

METTLER TOLEDO APPLICATION NOTE

Desalinization Of Sea Water

BACKGROUND

Desalinization is the name given to processes that remove salt from water. Although 70% of the world's surface is covered with water, almost all of this water cannot be used without some removal of salt. Areas with large, growing populations and little fresh water resources are increasingly turning to desalinization for their water needs. Many industrial plants and electrical utilities are located by the ocean so that they can be assured of a large, dependable, fixed-cost water supply. Seawater, however, is so corrosive that it is generally more cost effective to remove the salt than to replace piping or install pipe of more resistant materials.

In a typical desalinization process, raw seawater is filtered to remove solids and then combined with acid in a treatment tank. The treated seawater is heated in an evaporator, with its resulting vapor collected and recondensed in the condenser, resulting in fresh water. One of the problems in this process is scale formation on the hot surfaces of the evaporation equipment. Careful pH control can minimize some of the scaling problems

THE PROCESS

There are two separate scaling problems that must be dealt with in a seawater evaporator. The first includes both calcium carbonate (limestone) and magnesium hydroxide scale. These are formed under higher pH conditions when bicarbonate ions can form carbonate ions and when more hydroxyl (OH⁻) ions are present. Carbonate and hydroxyl ions react with the

calcium and magnesium normally present in seawater.

CaCO₃ and Mg(OH)₂ scaling can be minimized by lowering the pH of the feed water under 5.7, thus preventing the formation of appreciable amounts of scale. This is commonly achieved by adding citric acid, ferric chloride, or sulfuric acid. However, too much acid will result in corrosion.

The second scale problem appears when the feed solution becomes saturated with calcium sulfate. CaSO₄ cannot be controlled by pH adjustment. It is necessary to maintain the CaSO₄ concentration below the saturation point (roughly 2 g/L) by removing a portion of the heavy brine in the evaporator. Although measuring conductivity does not provide a specific indication of the concentration of calcium sulfate, it does correlate to the level of all dissolved solids.

INSTRUMENTATION

To minimize calcium carbonate (limestone) and magnesium hydroxide scale build-up while avoiding corrosion, a proper pH balance can be maintained using the Mettler-Toledo 2100 pH analyzer in conjunction with an InPro[®] 4500 pH sensor.

To address the problem of calcium sulfate scale, the Mettler-Toledo Condl 7100 Toroidal Conductivity Analyzer and the InPro[®] 7201 Toroidal Conductivity Sensor can be used to prevent excessive buildup of the dissolved solids that could lead to fouling in the evaporator.

PRODUCTS

2100 pH Analyzer

- Detachable front panel and plug-in terminals for ease of installation
- All functions accessible through the keypad for increased ease of use
- Continuous sensor and transmitter diagnostics to monitor performance
- FM certification for Class I, Div 1 & 2 Environments and CSA General Purpose Approval
- 3 year warranty

InPro[®] 4500 Solid Polymer pH Electrode

- Patented Xerolyt[®] solid polymer reference system maintains a stable potential for accurate and repeatable pH measurement and low maintenance
- Open junction eliminates reference clogging and extends sensor life
- High pressure resistance eliminates requirement for pressurizable housing
- Xerolyt[®] solid polymer is particularly suitable for use in emulsions, suspensions, heavily contaminated or sulfide-containing media, and solutions with a high concentration of suspended solids

Model I 7100 Toroidal Conductivity Analyzer

- Measures conductivity, resistivity and % concentration
- Detachable front panel and plug-in terminals for ease of installation
- All functions accessible through the keypad for increased ease of use
- Continuous sensor and transmitter diagnostics to monitor performance
- FM certification for Class 1, Div 1 & 2 Environments
- 3 year warranty

InPro[®] 7200 Toroidal Conductivity Sensors

- Recommended for high accuracy measurement in high conductivity processes
- Choice of materials of construction for increased chemical compatibility
- High temperature range option suitable for CIP and Boiler Blowdown applications
- FM approved for electrical safety