

## **SILOXY BLACK LIQUOR DESILICATION TECHNOLOGY FOR PULP AND PAPER MILLS**



The presence of silica in nonwood fiber causes major problems in the pulping process and limits the use of these feedstocks. Whether using soda or kraft processes, the majority of the silica reacts with the hydroxide, forming water-soluble ions. The content of silicate in the spent cooking liquor (i.e., black liquor) ranges from 10 kg SiO<sub>3</sub> per ton of total dissolved solids when bagasse is the feedstock to 150 kg SiO<sub>3</sub> per ton for rice straw.

The main problems associated with the presence of silicate ions in black liquor are:

- scaling of the multiple-effect evaporator heat transfer surfaces
- high black liquor viscosity, which makes it difficult to concentrate the liquor
- poor settling of lime mud and lower conversion of carbonate to sodium hydroxide in the causticizing system

To maintain a tolerable silica content in the black liquor, mills purge silica from the process by:

- sending some or all of the black liquor to the sewer
- landfilling lime mud

The Siloxy desilication process can eliminate the need to send black liquor to the sewer or to landfill lime mud.

### **SILICATE CONTENT IN VARIOUS TYPES OF MATERIALS**

(as kilograms of SiO<sub>2</sub> per ton of dry solids)

hardwood (birch)	1
bagasse	10
bamboo	20–22
reed	25–50
wheat straw	45–80
rice straw	110–160

## TECHNOLOGY FOR SUSTAINABLE PULP PRODUCTION

### SILOXY DESILICATION PROCESS

When the alkalinity, i.e., pH, of black liquor is reduced, the silicate ion and a part of the organic material in the liquor agglomerates to a colloidal form. When the pH is sufficiently low, it solidifies as amorphous silica and organic matter. The solidified matter can be separated from the liquor by filtration or centrifugation. Low-purity carbon dioxide (CO<sub>2</sub>) has been used in laboratory and pilot-scale trials to reduce liquor pH for silica precipitation. A commercial system has never been built, in part because of excessive foaming caused by the large amount of inert gas passing through the reactor. The Siloxy desilication process, which uses high-purity CO<sub>2</sub>, can eliminate the problems associated with the use of low-purity CO<sub>2</sub>.

A difficult pH control problem is avoided when a surplus of high-purity CO<sub>2</sub> is used to neutralize silica ions in black liquor. The pH drops quickly to 8.0–8.5, which eliminates the intermediate “colloidal” state of the silica. A solid silica precipitate is produced that can be separated efficiently. In trials, up to 95% of the dissolved silica in rice straw black liquor was removed as filter cake.

The use of high-purity CO<sub>2</sub> can also:

- eliminate foaming
- minimize the size of the desilication reactor because the CO<sub>2</sub> partial pressure inside the gas bubble will be about five times higher versus other CO<sub>2</sub> gas streams previously used

The Siloxy desilication process was tested successfully in Finland and in the People's Republic of China in co-operation with the China National Environmental Protection Corporation and the Shandong Huajin Group at their straw pulp mill at Sishui, Shandong Province. The first commercial installation has been installed at the Kaiyuan Pulp and Paper Making Limited Company in northern China.

### CARBON DIOXIDE GENERATION

The Siloxy processes are all fully integrated; the CO<sub>2</sub> gas used in the desilication system is produced in the Siloxy oxidizer (see the Siloxy Oxidation Technology data sheet). High purity oxygen is used to combust the black liquor instead of air, producing a flue gas with a very high CO<sub>2</sub> concentration. Approximately 10% of the flue gas produced is used in the desilication process. The remainder is either discharged to atmosphere, used within the mill, or potentially sold as “merchant” carbon dioxide.

### CONTACT US

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