SILOXY™

a NORAM company

TECHNOLOGY FOR SUSTAINABLE PULP PRODUCTION

# 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. 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.

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.

## 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. 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.

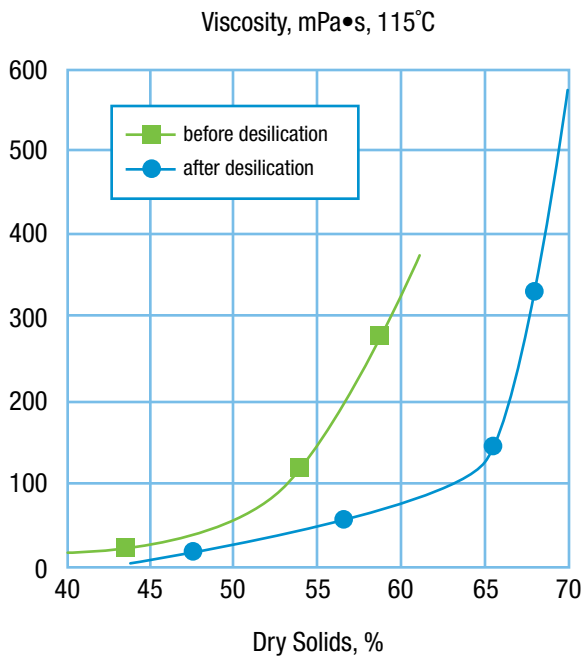
In the Siloxy method, an oxidizer operating on high-purity oxygen produces high concentration carbon dioxide.

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. The first commercial installation has been installed at the Kaiyuan Pulp and Paper Making Limited Company in northern China.

Samples of the black liquor from before and after desilication were sent to the Pulp and Paper Research Institute of Finland. The Institute tested the viscosity of the samples at increasingly dry solids content using their standard method.

In Figure 2, the influence of the silica on each sample's viscosity can be seen clearly. The curve with the lower viscosity values was obtained with the desilicated liquor.

Figure 2




A high viscosity of the black liquor is sometimes attributed to the content of hemicelluloses (pentosans) in the liquor. Because the desilication takes place at a temperature well below the temperature at which pentosans degrade, it is obvious that the removal of the silica caused the marked reduction of the liquor viscosity.

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## CONTACT US

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

Siloxy Limited
70 Sir John Rogerson's Quay
Dublin 2, Ireland

Tel 604.696.6939

Or contact Mr. Jim Wearing
jwearing@siloxy.com

**WWW.SILOXY.COM**