



Eye On Water

A publication about water purification and specialty applications using DOWEX™ ion exchange resins

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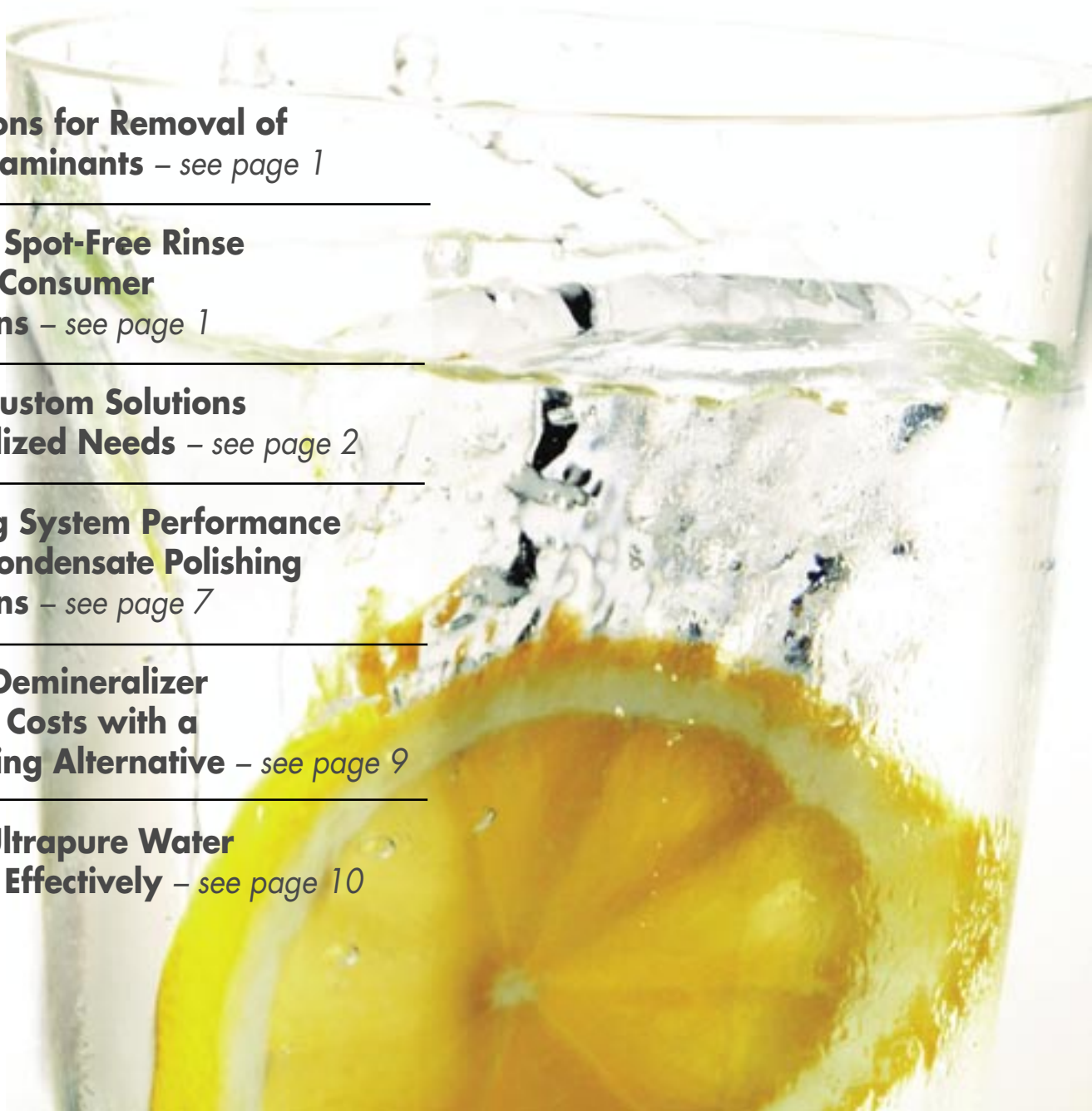
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New Product Producing Spot-Free Rinse Water for Consumer Applications

Although DOWEX™ resins remain the preferred choice for technically challenging applications, DOWEX resins also offer an affordable alternative for consumer applications.

DOWEX MB resin is a mixed bed product that can be used to produce demineralized water quickly and cost-effectively. What's more, DOWEX MB resin is a single-use product that comes ready to use – just drop it into the vessel to start producing good quality water. (Consult the product label for instructions.) DOWEX MB is ideal for applications that require good quality dilution water or spot-free rinse water. DOWEX MB will typically produce between 500 and 700 gallons of spot-free water per cubic foot (66 to 90 liters of water per liter of resin), depending on the salt load. At about 10 to 20 cents per gallon of demineralized water, DOWEX MB resin is the convenient and affordable choice.

Product Portfolio New Options for Removal of Trace Contaminants

To help customers meet safe drinking water standards, Dow has developed a new portfolio of options for removing trace contaminants, including nitrate, perchlorate, radium and more. DOWEX™ ion exchange resins provide the optimal balance of quality performance, reliability and efficiency. With DOWEX resins, customers can count on the following benefits.

- **Selectivity** – Ion exchange resins provide selective removal of trace contaminants by matching the chemistry of the contaminant with a specific chemistry of resins to achieve removal of only that substance.
- **Flexibility** – By nature, ion exchange resins offer excellent operational flexibility. And, the broad product line of DOWEX resins provides even more flexibility in choosing the right ion exchange solution for your application.
- **Productivity** – Produced with uniform particle size (UPS) technology, DOWEX™ ion exchange resins provide faster kinetics for higher flow rates, greater operating capacity, less resin loss, increased resistance to fouling, and greater productivity in a fixed tank volume.
- **Efficiency** – Ion exchange processes often concentrate the contaminant so effectively that the loaded resin represents the smallest possible volume of waste. Whether the resins are then regenerated or disposed, ion exchange enables efficient removal of contaminants, as well as safer disposal options.
- **Durability** – Ion exchange resins are tough, durable plastic beads that remain stable when exposed to strong acids, bases and solvents. DOWEX resins have been engineered by polymer chemists at Dow to be the toughest beads on the market.
- **Reliability** – DOWEX ion exchange resins provide reliable and dependable water purification solutions, backed by more than 60 years of ion exchange manufacturing expertise.

For additional information about specific trace contaminants and the DOWEX resins that are available for their removal, please see Table 1 on pages 3-4.

Specialty Applications Creating Custom Solutions for Specialized Needs

When it comes to specialized applications, the problem-solving experts at Dow can match your specific need with a viable, cost-effective solution. Dow offers solutions for any of these specialized application areas:

- Beverage
- Biotech/Pharma and Fine Mesh
- Catalysis of Organic Reactions
- Dairy
- Mining & Metals
- Offshore Oil Injection Water
- Solvent Drying
- Styrene-DVB Copolymer Beads
- Ultrapure Chemicals and Gases
- VOC Control with Polymeric Adsorbent
- Waste Water and Groundwater
- Water Treatment

Sweeteners Processing

DOWEX™ resins are used as an integral part of processing for corn syrup, high-fructose corn syrup and other starch-based syrups. They are also used extensively in many other sweetener feed streams. In sucrose processing, the resins are used for softening feed streams, recovering sugar from molasses streams, or decolorization. In addition, DOWEX resins are used in the production of non-nutritive sweeteners such as xylitol, sorbitol and mannitol.

Dow provides a wide variety of resins designed specifically for sweetener applications:

- Corn Wet Milling
- Beet Sugar Processing
- Cane Sugar Processing
- Chromatographic Separations

Chemical Processing

For chemical processing applications, DOWEX resins have become an indispensable tool for cost-effective catalysis and removal of a broad spectrum of metal salts, while also reducing unit operations and minimizing safety and storage concerns. DOWEX ion exchange resins have the highest exchange capacities in the industry for metals and mineral salts that can accumulate during use.

The broad product range from Dow offers a wide selection of fine mesh resins with varying levels of cross-linking that allow interaction of the catalyst site with cumbersome alkyl groups. Cross-linking levels range from 2 percent to 8 percent and particle sizes from 300 microns to 37 microns. And, our long experience in the business of separation technology means we can provide the right balance of quality performance, reliability and cost-effectiveness.

DOWEX resins are being used successfully in a number of chemical processing applications, including:

- Acid Purification/Acid Retardation
- Acid Removal for Corrosion Control
- Catalysis of Organic Reactions
- Caustic Purification
- Chelating/Selective Resins
- Formic Acid Removal from Formaldehyde
- Inhibitor and Stabilizer Removal
- Ion Retardation
- Metals Removal
- Salts Removal
- Solvent Drying
- Solvent Recovery from Air Streams
- Styrene-DVB Copolymer Beads

The new portfolio of DOWEX™ ion exchange resins for potable water applications offers many options. At Dow, we can work with you to design a water purification system that meets your specific needs. So if your application requires removal of a contaminant that isn't listed in this chart, please contact us. We can work with you to find a solution that's right for your needs.

DOWEX™ Resins for Potable Water Applications

Table 1 www.dowex.com

Potable Water Resins	Functional Type	Structure	Chemistry	Hardness	Uranium	Nitrate	Perchlorate	Radium	Barium	Chrome	Heavy Metals	Boron	Arsenic	Color Removal
<i>Trace Contaminant Removal</i>														
DOWEX™ 1 Resin	Strong Base Anion	Gel	Amine		●	●	●		●					
DOWEX NSR-1 Resin	Strong Base Anion	Macro	Amine		●									
DOWEX TAN-1 Resin	Strong Base Anion	Macro	Amine										●	
DOWEX PSR-2 Resin	Strong Base Anion	Gel	Amine			●								
DOWEX PSR-3 Resin	Strong Base Anion	Macro	Amine		●	●								
DOWEX RSC Resin	Radium Selective	Gel	Sulfonic Acid				●	●						
DOWEX™ MARATHON™ A Resin	Strong Base Anion	Gel	Amine						●					
DOWEX MARATHON MSA Resin	Strong Base Anion	Macro	Amine						●				●	
DOWEX SAR Resin	Strong Base Anion	Gel	Amine						●					
DOWEX BSR Resin	Weak Base Anion	Macro	Amine								●			
DOWEX MAC-3 Resin	Weak Acid Cation	Macro	Carboxylic Acid							●				
ADSORBSIA™ GTO™ Media	Titanium Based	—	Titanium									●		
DOWEX™ OPTIPORE™ SD-2 Resin	Adsorbent	Macro	Amine										●	
<i>Softening</i>														
DOWEX HCR-S Resin	Strong Acid Cation	Gel	Sulfonic Acid	●						●				
DOWEX HCR-S/S Resin	Strong Acid Cation	Gel	Sulfonic Acid	●						●				
DOWEX MARATHON C Resin	Strong Acid Cation	Gel	Sulfonic Acid	●						●				

Recommended Solution
 Preferred Solution

CADIX Providing the Tools You Need

CADIX (Computer Assisted Design for Ion eXchange) is a comprehensive ion exchange engineering software tool for system design and evaluation of existing plant performance. CADIX allows design of both co-flow and counter-flow regenerated systems for softener and demineralization applications.

CADIX allows an economic comparison of co-current and counter-current regeneration for your particular system. CADIX also provides details on the benefits of the UPCORE™ counter-current regeneration system for your plant. To download CADIX, go to www.dowex.com and click on “Download Software.”

DOWEX™ Resins Deliver Performance and Power

www.dowex.com

Table 2

Product	Resin Types	Ionic Forms	Total Capacity, eq/l, min.	Water Content %	Comments
DOWEX™ MARATHON™ C	Strong Acid	Na ⁺	2.0	42-48	Gel cation resin designed for excellent regeneration efficiency and superior operating capacity for demineralization and softening applications.
		H ⁺	1.8	50-56	
DOWEX MARATHON C-10	Strong Acid	Na ⁺ H ⁺	2.2 1.9	40-45 46-51	Highly cross-linked, high capacity gel cation resin. Designed for mixed bed applications and physically or chemically demanding environments.
DOWEX MARATHON MSC	Strong Acid	Na ⁺ H ⁺	1.7 1.6	44-50 50-56	Uniform particle size, macroporous resin with exceptional physical and chemical stability.
DOWEX MAC-3	Weak Acid	H ⁺	3.8	44-50	Acrylic macroporous weak acid cation resin designed for excellent regeneration efficiency. Designed for use in demineralizers and dealkalizers. Removes hardness associated with alkalinity.
DOWEX MARATHON A	Strong Base Type 1	Cl ⁻	1.3	50-60	Gel anion resin designed for excellent regeneration efficiency and superior operating capacity for demineralization.
		OH ⁻	1.0	50-60	
DOWEX MARATHON A LB	Strong Base Type 1	Cl ⁻	1.3	48-55	Gel anion resin with larger particle size and porosity, specifically designed for use in layered anion beds.
DOWEX MARATHON 11	Strong Base Type 1	Cl ⁻	1.3	48-58	Highly porous gel anion resin specifically suited for demineralization of high organic water and as an organic scavenger.
DOWEX MARATHON A2	Strong Base Type 2	Cl ⁻	1.2	45-54	Type II gel anion resin designed for use in demineralizers and dealkalizers. Offers high operating capacity and excellent regeneration efficiency.
DOWEX MARATHON MSA	Strong Base Type 1	Cl ⁻	1.1	56-66	Uniform particle size, macroporous anion resin with exceptional physical stability and osmotic shock resistance.
DOWEX MARATHON WBA	Weak Base (free base)	FB	1.3	50-60	Weak base anion resin designed for excellent regeneration efficiency for high flow rate applications. Ideal for applications with organic fouling potential.
DOWEX MARATHON WBA-2	Weak Base (free base)	FB	1.7	40-51	Weak base anion resin designed to obtain the highest operating capacity.
DOWEX MARATHON MR-3	Mixed Resin Strong Acid/Base	H ⁺ OH ⁻ 1:1 by capacity	1.8 1.0	50-56 50-60	A 1:1 equivalent mixture of DOWEX MARATHON C10 (H) and DOWEX MARATHON A (OH) for mixed bed demineralization.
DOWEX IF-59	Floating Inert	None	–	–	A polypropylene floating inert resin for upflow service packed bed counter-current regeneration systems.

DIRECTORSM Services

Offering Resin Sample Analysis

DIRECTORSM Services at Dow provides resin analysis to help customers optimize system performance and identify the cause of performance problems. A staff of highly trained engineers and technicians is available to customers around the world, at competitive prices. The analysis service includes a variety of inspection, diagnostic and testing procedures – and a comprehensive range of tests is available for ion exchange resins. To learn more, please visit our website.

Lower Costs

Optimizing System Performance in Harsh Condensate Polishing Applications

For power generation plants, treatment of condensed steam is critical to maintain steam generator chemistry. DOWEXTM ion exchange resins achieve the highest water quality while reducing operating costs.

DOWEX resins are manufactured with uniform particle size distribution. The uniform size and lack of large beads means faster kinetics and greater protection in the event of a condenser leak. The small size of the beads improves resin rinse down and regeneration. The greater number of “pinch points” between beads increases filtration for

higher output and more efficient operation at the same operating cost.

Condensate polishing is a harsh process, with high flow rates, high elevated temperatures and high physical damage risks. That’s why DOWEX resins are produced by process controls for consistently high quality and confirmed by specifications analysis of every batch. The consistently high quality of DOWEX resins helps to reduce the need for resin replacement and reduced life cycle cost.

Our Global Presence You Should Know...

Dow is a world leader in water purification solutions. With sales personnel, technical service representatives and research centers on five continents, we are equipped to serve you globally.

History of Dow Innovations in Water Purification

Ion exchange occurs in a variety of substances and has been used for industrial applications since 1910. In 1935, the introduction of synthetic organic ion exchange resins first enabled the reversible exchange of cations and anions. Dow became involved with ion exchange in 1940 when William C. Bauman began to research the recovery of iodine from oil field brines using ion exchange resins. During this time, Dow also discovered that magnesium chloride could be recovered from seawater with cation exchange resins. These findings led to the development of the first Dow ion exchange resin, DOWEXTM 30 resin.

The primary objective of this work was to extract magnesium ions from seawater and to regenerate the resin with salt. The first pilot plant for extracting magnesium chloride from seawater was designed and constructed in Midland, Michigan, and became the first, continuous operating countercurrent ion exchanger. At the same time, evaluation work continued on organic materials for ion exchange resins. The result was an improved product – the sulfonated divinylbenzene-styrene copolymer that became DOWEXTM 50 resin.

Ion exchange resin developments have continued at Dow in recent years. Dow was the first company to manufacture and commercialize gel-type uniform particle size (UPS) resins in 1983 with the development of its monodisperse resin production technology. Today, UPS technology is available across the entire line of DOWEX ion exchange resins, including the line of macroporous resins from Dow.

In 1985, Dow purchased FilmTec Corporation, the industry leader in reverse osmosis technology. This wholly owned subsidiary of Dow continues to advance in reverse osmosis membrane technology with recent innovations such as high active surface area elements, low energy elements and seawater elements.

Dow Liquid Separations continues to improve its separations technologies to meet the growing demands for pure water and other high quality separations.

Industry News

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About Dow

DOWEX™ ion exchange resins are made by The Dow Chemical Company, a globally recognized leader in water purification technology since 1940. Dow was the first company to commercially manufacture gel-type uniform particle size (UPS) ion exchange resins, and the first to offer uniform cation and anion resins as both gel and macroporous products.

Today, Dow also offers reverse osmosis (RO) products through its subsidiary, FilmTec Corporation, the world leader of reverse osmosis technology. By offering both ion exchange and RO technologies, Dow is uniquely equipped to help customers choose the proper technology – or mix of technologies – to meet their specific needs.

Serving a Wide Customer Base

Dow customers are primarily original equipment manufacturers of water treatment systems, engineering companies that specialize in the design and installation of water treatment systems, water service companies that operate water treatment systems for industrial and other water end users, public and private water utilities and the military. Our customers serve a wide range of end users, including power generation and semiconductor plants, chemical and process industries, municipalities, and other commercial and consumer customers around the world.

UPCORE™ System

Reducing Demineralizer Operating Costs With a Self-Cleaning Alternative

Whether you need to install a demineralizer system in a new or existing plant, the UPCORE™ system offers a cost-effective, self-cleaning alternative. The UPCORE system combines upflow, counter-current regeneration technology with uniform particle size resin to achieve higher water quality, more efficient regeneration and greater operating capacity.

Because the UPCORE system is an upflow regeneration system with downflow service, the packed resin bed is less vulnerable to fluctuations in water flow during the system cycle than beds with upflow service. UPCORE's downflow service also assures that ionic layering in the resin bed remains undisturbed so exhausted resin from the upper portion of the bed does not become mixed into the highly regenerated zone at the bottom. This produces higher water quality and uncompromised bed operating capacity.

What's more, the unique design of the UPCORE system eliminates the need for periodic backwashing to remove resin fines and other particulate matter, because these particulates naturally accumulate at the top surface of the bed during the service cycle. The particulates are then swept out of the bed at the beginning of each upflow regeneration cycle.

Increased Efficiency

Creating Ultrapure Water More Cost Effectively

Ultrapure water (UPW) is essential for proper fabrication of today's integrated circuits. As the first global supplier of both ion exchange resins and reverse osmosis elements, Dow is uniquely positioned to offer a full range of options, including optimized hybrid systems that use both technologies to create ultrapure water.

DOWEX™ MONOSPHERE™ ultrapure water grade ion exchange resins offer significant improvements over competing resins. Their uniform particle size distribution

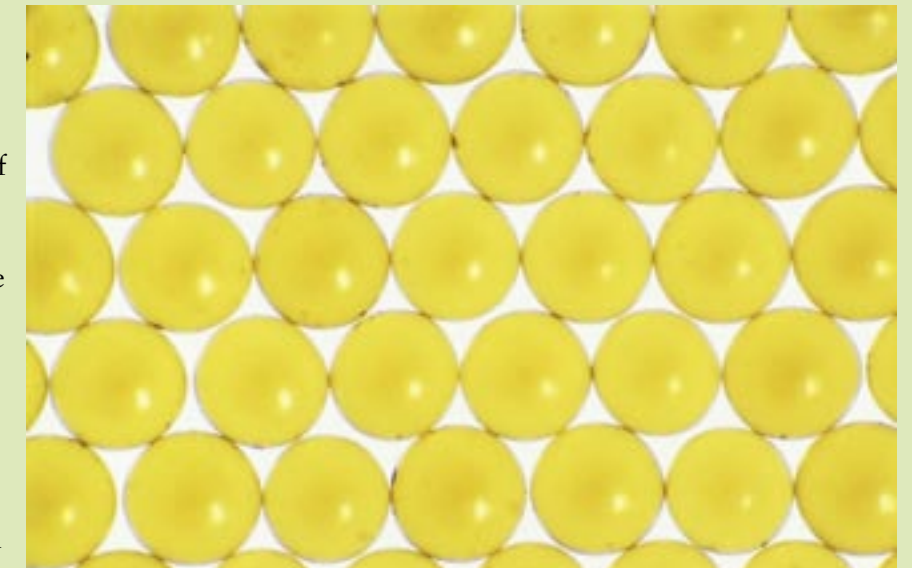
provides faster kinetics, shorter rinse times, better regeneration efficiency and longer resin life, all of which combine to increase cost effectiveness. In addition, the color difference between DOWEX MONOSPHERE cation and anion resins makes it easy to verify that complete separation has occurred, reducing labor costs for correcting improper separations.

Find out how Dow's full range of options and products can help you meet even your most demanding ultrapure water applications.

Uniform Particle Size (UPS)

You Should Know...

In ion exchange, resin beds containing beads with the same particle diameter offer a number of process advantages over beds containing beads with conventional Gaussian particle size distribution. For many years, UPS resins could only be produced by screening conventional product – a cost-prohibitive process. In the early 1980s, Dow researchers developed and patented a process to produce UPS ion exchange resin beads without a mechanical process. Conventional resin beads range in size from 50 to 16 mesh, or 300 to 1200 microns, whereas UPS resins have a much narrower particle size distribution, in which 95 percent of the resin beads are within 100 microns of the average particle diameter. The mastery of UPS technology at Dow has revolutionized the ion exchange industry, bringing new advantages such as higher regeneration efficiency, greater operating capacity, less resin loss, increased organic fouling resistance and much more. UPS technology is now available across the entire line of DOWEX™ ion exchange resins.





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