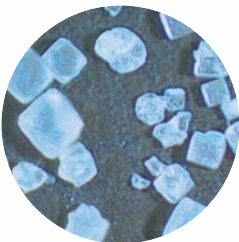


Silica Sorption Process

VWS Oil & Gas has developed process technology for cost-effective removal of silica from water and wastewater.

The Silica Sorption technology is effective for processing and disposal of brines with high concentrations of silica and other scaling constituents.

The advantages of this technology include decreased chemical consumption as well as reduction of solid and liquid wastes when compared to conventional treatment methods.



Silica Sorption Process Applied to Evaporation for Produced Water Treatment

Evaporation technology is an accepted method of treating oilfield produced water from SAGD (steam assisted gravity drainage) operations. This thermal process provides high-quality distillate as feedwater for steam generation and allows the flexibility of using either traditional OTSGs (once-through steam generator) or drum-type boilers.



The Silica Sorption Process allows cost-effective methods of disposing of waste brines from produced water treatment utilizing evaporation

Issues with Conventional Evaporative Processes

Existing evaporative processes use large amounts of caustic to prevent silica scaling in the evaporator. The caustic keeps the silica dissolved, but promotes the precipitation of calcium and magnesium salts (hardness scaling). The resulting scaling of the evaporator heat transfer surfaces becomes an issue, particularly when brackish make-up water is used in the SAGD process.

Disposal of high pH evaporator concentrate requires costly, secondary processes which are maintenance intensive and have experienced limited success. In some cases, on-site disposal may require the addition of acid that may release noxious H₂S (hydrogen sulfide), which can create safety and environmental hazards. Salt caverns may be used as another option for disposal, but is usually an expensive alternative.

The Silica Sorption Process, when utilized with evaporation, offers a more cost-effective, safer, and environmentally friendly method of disposing of evaporator concentrate.

Silica Sorption Process Flexibility

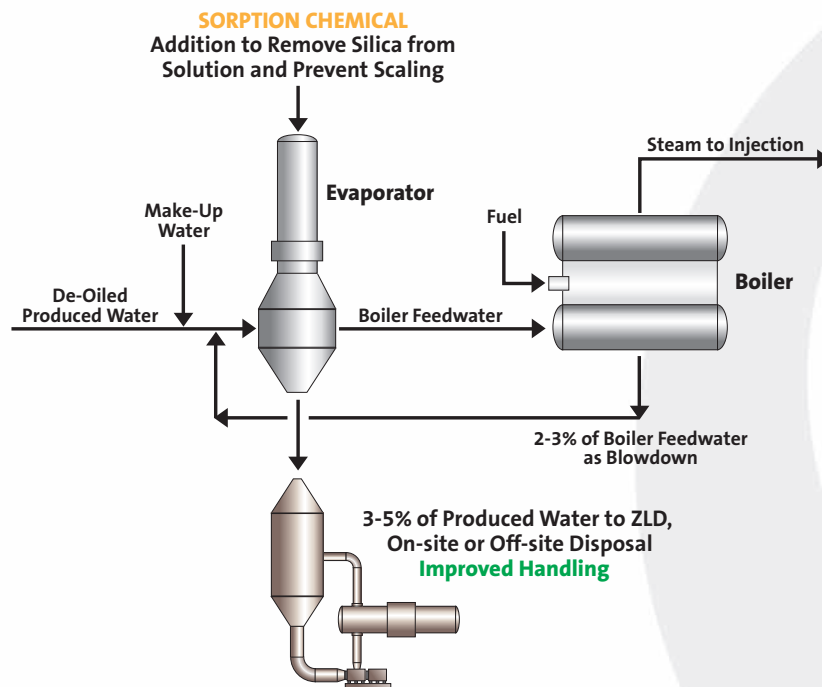
The Silica Sorption Process offers significant improvements in evaporation system economics and operation when compared to standard evaporative processes by reducing caustic consumption and providing a wider variety of disposal options for evaporator concentrate.

The process eliminates the potential for silica and hardness-related scale by sorbing silica and co-precipitating other compounds onto sorption crystals utilizing commercially available chemicals. As a result, the process is able to tolerate higher levels of hardness and organics in the evaporation system. This provides the opportunity for use of high-saline, high-hardness make-up water.

Producers combining Silica Sorption technology with on-site disposal options, or off-site disposal options from Veolia Water, can realize sizeable capital cost savings if ZLD (Zero Liquid Discharge) systems are not desirable or practical.



If Zero Liquid Discharge is required, the Silica Sorption Process can be easily coupled with a brine crystallizer



Benefits of the Silica Sorption Process

- Savings in capital costs of 25% in the water treatment system when compared to conventional evaporation systems that require ZLD systems to dispose of evaporator concentrate
- Reduced caustic consumption, resulting in chemical cost savings up to 25% when compared to conventional evaporation systems
- Evaporator concentrate is suitable for cost-effective on-site and off-site disposal
- Integrated Vapor Washer ensures higher-quality distillate for boiler feedwater
- Additional removal of Calcium and Magnesium allows use of high hardness, saline make-up water