of toxic chemicals. Other online applications in the pulp and paper industry are during the bleaching process.

BENEFITS FOR ONLINE TITRATION IN PROCESS

- Increased causticizing efficiency
- Reduced TTA and EA variability
- Greater and faster return on investment
- Safe working environment and automated sampling

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CONFIGURATION



2060 Process Analyzer

The 2060 Process Analyzer is an online wet chemistry analyzer that is suitable for countless applications. This process analyzer offers a new modularity concept consisting of a central platform, which is called a «basic cabinet».

The basic cabinet consists of two parts. The upper part contains a touch screen and an industrial PC. The lower part contains the flexible wet part where the hardware for the actual analysis is housed. If the basic wet part capacity is not sufficient enough to solve an analytical challenge, then the basic cabinet can be expanded to up to four additional wet part cabinets to ensure enough space to solve even the most challenging applications. The additional cabinets can be configured in such a way that each wet part cabinet can be combined with a reagent cabinet with integrated (non-contact) level detection to increase analyzer uptime.

The 2060 process analyzer offers different wet chem techniques: titration, Karl Fischer titration, photometry, direct measurement and standard additions methods.

To meet all project requirements (or to meet all your needs) sample preconditioning systems can be provided to guarantee a robust analytical solution. We can provide any sample preconditioning system, such as cooling or heating, pressure reduction and degassing, filtration, and many more.