Safeguard Your System

Get peace of mind with DuPont Water Solutions’ System Optimization Services℠ (SOS)
Sustaining High Performance Long Term

Each water treatment system is unique, as are the challenges you face as you try to keep your systems running at peak efficiency.

What is not unique are the impacts of an inefficient system. From downtime to make repairs, replace components, or clean a fouled system, to increased energy and chemical costs, to lost manufacturing capacity, a damaged or poorly operating water treatment system impacts the bottom line. That’s why you shouldn’t wait until your water treatment system is broken before you call the experts.

DuPont Water Solutions’ System Optimization Services℠ (SOS) put a global team of highly skilled, experienced scientists and technicians at your disposal. Our team can run a battery of sophisticated assessments using state-of-the-art equipment and methods to identify critical issues affecting your ion exchange, reverse osmosis, and ultrafiltration systems. More important, our technical experts can use the data to suggest corrective actions that can help get you performing at peak efficiency.

More Than Just Test Results

Our technical experts interpret the data and provide you a complete report with a description of the tests performed, the implications of our findings on your operation, and suggestions for how to enhance your system performance.

Choose from a Wide Range of Services

SOS Services℠ place our extensive knowledge and experience at your disposal so you don’t have to face unexpected system problems alone. Our service support can lighten the burden of system start-up and staff training, as well as assist with ongoing operation and maintenance.

SOS Services℠ include:

• RO element and UF module testing
• Membrane and fiber fouling composition
• Membrane and fiber characterization
• Ion exchange resin analysis
• Water analysis
• Technical field support
• Comprehensive overall service and support
Membrane Testing Services

DuPont Water Solutions offers troubleshooting and membrane element and module testing and evaluation services to help diagnose the root cause of system underperformance and maximize your overall operation. Our battery of tests will determine your elements’ or modules’ suitability for continued operation or troubleshoot problems in reverse osmosis (RO), nanofiltration (NF), or ultrafiltration (UF) systems. Our experts will then interpret the data and provide a complete report describing the tests performed and the implications of the test results on your operation, and suggest ways to enhance your system performance.

RO, NF, and UF evaluation includes:

Non-Destructive Testing

- **Physical Inspections of RO/NF Element or UF Module**
  Noninvasive test to observe the physical integrity of the element or module and identify potential foulants.

- **Performance Testing**
  Noninvasive test to determine how the element or module is performing at standard test conditions compared to new product specifications.

- **Probing**
  - Vacuum Leak Test (RO element) or Integrity Test (UF module). The rate of the vacuum decay indicates mechanical integrity or a leak of the membrane element. A mechanically intact element with a chemically damaged membrane would still hold the vacuum, but a mechanically damaged element would not.
  - Modules and fiber integrity are tested by holding pressurized air in the feed side of the module to identify potential leaks.

- **Cleaning Recommendations**
  Evaluation of a visual inspection and performance test indicating what type of cleaning would be most effective.
  - Technicians may perform different cleaning cycles in order to improve performance of the element or module.

Destructive Testing

- **Dye Testing**
  To determine the cause(s) and the location of salt passage, the RO element is operated with a pressurized dye solution.

- **Element or Module Autopsy and Membrane Analysis**
  Invasive analysis that requires the RO element to be cut lengthwise to unroll and inspect the status of the membrane sheet and other element materials. UF modules require cutting of the shell to access membrane fibers for analysis.

- **Determination of Fouling, Scaling, or Chemical Damage**
  - Verification of scaling
  - Biofouling analysis
  - Organic fouling
  - Membrane chemical degradation
  - Elemental analysis of the membranes (identification of metals, silica, etc.)
  - Identification of halogens
Ion Exchange Resin Analyses

Our ion exchange resins and adsorbents testing and evaluation services determine the performance and condition of current system operation and, if needed, can troubleshoot and identify the root cause for challenges. We also can retest resins that have been warehoused beyond their recommended storage period. As with our membrane analyses, DuPont experts also interpret the data and provide you a complete report with a description of the tests performed and the implications of the test results on your operation, and suggest ways to enhance your system performance.

Ion exchange evaluation includes:

• **Microscopic Bead Examination**
  A sample of the resin is placed under a microscope and photographs are taken to be included in the report. This important examination helps determine the physical integrity of the beads, whole bead or whole unbroken bead content, and can help with visualization of contaminants or fouling of the resin surface.

• **Particle Size Distribution**
  A sample of the resin is tested with a light-blocking device, which has been calibrated to determine the particle size distribution of ion exchange resins. The particle size distribution is reported to show the bead harmonic mean size, uniformity coefficient, and percent through/retained on standard screen sizes.

• **Total Exchange Capacity (TEC)**
  This test measures the total number of ion exchange sites per volume of resin. Fully regenerated resin is titrated to obtain milliequivalents of capacity per milliliter of resin.

• **Total Exchange Capacity as Received (TEC as Received)**
  This test measures the number of ion exchange sites that are in the regenerated (H⁺ or OH⁻) form. If the sample is submitted as regenerated resin, this result can be compared against the total exchange capacity to determine the efficiency of regeneration. If the sample is submitted as an exhausted resin, this result can determine the extent of exhaustion.

• **Salt-Splitting Capacity (SSC)**
  This test measures the strong base (quaternary amine) sites on an anion resin. Salt-splitting sites are necessary to remove weak acid species such as bicarbonate and silica. A reduction in SSC is typically indicative of an increase in weak base capacity.

• **Water Retention Capacity (WRC)**
  This test measures the inherent moisture content of the ion exchange resin. A fully hydrated resin sample is centrifuged or buchnered to remove free water. The resulting sample is weighed before and after drying to determine the water content. Elevated water content indicates degradation of the polymer chain, while depressed water content typically results from accumulation of foulants in the beads.

• **Organic Fouling**
  The degree of organic accumulation on the anion resin is measured. Elevated organic loading can result in extended rinse-down following regeneration, reduced total throughput to silica break, and eventual permanent loss of strong base capacity by conversion to weak base capacity.

Plant Operational Analyses

DuPont also provides a comprehensive Plant Operational Analysis Report, which can identify and recommend actions to address any reverse osmosis or ion exchange system issues.
• **Inorganic Fouling**
  Inorganic contaminants, such as iron, calcium, and silica, can be identified using atomic absorption (AA), X-ray fluorescence (XRF), inductively coupled plasma (ICP), spectrophotometry, or other analytical methods.

• **Mass Transfer Coefficient (MTC) Testing**
  This test measures resin kinetics (a resin’s ability to quickly remove ions from solution). As resins age, the rate of exchange may not be fast enough to remove all ions before flow reaches the bottom of the bed, thus exhibiting poor operating performance while maintaining a high total exchange capacity. Surface fouling can also inhibit the kinetics of resins. For strong base anion resins, sulfate (which is a slow kinetic exchanger due to its size) is used to challenge the resin. For strong acid cation resins, sodium is used.

• **Resin Cleaning Tests**
  This analysis evaluates the resin using the standard testing and will usually indicate if a resin would benefit from cleaning (e.g., to remove organics, iron, or silica). After cleaning, the resin is retested to evaluate the degree of success and then we make recommendations for remediation.

• **Osmotic Shock and Attrition (OSA)**
  The resin is evaluated for osmotic stability by repeated cycles through exhaustion and regeneration using concentrated reagents. The parameter measured to detect the attrition resistance is designated as percent fragmented beads, which is an indication of the resistance of the beads to fragmentation and cracking.

**Water Analysis**

A full water analysis is available with specific breakdown and balance of cations/anions, pH, silica, metals, and total organic carbon (TOC).

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### Available Resin Analyses for Water Treatment Applications*

<table>
<thead>
<tr>
<th>Available Resin Analyses</th>
<th>Softening</th>
<th>Demineralization</th>
<th>Condensate Polishing</th>
<th>Ultrapure Water</th>
<th>General</th>
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<tbody>
<tr>
<td></td>
<td>Strong Acid Cation</td>
<td>Strong Acid Cation</td>
<td>Strong Base Anion</td>
<td>Strong Acid Cation</td>
<td>Strong Base Anion</td>
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<tr>
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*Not all tests are run for every sample received; DuPont experts will determine the most appropriate tests required to define the condition of the resin.*
Contact us to schedule your analysis today.

To submit a sample for analysis, go to the DuPont Water Solutions’ website to fill out an online Analysis Request. The request forms will provide all the details and instructions necessary to safely and securely submit your resin or membrane to one of our global SOS Services™ analytic teams.

If you have any questions, contact your regional Technical Service team to schedule a plant sample analysis. We have teams across the globe ready to help you.

Have a question? Contact us at: dupont.com/water/contact-us