



# DesaliTec™ SOAR CCRO

DuPont Water Solutions helped Archer Daniels Midland achieve superior CIP frequency, feed water flexibility, and water treatment costs with closed circuit reverse osmosis.

## The challenge

The world is growing, and global food processing leader Archer Daniels Midland (ADM) is helping to feed it. Producing quality food, livestock feed, and bio-fuel requires a reliable supply of highly purified water – often from multiple sources of varying quality. ADM's legacy multi-stage reverse osmosis (RO) systems have been the standard technology for removing salts from water sources, however these traditional systems left much to be desired. They were plagued by excessive microbial growth (biofouling) and mineral scaling, requiring frequent cleanings-in-place (CIPs). CIPs temporarily shut down production, reduce the facility's productivity, and shorten membrane lifespans. Furthermore, the legacy systems struggled with seasonal variations in source water quality. Instead of a hands-off process, water production had become a headache. ADM needed a better way to secure clean process water, so they called DesaliTec.

## The solution

ADM adopted DesaliTec Closed Circuit Reverse Osmosis (CCRO) systems as their new standard for water purification, replacing traditional multi-stage reverse osmosis systems. Whereas traditional reverse osmosis relies on sequential membrane arrays to maximize recovery, CCRO cycles a given batch of water through a single membrane array until no further recovery is possible. At a software based set point, the system automatically flushes out all the concentrate, and then returns to its normal operation mode. The flush is automatically triggered by the operating software in response to set points that can include recovery, pressure, permeate quality, and other water quality parameters. During the concentrate flush step, the system continues to be fed and to generate permeate, while concentrate is pushed out of the elegant single-stage system in one sweep.

## Fast Facts

**Industry:** Industrial Utility Water

**Client Profile:**

Archer Daniels Midland is a global leader in food production, livestock feed ingredients, and bio-fuels.



**Client Challenges:**

- Frequent cleanings-in-place (CIP)
- Short membrane life
- Inability to adjust to varying feed waters
- Bio-growth challenges
- Excessive downtime
- High water treatment costs

**Key Benefits:**

- Slashed CIP frequency
- Extended membrane lifespan
- Automatic adjustments to varying feed water conditions
- Significantly inhibited bio-growth
- Improved facility up-time and productivity
- Lowered operational costs
- Maximized recovery
- Reduced energy consumption
- Increased cleaning speed

### The challenge

Thanks to DesaliTec, all three ADM sites enjoyed dramatic improvements. Site 1 saw recovery improve from 75% to 93% (88% without addition of acid), CIP frequency is at a dramatically low level of once per quarter, and boiler cycles were increased from 7 to 90 saving \$84,000 annually. Even with the low CIP intervals, membranes showed no evidence of biological activity at an 8 month inspection.

Site 2 saw CIP frequency drop by 50% when operating at 85% recovery even with a limiting factor of difficult to treat soluble aluminum. At site 3, the DesaliTec unit was able to sustain performance at 90% recovery on challenging wastewater that would limit a traditional 3 stage RO to 83.4% recovery. This is unheard of with traditional RO, as barium sulfate ( $\text{BaSO}_4$ ) is known to cause severe membrane damage when scaling occurs.

DesaliTec promised a lot, and then delivered for ADM. "We thought it sounded too good to believe," said Mark Carroll, a water resource engineer with ADM, "but everything worked as promised." The frequency of cleanings, traditionally a major burden on ADM's water processing, was reduced by a factor of three. Overall operations and project management is now much simpler, he said; all feed changes and recovery adjustments can be made from a single control panel, cutting down on complexity, labor costs, and human error.

With DesaliTec support, ADM is poised to continue advancing its water sustainability goals while simultaneously reducing costs and streamlining operations. "The DesaliTec closed circuit process is the first major change we've seen in decades," Carroll said. "I can confidently say that we found the best possible technology."

DesaliTec currently treats over 2,000 gpm for both water and wastewater reuse applications at 4 plants for ADM, with additional projects currently under construction.

DesaliTec systems are flexible and adaptable to fit the specific challenges of any application:

#### Site 1 – 30 GPM

##### Challenge:

Replace outdated water softener with a new water softener and reverse osmosis system that could provide the maximum water recovery rate and maximize system uptime.

##### Results:

- Improved recovery from 75% to 93%
- CIP only required quarterly
- Boiler cycles increased from 7 to 90
- Annual energy savings: 21,000 MMBTU
- Annual dollars saved: \$84,000\*

#### Site 2 – 1200 GPM

##### Challenge:

Expand existing RO capacity to the high pressure boilers. System must treat soluble aluminum, maximize recovery, automatically adapt to seasonal variations.

##### Results:

- Improved recovery: 85% to 92%
- Decreased CIP frequency by 50%
- Reduced waste by more than 40%
- Annual water savings: 125,00 kgal
- Annual dollars saved: \$1,837,500\*

#### Site 3 – 100 GPM

##### Challenge:

Maximize recovery and minimize RO CIP frequency on MBR effluent with high concentrations of  $\text{BaSO}_4$  and organics.

##### Results:

- Boosted recovery from 83% to 90%
- Exceeded CIP requirements
- Pushed  $\text{BaSO}_4$  into supersaturation

\* Presented at 2016-2017 US Industrial rate of \$4/MMBTU and \$14.7/kgal - Not representative of actual ADM water & electricity rates.

