

Problems with Silica in Pulp and Paper Production



In nonwood pulp production, the recovery of chemicals and energy from the spent cooking liquor (black liquor) has been difficult. This is due to the silica (SiO_2) present in the liquor, which causes fouling of heat transfer surfaces and high viscosity when the liquor is evaporated. By lowering the liquor pH, the silica can be precipitated and separated; however, previous attempts to do this have not been successful. New technology has been developed by Siloxy that now makes this possible. Based on the saturation of the black liquor with strong carbon dioxide and separation of the formed precipitate by an efficient filter press, nonwood fiber can now be processed more profitably and in an environmentally acceptable way.

Silica in Fiber Raw Materials

Silica is a problem specific to nonwood pulp production when using the soda or kraft process. The following table shows the content of silica as kilograms of SiO_2 per ton of dry solids in the spent cooking liquor when processing various raw materials:

hardwood (birch)	1
bagasse	12
bamboo	20–22
reed	25–50
wheat straw	45–80
rice straw	110–160

Precipitation of Silica

The most efficient way to separate silica from the black liquor is to lower the liquor pH, which can be done with carbon dioxide. By doing so, the silica can be precipitated. However, at the same time, a part of the organic substance in the liquor becomes partly solidified and forms a slimy mass.

Technology for Sustainable Pulp Production

This makes the separation of the silica crystals very difficult. In previous attempts, a pH interval has been sought where the silica can be crystallized without formation of the organic slime. Considering the variability of the black liquor properties, it has seemed impossible to maintain these conditions in mill-scale operation.

The New Siloxy Method

The Siloxy method makes this possible by utilizing the following procedure:

- The black liquor is saturated with concentrated carbon dioxide
- A high liquor temperature is maintained during precipitation
- The liquor residence time during precipitation is optimized
- Equipment is used that can separate the precipitate from the liquor efficiently

With the Siloxy method, the problems encountered in previous attempts can be avoided. By saturating the black liquor with carbon dioxide, a difficult pH control problem can be eliminated.

The precipitated organic substance will be well crystallized, and it can be separated together with the more or less completely precipitated silica.

Figure 1

The photo shows the amount of silica separated with the filter press from 15 liters of black liquor with a dry solids content of 12% after saturation of the liquor with carbon dioxide under suitable conditions.



By using concentrated carbon dioxide containing little inert gas, foaming can also be avoided, and a favorable contact between the gas and the liquor can be obtained.

In the Siloxy method a CO₂ capture technology is used to generate high concentration carbon dioxide.

The Siloxy method has been tested successfully in Finland and the People's Republic of China. The trials in China were carried out in cooperation with the China National Environmental Protection Corporation and the Shandong Huajin Group at their straw pulp mill in Sishui, Shandong Province.

contact us

For more information about this novel Siloxy desilication technology and how it could help you, contact us today.

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