SILOXY™

a NORAM company

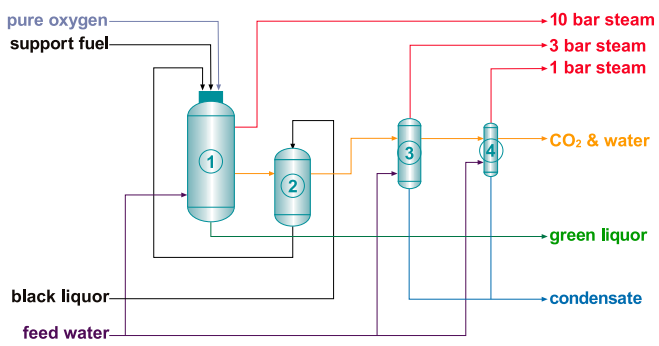
TECHNOLOGY FOR SUSTAINABLE PULP PRODUCTION

SILOXY OXIDATION TECHNOLOGY FOR PULP AND PAPER MILLS

The novel Siloxy oxidation technology was designed to eliminate organic compounds that can create chemical oxygen demand (COD) in aqueous waste liquors. The technology provides high-thermal-efficiency oxidation of black liquor and waste streams in pulp and paper mills.

Figure 1

Siloxy Oxidation System



THE SILOXY OXIDATION SYSTEM

The oxidizer is shown schematically in Figure 1, and a 3-dimensional drawing of the system installed at the Kaiyuan Paper Mill in northern China is shown in Figure 2.

The main components of the system are:

1. A reactor designed for suspension firing of black liquor or concentrates and an integral smelt dissolver
2. Direct-contact evaporator/ rapid gas quench
3. 3-bar steam generator/wet scrubber
4. 1-bar steam generator/ secondary wet scrubber

The reactor and direct-contact evaporator are surrounded by a cooling jacket that generates 10-bar steam.

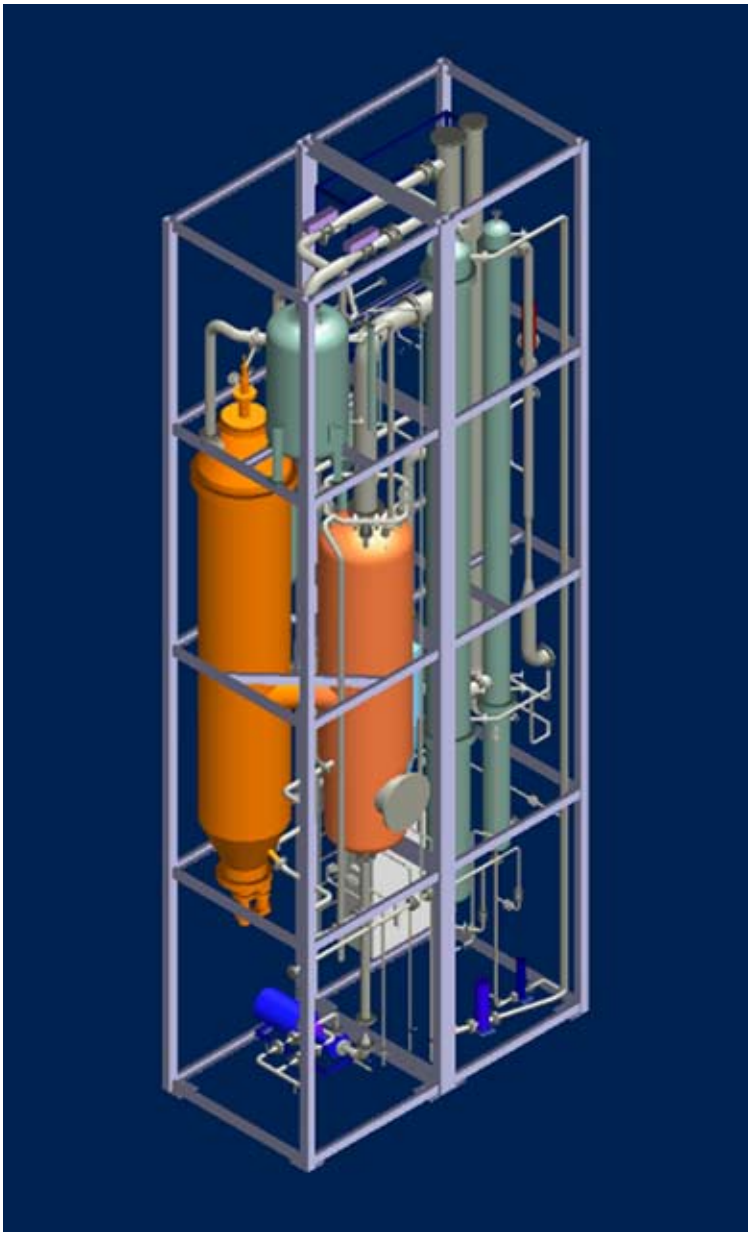
The Oxidation Process

In the Siloxy oxidation process, black liquor is oxidized/combusted in the reactor at a pressure of 10 bars. The reactor is immersed in a water-filled pressure vessel. The vessel and reactor pressure are kept equal to eliminate having a substantial pressure difference across the reactor wall.

High-purity oxygen is used for combustion. Eliminating nitrogen, which constitutes 79% of the volume in air, and operating at 10 bars reduces the gas volume to approximately 2% of the volume that would be produced if the liquor was burned with air at atmospheric pressure. This makes it possible to modularize the oxidizer system onto skids and deliver it to the site in standard containers.

The liquor is evaporated to its final solids concentration and preheated in the direct-contact evaporator (see gas handling). It is then pumped to the burner located at the top of the reactor. The liquor is atomized into small droplets that ignite and burn. Approximately 5% surplus oxygen is used to promote complete combustion. A pilot burner that uses fuel oil is used to initiate combustion.

Figure 2



At the reactor combustion temperature, the inorganic material in the black liquor forms droplets of molten slag/smelt. When these droplets hit the water-cooled reactor wall, they adhere and solidify. The solid slag layer grows until the surface reaches the slag melting point. This solidified layer helps to prevent corrosion of the reactor walls and limits the transfer of energy to the water jacket. The remaining molten slag runs down into the slag/smelt dissolver located below the reactor chamber.

Slag Handling

The molten slag/smelt runs by gravity into the slag dissolver, which is integrated with the reactor chamber, and thus also operates at 10 bar. Hot condensate or weak wash is pumped into the dissolver, which is equipped with an agitator. The slag, which is essentially sodium carbonate, produces green liquor. The green liquor is extracted from the dissolver through a control valve and sent into an atmospheric flash tank.

Gas Handling

The combustion gases exit the reactor and enter a direct-contact evaporator. The incoming black liquor is fed into the direct-contact evaporator through atomizing spray nozzles into the hot combustion gas coming from the combustion chamber. Here, the dissolved solids content of the black liquor is increased to the desired firing concentration and the temperature is increased to about 180˚C. The gas is rapidly cooled to a temperature close to the water boiler temperature. The concentrated liquor is then pumped to the burner.

The quenched gas, now saturated with water vapor and at 10-bar pressure, flows to a heat exchanger where water vapor is condensed from the gas. The latent heat that is released is transferred to pure water, generating process steam at typically 3-bar pressure. At the heat exchanger outlet there is still condensable water vapor in the gas. Therefore, a second heat exchanger is employed that produces 1-bar steam. The final gas temperature is about 110˚C. There is very little water vapor remaining in the gas. The primary component of the depressurized exit gas is carbon dioxide (CO_2).

Energy Efficiency

The energy efficiency of the oxidizer is very high. The energy content of the hot combustion gases is utilized twice; first to evaporate water from the incoming black liquor, and then for steam generation. Because the off-gas does not contain the nitrogen ballast present in the gas when combusting with air, there is very low flue gas loss. A thermal efficiency in excess of 85% can be achieved.

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Technology for Sustainable Pulp Production

CONTACT US

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