



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<sub>2</sub>S») 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 « $\text{Na}_2\text{SO}_4$ » is reduced to  $\text{Na}_2\text{S}$ . Then, the green liquor (containing mostly  $\text{Na}_2\text{S}$  and sodium carbonate « $\text{Na}_2\text{CO}_3$ »), is sent to the causticizing plant to react with lime « $\text{CaO}$ » 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.

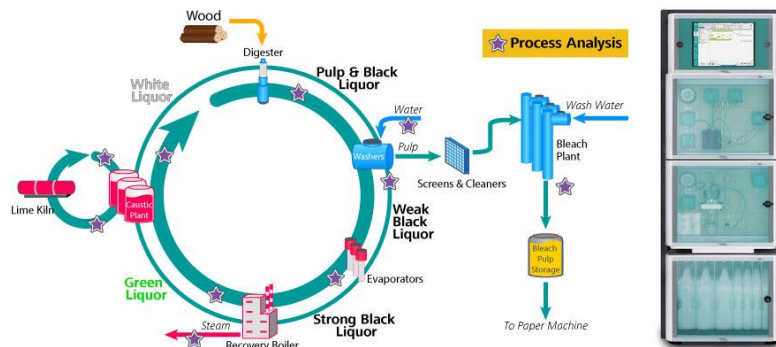
## APPLICATION

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.

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.



**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  $\text{CO}_3^{2-}$  and  $\text{S}^{2-}$ , 0.1–6 mol/L  $\text{OH}^-$ , 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

## CONTACT

Metrohm Deutschland  
In den Birken 3  
70794 Filderstadt

[info@metrohm.de](mailto:info@metrohm.de)

## CONFIGURATION



### 2060 Process Analyzer

Der 2060 Process Analyzer ist ein Online-Analysengerät für die Nass-Chemie, das sich für zahlreiche Anwendungen eignet. Dieser Prozessanalysator bietet ein neues Baukastensystem, das eine zentrale Plattform hat, den sogenannten „Basisschrank“.

Der Basisschrank besteht aus zwei Teilen. Der obere Teil enthält einen Touchscreen sowie einen Industrie-PC. Im unteren Teil befindet sich der flexible Nassteil, in dem die Hardware für die eigentliche Analyse untergebracht ist. Wenn die Kapazität des Nassteils aus der Grundausstattung nicht ausreicht, um eine analytische Herausforderung zu bewältigen, kann der Basisschrank auf bis zu vier weitere Nassteilschränke erweitert werden. So lässt sich sicherstellen, dass selbst für die anspruchsvollsten Anwendungen genügend Platz vorhanden ist. Die zusätzlichen Schränke lassen sich so konfigurieren, dass jeder Nassteilschrank zwecks Erhöhung der Betriebszeit des Analysengeräts mit einem Reagenzienschrank, der über eine integrierte (kontaktlose) Füllstandserfassung verfügt, kombiniert werden kann.

Der 2060 Process Analyzer bietet verschiedene nasschemische Methoden: Titration, Karl-Fischer-Titration, Photometrie, Direktmessung und Standardadditionsverfahren.

Zur Erfüllung aller Projektanforderungen (oder all Ihrer Bedürfnisse) sind auch Probenaufbereitungssysteme erhältlich, die eine stabile Analyselösung garantieren. Wir können jedes Probenaufbereitungssystem liefern, unter anderem zum Kühlen oder Heizen, Druckmindern oder Entgasen, Filtrieren und für vieles mehr.