Application Bulletin

Reverse Osmosis for Electrocoat Paint Process Applications

Customer Benefits

- Reduced DI water consumption
- Less paint to waste treatment
- Higher quality closed-loop rinsing

Overview

Ultrafiltration (UF) is a critical technology for the electrocoating process because it closes the mass balance of the process while producing rinse waters from the e-coat bath itself, which can result in 95% or higher transfer efficiencies with no net water addition. UF can be used to recover paint solids from deionized (DI) rinse water, thereby reducing the amount of paint wasted and lessening the burden on wastewater treatment facilities.

Electrocoat paint is a colloidal dispersion of pigment and resin in water with solubilizer, salts, and solvents. In ultrafiltration of electrocoat paint, the pigment and high molecular weight resin are rejected by the membrane and the water, low molecular weight resin, solubilizer, dissolved salts, and solvents pass through the membrane as UF permeate. The UF permeate can be further filtered to generate a higher quality closed-loop rinse water.

The Challenge

To treat UF permeate to reduce DI water consumption, increase paint solids recovery, and decrease water and wastewater treatment in electrocoat paint process applications.

The Solution

Reverse osmosis (RO) can be used to remove low molecular weight resin and dissolved salts from electrocoat paint ultrafiltrate, thereby reducing the consumption of DI water, and generating less wastewater.

ROGA™ cellulose acetate RO elements from Koch Membrane Systems (KMS) provide a successful solution for processing UF system permeate from electrocoat processes. ROGA membranes have shown stable permeate rates compared to other types of RO membranes when operated on cathodic ultrafilter permeate, leading to less frequent membrane cleanings and better acceptance of RO technology for this application by electrocoat end-users.

RO for cathodic electrocoat ultrafiltrate can be used in both new and existing plants and may potentially improve quality and reduce defects. The list of satisfied customers incorporating KMS membranes into their electrocoating processes includes leading global manufacturers producing automobiles, appliances, metal furniture, lawn and garden equipment, and more.

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Case Study

In November 2006, a UF/RO system was installed at an automotive assembly plant in Texas to process electrocoat paint. The paint type was an unleaded, gray cathodic epoxy. Typical paint characteristics were total solids- 20.5%, pH- 6, conductivity- 1500 to 1600 micromhos, and temperature- 90°F. The ultrafilter used 10-inch diameter potted spirals and was designed to generate 24 gal/min of UF permeate. The ultrafiltrate consisted of 0.6% total solids and was sent to a UF permeate holding tank.

The RO system used 8-inch diameter cellulose acetate RO spirals and was designed to generate 4 gal/min of RO permeate. The RO concentrate was returned to the UF permeate tank which overflowed to the last recirculated spray rinse in the closed-loop rinse system. The RO permeate was sent to an RO permeate storage tank from which it was pumped to a spray halo as the last rinse in the closed-loop rinse system.

One year of operating data showed that both the UF and RO systems demonstrated very stable permeate rates. During this time period both systems had not required cleaning. Inlet operating pressures have averaged 45 psi for the UF system and ranged between 80 and 100 psi for the RO system. The RO permeate conductivity was approximately 60 micromhos while the RO feed conductivity ranged from 1000 to 1250 micromhos. The RO permeate pH ranged from 3 to 5 while the RO feed pH ranged from 5 to 6.

Case Study

In January 2008, an RO system was installed at an automotive assembly plant in Canada. The primary objective was to reduce the amount of DI water usage in the electrocoat rinse following the closed loop while maintaining or improving vehicle paint quality (i.e., same or less defects). The project included increasing the existing UF permeate rate and installing an RO system on the electrocoat UF permeate to reduce total solids upstream in the close loop rinse with rinse system modifications.

The ultrafilter capacity was increased by adding large area 10-inch diameter potted UF spirals to the existing 8-inch diameter spiral system, using available excess pumping capacity. The ultrafilter permeate rate was increased from 23 gal/min to 30 gal/min. The RO unit used 8-inch diameter cellulose acetate membrane elements and was sized to generate 10 gal/min of RO permeate.

The RO permeate is sent directly to a spray halo to serve as the last rinse in the closed loop. The RO concentrate is sent to the UF permeate holding tank. A pump sends the UF permeate from this holding tank to a spray rinse just ahead of the RO permeate spray rinse.

The reduction in DI water usage due to RO system implementation, increase in UF permeate rate and modifications to the closed-loop and DI rinse systems is estimated at 67%. An annual cost savings of nearly $250,000 is estimated based on decreased DI water use, decreased water treatment, decreased wastewater treatment, increased paint recovery, and decreased biocide additions. The project has an estimated payback of less than two years.

Products Used

ROGA™ cellulose acetate membranes are designed for high organic fouling environments and are widely used for applications where chlorine is needed on a continuous basis. ROGA membranes perform exceptionally well in new or existing systems, and are ideal for high rejection processes where oxidizing agents are a concern.

KMS offers pre-engineered, packaged water treatment systems using RO and NF technology as well as modular, reduced-scope Vessel Control Block suited to larger projects and operators who prefer to provide axial equipment. For larger systems, KMS engineers can design and build a custom system to meet your specific needs.

Both KMS packaged and custom water treatment systems offer:

- A flexible, cost-effective design with lower auxiliary equipment costs
- Fast installation and start-up
- Capacities ranging from 565-1,700 m^3/d (150,000-450,000 GPD)
- Production of high-quality permeate water
- Drinking water and industrial wastewater recycling

KOCH MEMBRANE SYSTEMS™

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