



Kraft Pulping

Industry: Pulp and Paper
Product: Inductive Conductivity Meters

Introduction

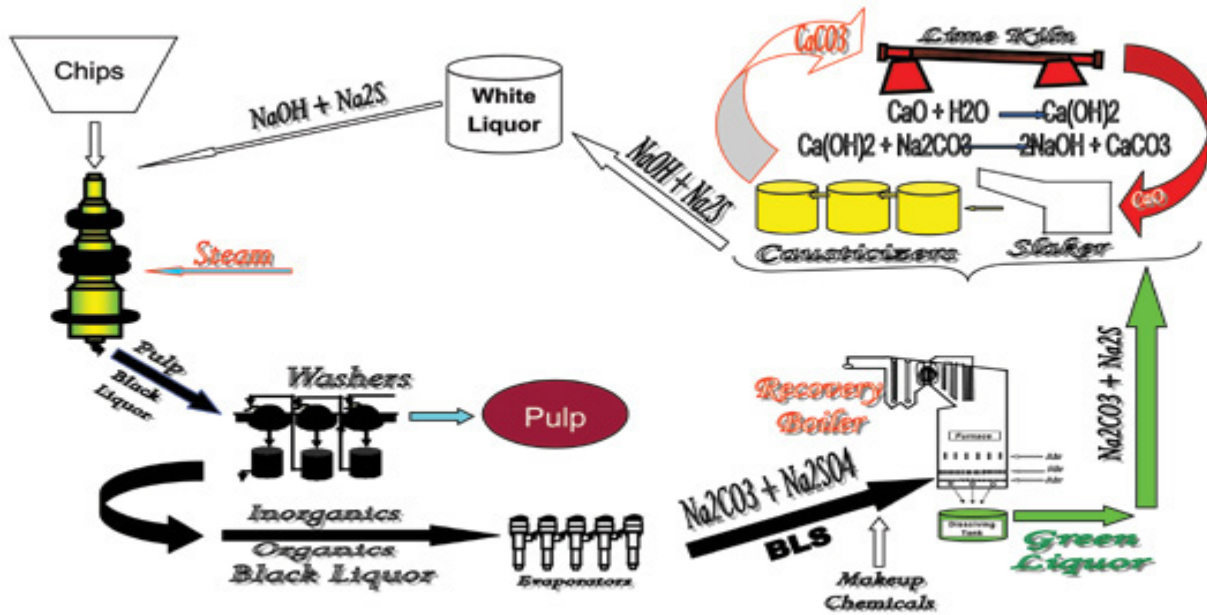
The kraft process (also known as kraft pulping or sulfate process) describes a technology for conversion of wood into wood pulp consisting of almost pure cellulose fibers. Wood chips are treated by harsh chemicals (white liquor) to produce pulp and spent liquor (black liquor). The spent liquor is later regenerated to white liquor in the causticizer. Today, the process is used in approximately 80% of paper production. Those companies using the Kraft process are easy to recognize by their strong, offensive smell. This is because one of the byproducts of the process is hydrogen sulfide gas and other sulfur gas compounds. Kraft pulping uses less than 50% of the tree. The rest ends up as sludge which is burned, spread on land or land field.

Since the amount of bleach needed is related to the lignin content of the pulp, the Kappa number can be used to monitor the effectiveness of the lignin-extraction phase of the

pulping process. The Kappa number determines the lignin's relative hardness, bleach ability, or degree of dezincification of the pulp. It estimates the amount of chemicals required during bleaching of wood pulp to obtain a pulp with a desired degree of whiteness. Measuring conductivity in the recirculation zone of a continuous digester can provide control feedback and lower variability in the Kappa number of the product pulp.

Process

The Kraft Process is a cyclical, self-sustaining process. As a result of the process, a byproduct called black liquor is formed. Wood chips are fed into a digester where they are impregnated with the cooking liquors (white and black liquor). The black liquor is the spent cooking liquor that is a combination of the removed lignin, water, and chemicals used in the extraction process. The inorganic portion of the black liquor, white liquor, is the regenerated mixture of



sodium hydroxide and sodium sulfide produced in the recover process that is vital to delignification.

The wood chips remain in the digester for several hours are 130 to 180°C to allow for the maximum delignification as possible. Under these conditions lignin and some hemicellulose degrade to give fragments that are soluble in the strongly basic liquid. The remaining solid pulp is collected and washed. The remaining stock is quite brown and color and is known as "brown stock". This material goes further into the manufacturing process to later be bleached and become the end product.

While the wood chips reside in the digester the sodium hydroxide and sodium sulfide are consumed by the acetic and lignin components in the wood chips. To make sure that the white liquor is not completely consumed a conductivity value and be measured and correlated with an acceptable Kappa number range. This allows the feed rate of the white liquor to the digester to be adjusted and maintained at a certain conductivity value throughout the digestion process.

Product Recommendations

Yokogawa recommends using the ISC450G Inductive Conductivity sensor to measure the alkali concentration in black liquor because the sensor has proven to be rugged and reliable with a minimum of maintenance needed. The Yokogawa ISC40G sensor comes in two different chemical resistant materials PEEK and Teflon, along with various process connection capabilities. This allows for a wide range of flexibility for installation from threaded to flanged to flow thru.

The Yokogawa EXA ISC202 series transmitter is housed in a robust chromated cast aluminum housing, coated with a Epoxy-polyester makes it the ideal 2-wire transmitter for mounting directly on-site, even under tough environmental conditions. Yokogawa has implemented three leading process Fieldbus technologies in their 202 series: HART®, Foundation Fieldbus H1 and Profibus PA. The Yokogawa EXA ISC202 series transmitter is housed in a robust cast aluminum case with chemically resistant coating, cover with flexible polycarbonate window.

Transmitter

- 2-wire conductivity measurement system ISC202
- 4-wire conductivity measurement system ISC450

Sensor/ Holder

- ISC40FS/ISC40FF Insertion of Flow-thru assembly
- ISC40PR Retractable assembly
- ISC40G General Purpose Sensor
- ISC40S Intrinsically Safe Sensor

Note: For additional information or assistance on this application, please contact the Yokogawa Analytical Product Marketing.

1.) Lignin or lignen is a complex chemical compound most commonly derived from wood, and an integral part of the secondary cell walls of plants and some algae. Its most commonly noted function is the support through strengthening of wood (xylem cells) in trees.

2.) *Kappa number* is the volume (in milliliters) of 0.1 N potassium permanganate solution consumed by one gram of moisture-free pulp under the conditions specified in the published ISO 302:2004 method.

