



Application Note AN-PAN-1004

ABC 滴定法: 分析制浆液中的碱、碳酸盐、氢氧化物和硫化物

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 «Na₂S») 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 «Na₂SO₄» is reduced to Na₂S. Then, the green liquor (containing mostly Na₂S and sodium carbonate «Na₂CO₃»), 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.

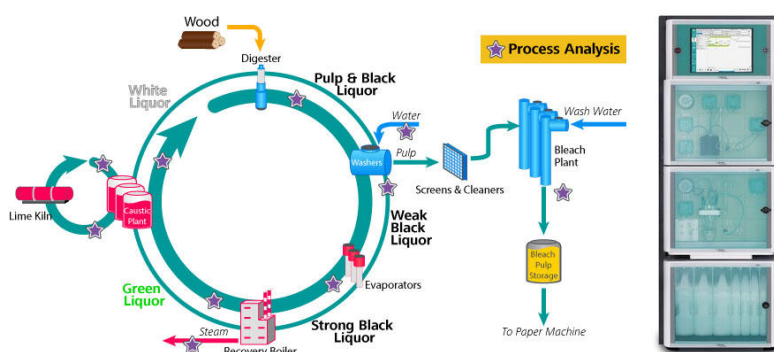


Figure 1. (left) Typical Kraft sulfate pulping and recovery process. (Right) 2060 Process Analyzer for ABC titration measurements for the pulp and paper industry.

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

2060 Process Analyzer 是一种在线湿化学分析仪,适用于无数应用。此过程分析仪提供了一个新的模块化概念,由一个称为«主机柜»的中心平台组成。

主机柜由两部分组成。上部包含触摸屏和工业计算机。下部含有柔性取样部,其中放有用于实际分析的硬件。如果主取样部容量不足以应对分析挑战,那么主机柜可以扩展为多达四个额外的取样部机柜,以确保有足够的空间来应对具挑战性的应用。附加机柜的配置方式使每个取样部机柜可以与具有集成(非接触式)液位检测的试剂柜组合使用,以增加分析仪的正常运行时间。

2060 Process Analyzer 提供不同的湿化学技术:滴定法、卡尔费舍尔滴定法、光度测定、直接测量和标准添加法。

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