AQUAMAG®

Magnesium Hydroxide Slurry

Used for Partial Substitution of Caustic Soda in Oxidative Reinforced Alkaline

Oxidative Reinforced Alkaline Extraction

All bleaching agents used to delignify chemical pulp, with the exception of sodium hydrosulphite, break lignin down into smaller molecules. These breakdown products are generally soluble in water, especially if the pH is greater than 7. These materials are removed between bleaching stages to avoid excessive use of subsequent stage bleaching chemicals. In the subsequent stages these smaller molecules are still susceptible to oxidation and as such it is prudent to remove them in the extraction stage. An alkaline extraction stage (E) is routinely found between chlorine dioxide (D) bleaching stages for this reason.

Addition of oxygen to the pulp in alkaline extraction (Eo) is an efficient method for increasing the bleaching effect and decreasing the consumption of the more expensive chlorine dioxide in ensuing bleaching stages. Oxygen improves the dissolution of lignin thereby improving the overall efficiency of the extraction stage. Hydrogen peroxide, along with oxygen, can also be added to the extraction stage (Eop). The use of oxygen and peroxide in the alkaline extraction stage, to increase delignification, has become common. Oxygen opens rings and cleaves sidechains giving a complex mixture of small oxygenated molecules. Transition metal compounds, particularly those of iron, manganese and copper, which have multiple oxidation states, facilitate many radical reactions and impact oxygen delignification. The radical reactions are largely responsible for delignification, however they are also detrimental to cellulose.

Comparison Caustic vs. Mg(OH)2

Magnesium hydroxide is a suitable partial replacement for caustic soda in most Eop stages, as it is a cost effective source of alkalinity. It is possible to replace up to 25% of the caustic requirement with magnesium hydroxide. In addition to providing alkalinity, magnesium hydroxide provides a source of Mg ions for protection of the cellulose from free radical degradation.

On a pound for pound basis magnesium hydroxide provides 27% more alkalinity than caustic soda.

$Mg(OH)_2 \rightarrow Mg2+ + 2\ OH-$
Molecular weight $Mg(OH)_2 = 58.3$

$2\ NaOH \rightarrow 2\ Na+ + 2\ OH-$
Molecular weight NaOH = 80

1lb NaOH is equiv. to 0.73 lb's of $Mg(OH)_2$

continued on back

1lb $Mg(OH)_2$ is equiv. to 1.37 lb's of NaOH

Magnesium hydroxide has limited solubility in water, making the product very safe to handle. Conversely, caustic soda is very soluble in water making it extremely dangerous to handle. The low solubility of magnesium hydroxide is often an advantage as the reactions with it proceed more uniformly.

Solubility Product (Ksp): Magnesium Hydroxide

$Ksp=[Mg^{2+}][OH-]2 /[Mg(OH)_2]=5.66x10^{-12}$

In the Eop extraction stage the presence of hydrogen peroxide causes a reaction with the free alkalinity (from both caustic and magnesium hydroxide) to produce perhydroxyl ions.

H_2O_2 + OH- $\rightarrow$ OOH- (perhydroxyl ion)

As the perhydroxl ions are formed and the free alkalinity is used, the free alkalinity will be replaced with alkalinity from the magnesium hydroxide. In other words, as long as hydrogen peroxide is present, magnesium hydroxide will solubilize.

In addition to providing a low cost source of alkalinity, magnesium hydroxide also supplies magnesium ions which are essential to reduce catalytic decomposition of the hydrogen peroxide as well as protecting the cellulose fiber from attacks from free radicals.

The low solubility of magnesium hydroxide plus the high solubility of caustic provides a good balance of alkalinity in the Eop stage. This partial substitution of caustic can lead to significant savings in chemical costs.

Advantages

1) Stable Price.
2) Safe both for the environment and personnel.
3) Readily available.
4) Low freezing point.

For more information, please contact your local Hill Brothers representative.
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