



WATER & PROCESS SOLUTIONS

# Ion Exchange and Adsorbent Solutions for the Nutrition Market

Food matters. Dow makes it better.



# Reliability, Value, and Innovation

Dow is the largest manufacturer of ion exchange resins worldwide. Our comprehensive product line, technical expertise, and global reach allow for optimized performance of even the most complex manufacturing processes. With continuous investment in product innovation and manufacturing excellence, we have global expertise in serving the food processing industry.

Dow consistently offers:

- **Reliability** – capital investment in worldwide production facilities to supply increasing global demand and offer leading quality, global service, and support.
- **Value** – products designed for applications that help lower operating costs and increase throughput, yield, and product quality.
- **Innovation** – R&D focused on delivering innovative products to maximize plant performance.

#### AMBERLITE™ Resins

Proven innovation, quality, and consistency in specialty applications including food additives, nutritionals, and beverage production.

#### DOWEX™ Resins

Industry-leading performance in starch-based sweeteners including low dextrose equivalent syrups, glucose, fructose, and high fructose corn syrups.



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DOW DIRECTOR™ Services  
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# Sweeteners

## Corn & Starch Processing

### The Value of Uninterrupted Production

With Dow as your partner, you realize reliable production and benefit from our expertise.

You see Dow's value in consistent plant uptime and lower-than-typical operating costs. From standard resins to premium resins featuring MONOSPHERE™ Uniform Particle Size Technology, Dow products and solutions have served plants worldwide reliably for decades.

Dow's value also comes in our expertise. Our deep history in the industry helps us understand your needs. We help you balance resin selection, system design, and plant operations to achieve optimal results. Altogether, Dow helps you operate your plants with the highest return for your resin investment.

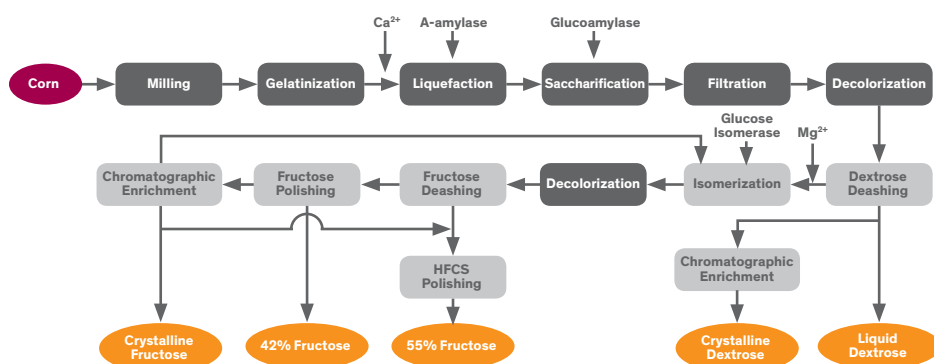


Diagram 1: Typical High Fructose Corn Syrup Plant



### Deashing and Mixed Bed Polishing

DOWEX™ Resins: An Excellent Choice for Corn and Starch Sweetener Deashing and Polishing

DOWEX™ Resins lead the corn and starch sweetener industry in deashing and mixed bed polishing, removing unwanted ions and other contaminants from the syrup stream. Dow offers a full line of cation and anion deashing products ranging from standard to premium offerings.

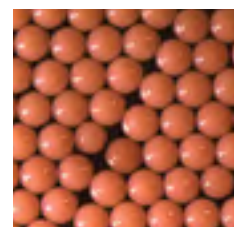
DOWEX 88 Strong Acid Cation (SAC) Resin and DOWEX 66 Weak Base Anion (WBA) Resin are an industry standard for deashing dextrose and fructose. DOWEX MONOSPHERE™ 88 SAC Resin and DOWEX MONOSPHERE 77 WBA Resin are premium products offering the ultimate in process performance.

DOWEX MONOSPHERE™ Resins Help Reduce OPEX and Increase Plant Capacity

DOWEX MONOSPHERE™ 88 SAC and DOWEX MONOSPHERE 77 WBA Uniform Particle Size Resins – offering one of the most uniform-size beads in the industry – are premium products designed to deliver high ion exchange efficiencies and physical strength. Resin uniformity facilitates high throughput, economical regeneration, long life, and low operating costs.

DOWEX MONOSPHERE resins are viewed as an industry standard as they help to achieve:

- Increased plant syrup capacity
- Less frequent regeneration, reducing chemical costs up to 25%
- Reduced sweetwater generation, reducing evaporation costs
- Reduced rinse requirements
- Reduced waste generation
- Packed bed and up-flow operations



DOWEX MONOSPHERE™ 88 SAC

## DOWEX™ Mixed-Bed Resins Help Improve Syrup Stability

Specifically designed for mixed bed polishing, DOWEX™ 22 Strong Base Anion (SBA) and DOWEX 88 MB (Mixed Bed) Strong Acid Cation (SAC) Resins – are used near the end of the 55 High Fructose Corn Syrup process. Using a mixed bed avoids the large pH swings seen when separate columns are used. This minimizes impurities from degradation reactions that reduce syrup shelf life.

To provide a good balance between cationic and anionic sites, a typical mixed bed polisher consists of 60% (by volume) DOWEX 22 SBA resin and 40% DOWEX 88 MB SAC resin. The DOWEX 22 SBA is paired to pick up both the acids produced by the cation, and weak acids in the product stream. DOWEX 88 MB SAC is specially designed to distinctly separate from the anion resin during the regeneration procedure.

This resin pairing provides an easy-to-regenerate process and a clean finished product stream.

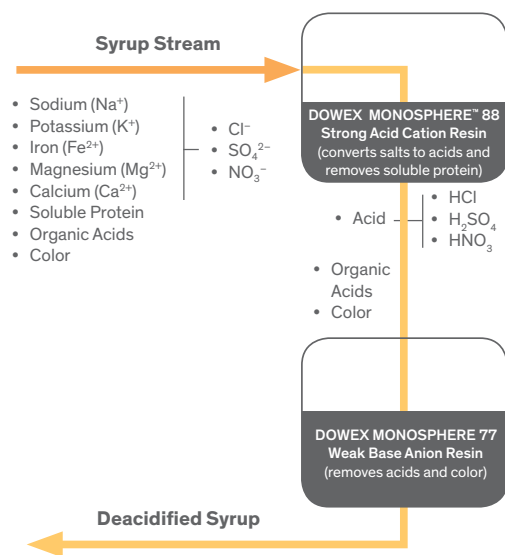


Diagram 2: Syrup Deashing

## Deashing and Polishing Product Pairs for Extended Syrup Run Times

Although performance-grade DOWEX™ Resins will deliver high product quality, premium-grade DOWEX MONOSPHERE™ Resins help decrease operating costs, and help improve plant capacity. Premium resins extend syrup run times up to 25%, reducing downtime and the chemicals spent on regeneration. A simple change to premium DOWEX MONOSPHERE resins can postpone or eliminate the need for capital expansion.

| Syrup Run Time                    | Strong Acid Cation (SAC) Resins | Anion Resins        |
|-----------------------------------|---------------------------------|---------------------|
| <b>DEASHING Base Performance</b>  | DOWEX™ 88                       | DOWEX 66            |
| <b>Enhanced ~10% Increase</b>     | DOWEX MONOSPHERE™ 88            | DOWEX MONOSPHERE 66 |
| <b>Premium ~ 25% Increase</b>     | DOWEX MONOSPHERE 88             | DOWEX MONOSPHERE 77 |
| <b>POLISHING Base Performance</b> | DOWEX 88 MB                     | DOWEX 22            |
| <b>Enhanced ~ 10% Increase</b>    | DOWEX MONOSPHERE 88             | DOWEX MONOSPHERE 22 |

## Corn and Starch Sweetener Deashing Product Guide

| Process and Resin Type       | Resins                | Best For  |
|------------------------------|-----------------------|---|
| <b>Deashing Cation (SAC)</b> | DOWEX™ 88             | Sodium form – Produces low-conductivity syrup products              |
|                              | DOWEX 88 H            | Hydrogen form – Produces low-conductivity syrup products            |
|                              | DOWEX MONOSPHERE™ 88  | Sodium form – Offers reduced sweetwater and rinse requirements      |
|                              | DOWEX MONOSPHERE 88 H | Hydrogen form – Offers reduced sweetwater and rinse requirements    |
| <b>Deashing Anion (WBA)</b>  | DOWEX 66              | Produces low-conductivity syrup products                            |
|                              | DOWEX MONOSPHERE 66   | Increased syrup throughput using a uniform size product             |
|                              | DOWEX MONOSPHERE 77   | Lowest processing cost using highest capacity, uniform size product |

## Corn and Starch Sweetener Polishing Product Guide

| Process                     | Resins  | Best For  |
|-----------------------------|---|---|
| <b>Polishing Mixed Beds</b> | DOWEX™ 88 MB H SAC paired with DOWEX 22 OH SBA            | Syrup products with maximum shelf stability; both resins in their regenerated ionic form  |
|                             | DOWEX 88 MB paired with DOWEX 22                          | Syrup products with maximum shelf stability; most stable resin forms for inventory safety stock (Na and Cl forms, respectively)   |
|                             | DOWEX MONOSPHERE™ 88 H paired with DOWEX MONOSPHERE 22 OH | Syrup products with maximum shelf stability; uniform particle size enables more efficient mixed bed utilization; both resins in their regenerated ionic form  |
|                             | DOWEX MONOSPHERE 88 paired with DOWEX MONOSPHERE 22       | Syrup products with maximum shelf stability; uniform particle size enables more efficient mixed bed utilization; most stable resin forms for inventory safety stock (Na and Cl forms, respectively) |



# Sweeteners

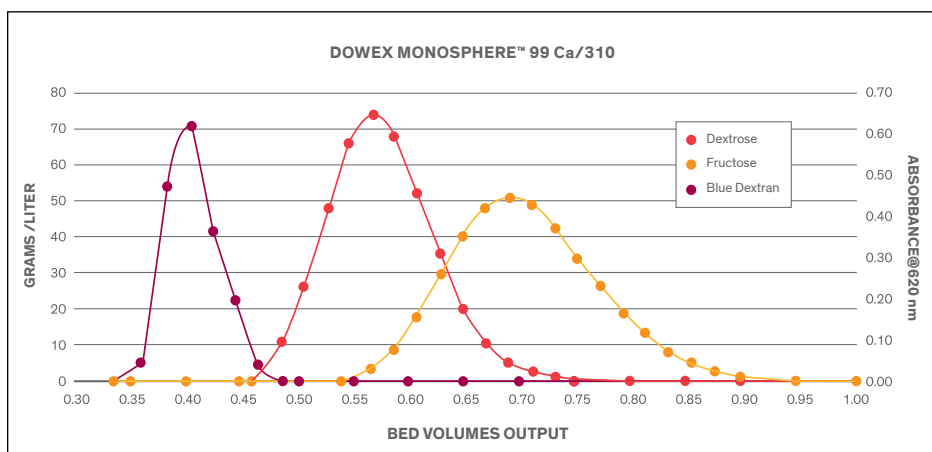
## Corn & Starch Processing

### Chromatography

Dow Helps Make Corn and Starch Sweetener Separations Better

DOWEX MONOSPHERE™ 99 Chromatography Resins help deliver fast, sharp, and economical chromatographic separations.

One of the most critical factors in chromatographic separation is the uniformity of the separation beads. Bead uniformity affects both the degree of sweetener separation achieved and the pressure on the processing system, chromatography columns. Resins with a wide particle size distribution demonstrate a high system pressure drop, which lowers productivity. Additionally, the wide particle size distribution beads produce more dilute product streams due to poor separation (wide and less distinct separation bands). Wide particle size beds require additional elution water and, as all of this water must ultimately be removed, places a higher demand and expense on the already expensive evaporation process.



DOWEX MONOSPHERE 99 resins help eliminate these problems. The resin bead's uniform size and structure, as well as their smooth surface, more effectively produce enriched fructose.

The graph illustrates the sharp separation achieved with DOWEX MONOSPHERE 99 in a small-scale laboratory column.

### Corn and Starch Sweetener Chromatography

DOWEX MONOSPHERE 99 resins are available with uniform bead size ranging from 220 – 350 µm to suit your specific operational goals for an extensive variety of applications, as summarized in the related tables.

| Chromatography Resin Size (µm) | Best For  | Application  | Chromatography Resin                          |
|--------------------------------|---|--|---|
| 350                            | Low pressure drop   | <b>Beet sugar</b>                                      | DOWEX MONOSPHERE™ 99 K/350, K/320, or K/310   |
| 320                            | Standard performance with a "workhorse" product                             | <b>Dextrose</b>  | DOWEX MONOSPHERE 99 K/320, K/310, or K/280    |
| 310                            | Reduced operating costs   | <b>HFCS</b>  | DOWEX MONOSPHERE 99 Ca/320, Ca/310, or Ca/280 |
| 280                            | Difficult separations, reduced separator water usage                        | <b>High purity fructose</b>                            | DOWEX MONOSPHERE 99 Ca/310 or Ca/280          |
| 220                            | Exceptional performance in shallow-bed separators, operating cost reduction | <b>Polyols</b>   | DOWEX MONOSPHERE 99 K/310, K/280, or K/220    |
|                                |   | <b>Sugar alcohols</b>                                  | DOWEX MONOSPHERE 99 K/310, K/280, or K/220    |
|                                |   | <b>Difficult to separate and high value sweeteners</b> | DOWEX MONOSPHERE 99 Ca/220 or K/220           |



## Decolorization

Dow Adsorbent Resins Facilitate Syrup Quality by Removing Impurities

DOWEX OPTIPORE™ SD-2 Adsorbent Resin helps deliver decolorization and extend product shelf life by removing unwanted flavors and aromas, as well as color precursors, such as 5-(Hydroxymethyl)furfural (HMF).

DOWEX OPTIPORE SD-2 adsorbent resin is used alone or in combination with activated carbon. The adsorbent can help correct for color spikes in the syrup stream, such as those caused by a process upset or shutdown.

### Sweetener Decolorization

| Process        | Adsorbents           | Best For                        |
|----------------|----------------------|---------------------------------|
| Decolorization | DOWEX OPTIPORE™ SD-2 | Efficient color and HMF removal |
|                | AMBERLITE™ XAD™761   | Syrup storage stability         |



## Enzymatic Immobilization

AMBERLITE™ Resins Offer Simpler Operation, Excellent Downstream Processing

The two primary applications of enzymes to starch-based sweeteners are converting starch to glucose (also known as dextrose) with alpha- and beta-amylase and converting glucose to fructose with glucose isomerase. The enzymes can be immobilized on phenolic-based media and applied in packed bed columns for a continuous, heterogeneous catalytic process.

AMBERLITE™ Resins offer effective enzymatic transformation to provide:

- Simpler operation and downstream processing
- Increased enzyme stability and lower enzyme use
- Higher and more consistent activity
- Lower costs for raw materials and operation

### Enzyme Immobilization

| Enzyme Immobilization                          | Weak Base Anion Resins | Best For                                    |
|--|------------------------|---|
| β-amylase, β-galactosidase, glucoseoxidase     | AMBERLITE™ FPA51       | Activity-optimized for smaller enzymes      |
| Maltose phosphorylase, trehalose phosphorylase | AMBERLITE FPA54        | Unique, highly porous                       |
| Glucose isomerase                              | DUOLITE™ A568          | Large pores facilitate high enzyme activity |





# Sweeteners

## Beet Sugar Softening and Chromatography

### Increase White Sugar Production with Dow Ion Exchange Softening and Chromatography Resins

Sugar beets are an important source of sucrose (saccharose). Diagram 3 illustrates the key steps involved in refining beets to recover sugar. Critical unit operations using ion exchange resins include softening (decalcification) and chromatography.

The sugar syrup stream contains salts and color. These contaminants are molassogenic, which cause valuable sugar to remain in the remaining liquor (molasses) after crystallization. To extract more of the high value sugar, the molasses is fed to desugarization chromatographic beds. DOWEX MONOSPHERE™ 99 K Resins, in potassium form, help separate sugar from salts and color. A purified sugar stream is recovered and recycled back to crystallization, facilitating an increased overall sugar yield. In some plants, valuable betaine is also recovered by chromatography. The salts and color are routed to other byproducts, such as animal feed products.

Decalcification upstream of the chromatography step helps DOWEX MONOSPHERE 99 K resins remain in the potassium



form. If calcium is not removed, the chromatography resin would convert to calcium form, which would significantly reduce separation performance. Decalcification of the process stream with a cation resin listed in the table below helps reduce evaporation scaling, which helps increase efficiency and helps reduce downtime.

Processors rely on Dow ion exchange technologies for critical decalcification processes and chromatographic recovery of sugar and betaine from beet molasses.

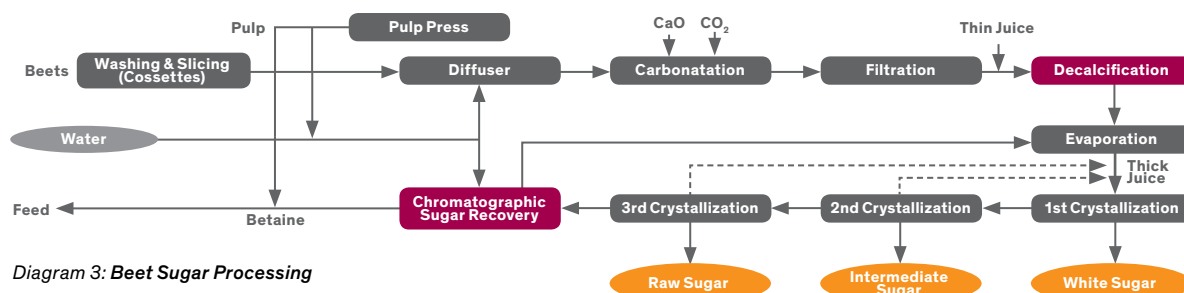


Diagram 3: Beet Sugar Processing

### Beet Sugar Decalcification

| Processes  | Strong Acid Cation Resins   |
|--|---|
| Thin Juice,<br>NRS Process,<br>Gryllus,<br>Quentin Process,<br>and Decalcification | AMBERLITE™ FPC14 Na<br>AMBERLITE FPC22 Na<br>DOWEX™ FPC16UPS Na<br>DOWEX 88<br>DOWEX MAC-3 Weak Acid Cation Resin |

### Beet Molasses Desugarization/Chromatography

| Process                       | Separation Resins          | Best For   |
|-------------------------------|----------------------------|--|
| Desugarization/Chromatography | DOWEX MONOSPHERE™ 99 K/310 | Low water consumption reduces evaporator cost        |
|                               | DOWEX MONOSPHERE 99 K/320  | Low-pressure design for deep beds                    |
|                               | DOWEX MONOSPHERE 99 K/350  | Low-pressure design for deep beds and high viscosity |





# Sweeteners

## Cane Sugar Decolorization



### Dow Ion Exchange Resins Help Maximize Cane Sugar Decolorization

AMBERLITE™ Ion Exchange Resins have proven to be an excellent choice for cane sugar decolorization.

Unlike with beet sugar, the sucrose in sugar cane cannot be extracted by diffusion alone. The cell walls of sugar cane must be broken, which is accomplished by crushing the sugar cane in large mechanical rollers. This processing introduces color impurities into the raw sugar. Cane-based color has a tendency to be incorporated into sugar crystals during crystallization. Therefore, as shown in Diagram 4, additional decolorization is required before cane sugar crystallization.

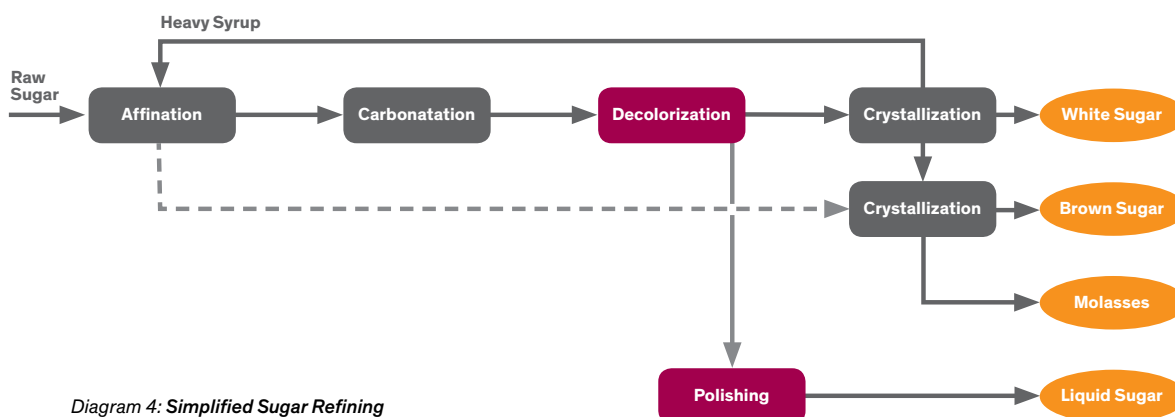


Diagram 4: Simplified Sugar Refining

### Cane Sugar Decolorization

| Resin Type             | Strong Base Anion Resins | Best For                                      |
|------------------------|--------------------------|---|
| <b>Acrylic Matrix</b>  | AMBERLITE™ FPA98 CI      | High-color syrups and regeneration efficiency |
| <b>Styrenic Matrix</b> | AMBERLITE FPA900UPS CI   | Uniform size for increased efficiency         |
|                        | AMBERLITE FPA90RF CI     | Size-graded for packed beds                   |
|                        | AMBERLITE FPA90 CI       | Highest degree of decolorization              |

### Liquid Sugar Purification

| Resin Type        | Resin               | Best For  |
|-------------------|---------------------|---|
| Strong Base Anion | AMBERLITE™ FPA42 CI | High-color capacity for high throughput                         |
| Weak Acid Cation  | DOWEX™ MAC-3        | Paired with AMBERLITE FPA42 CI – adds deashing to color removal |



## Beverages

### Dow Satisfies the Beverage Industry's Thirst for Innovation

The global marketplace for beverages is large, diverse, and dependent on consumer perceptions of quality and value. Consumers demand both quality and consistency in their beverage choices, including product clarity, taste, and nutritional value. AMBERLITE™ Resins help beverage companies worldwide deliver on those demands.

#### Citrus Debittering

Citrus juices have natural bitter components, such as limonin and naringin. Removal of these bitter molecules is important for taste and shelf life stability. As shown in Diagram 5, citrus processors use AMBERLITE™ FPX66 Adsorbent Resin to help debitter juice by removing these components through hydrophobic interaction. Ultrafiltration diverts the citrus pulp around the resin. Regeneration with hot dilute caustic removes the limonin and prepares the resin for reuse.

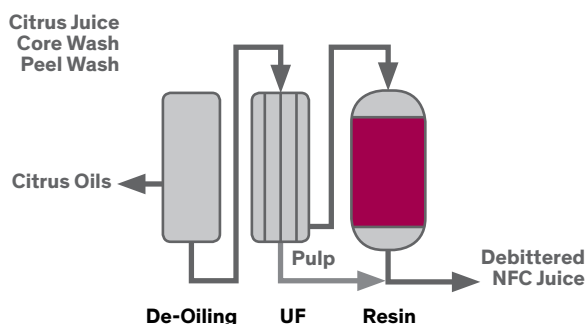


Diagram 5: Citrus Debittering

#### Juice Deacidification

Fruit juices, especially citrus juices, are naturally acidic, and excessive acidity can present taste and tolerance issues for consumers. Using ion exchange resins from Dow, processors deacidify fruit juices while still maintaining Federal Standards of Identity. The most common approach for citrus juice deacidification is shown in Diagram 6. Pulp is separated from the juice using either a centrifuge or ultrafiltration. The juice then contacts a weak base anion exchange resin in a packed bed column. The pulp is returned to the juice prior to packaging or evaporation.

For other fruit juices, a pectin removal process may replace the pulp centrifuge or UF system. Because of the high osmotic forces put upon the ion exchange resin in this application, the resin must have high osmotic stability and acid capacity – exactly the characteristics of AMBERLITE™ Resins.

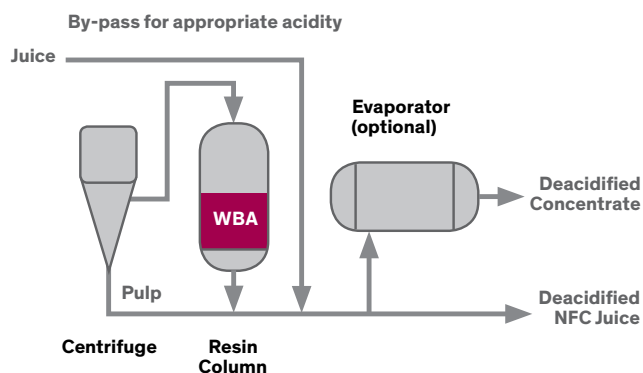


Diagram 6: Citrus Juice Deacidification



### Juice Decolorization

Color removal in fruit juice is usually part of a longer process to make a neutral base for converting the juice to a designed beverage, or to create juice for canning or blending as a supplemental natural sugar source.

Browning and color stability are the primary concerns when decolorizing a primary juice. Oxidized amino acids, polyphenols, and color precursors in the juice contribute to color formation. But these compounds can be successfully removed without significantly altering other juice properties using AMBERLITE™ FPX66 Polymeric Adsorbent. This process facilitates a clean and economical alternative to using powdered activated carbon.

### Protein Haze Stabilization

Haze can form in some beverages after packaging, which can have a negative impact on consumer preference. This occurs with beers, wines, and some fruit juices. This haze is typically formed by the interaction of proteins and polyphenols in the beverage. Removing the proteins will improve the haze stability of the beverage.

AMBERLITE™ FPX62 Adsorbent Resin helps remove haze-forming proteins from fruit/vegetable juices and syrups, beers, and wines. AMBERLITE FPX62 also helps beer to retain desirable head-forming proteins without the handling, yield, and waste issues encountered when using bentonite clay for this same purpose.



### Beverages

| Process                           | Products   | Best For   |
|-----------------------------------|--|--|
| <b>Citrus Debitting</b>           | AMBERLITE™ FPX66 Adsorbent   | Selective removal of limonin and naringin with large active surface area                         |
| <b>Juice Deacidification</b>      | DOWEX™ 66 WBA Resin  | Removal of citric and other acids  |
| <b>Juice Decolorization</b>       | AMBERLITE FPX66 Adsorbent<br>DOWEX OPTIPORE™ SD-2 Adsorbent              | High active surface area with large pores<br>High active surface area with a range of pore sizes |
| <b>Fruit Juice Deashing</b>       | DOWEX MONOSPHERE™ 88 SAC Resin paired with DOWEX MONOSPHERE 66 WBA Resin | Low-conductivity decolorized products  |
| <b>Protein Haze Stabilization</b> | AMBERLITE FPX62 Adsorbent  | Protein removal with minimal removal of flavor and color   |



## Food Additives & Nutritionals

### Dow Adsorbents and Ion Exchange Resins Extract Value

Nutritionals are components or derivatives of food products that have health benefits and/or commercial value and include valuable nutrients such as amino acids, polyphenols, and organic acids. These products are often extracted from substances such as green tea or fruits, or generated by fermentation.

In all cases, these products must first be separated from a solution and purified, which is precisely where adsorbents and ion exchange resins from Dow shine.

#### L-Lysine

L-Lysine is an essential amino acid and is commercially important as a nutritional supplement to animal feeds. It is produced via fermentation and recovered using a strong acid cation resin. Dow offers a wide range of strong acid cation exchange resins specifically designed for the recovery and purification of L-lysine. Resin selection will depend on local operating conditions.

#### Citric and Lactic Acids

Citric and lactic acids are large-volume, commercially important organic acids used primarily in the food and beverage industry as acidulents and preservatives. Citric acid is well-known as the source of the tart flavor in fruit juices. Lactic acid is used in many food applications including bakery, meat and dairy products, beverages, salads, and dressings.

Dow provides a full range of ion exchange products for manufacturing citric and lactic acids. Typical ion exchange processes include a strong acid cation exchange resin and a weak base anion exchange resin. Organic acids cause ion exchange resins to experience extreme swings in volume (swelling). For this reason, only the most physically stable ion exchange resins, such as those available from Dow, can be used to recover and purify organic acids.

One acid-refining technique, shown in Diagram 7, uses a precipitation process with lime to produce calcium citrate and calcium lactate solids. This is then contacted with sulfuric acid to produce a partially purified soluble organic acid and a large mass of calcium sulfate byproduct. These processes produce streams that require demineralization using Dow ion exchange products.

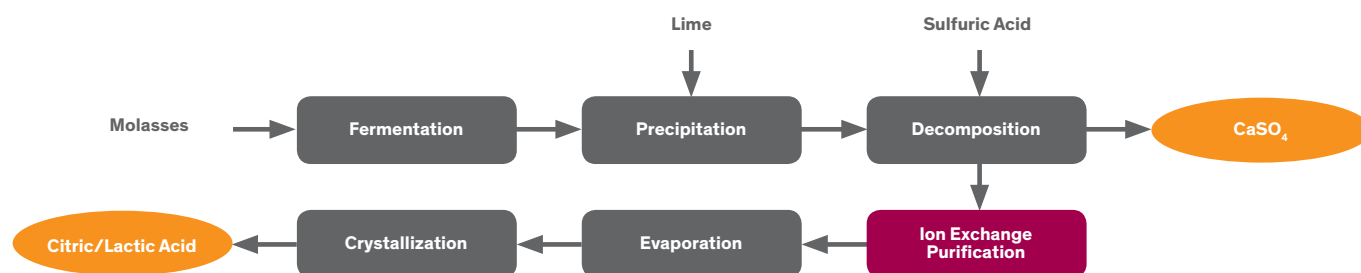


Diagram 7: Acid-refining Technique

#### Organic Acid Purification

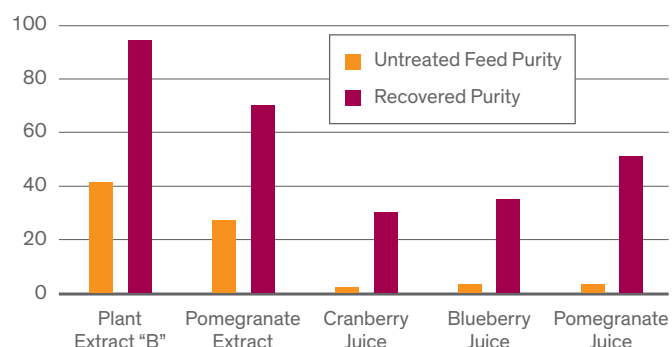
| Application                     | Resin                  | Best For   |
|---------------------------------|------------------------|--|
| Citric and Lactic Acid Deashing | DOWEX™ FPC23UPS H      | Lower processing cost using highest capacity, uniform size product                   |
|                                 | DOWEX MONOSPHERE™ 88 H | Offers reduced sourwater and rinse requirements                                      |
|                                 | DOWEX 88 H             | Reliable performance   |
|                                 | AMBERLITE™ FPA53       | Durable in citric or lactic acid feeds and paired with a SAC resin                   |
|                                 | AMBERLITE FPA55        |  |
| Lysine Recovery                 | AMBERLITE FPC11 Na     | Resists breakage under high-loading stress   |
|                                 | DOWEX FPC16UPS Na      |  |
| Chromatographic Separation      | AMBERLITE CR5550       | Excellent chromatographic resolution, eliminating the citric acid precipitation step |



## Plant Extracts and Polyphenols

Polyphenols are compounds found in natural foods that provide color and flavor and are highly valued for their antioxidant and health properties. These can be derived from many different sources including plants (cocoa, green tea, pine bark), fruits (red berries, pineapple, orange juice, grapes skins, and seeds), and oils.

Many nutrition companies use AMBERLITE™ FPX66 or AMBERLITE XAD™ 7HP Polymeric Adsorbents to help remove, recover, and purify a variety of polyphenols for commercial use. Once recovered, polyphenols can be added to foods and beverages.



## Whey Deashing

Milk is one of the most important forms of nutrition. It is a complex mixture of fats, proteins (caseins), minerals, enzymes, and carbohydrates (lactose). These components can be separated through the use of membrane processes to form cheeses, cultured milk products, and whey proteins.

Dow resins help milk processors produce high-quality demineralized whey. The highest levels of whey demineralization are achieved with a two-bed ion exchange system, using strong acid cation and weak base anion exchange resins.

## Gelatin Deashing

Gelatin, made by hydrolyzing collagen and used in a variety of food and pharmaceutical products, has strict quality requirements. The resulting solution contains a high molecular weight protein and a considerable amount of mineral content (ash). Dow ion exchange resins help remove this mineral content and ensure that the gelatin meets customer specifications and application requirements.



## Food Additives & Nutritionals

| Nutritional                                 | Products   | Best For   |
|---|--|--|
| <b>Polyphenols</b>                          | AMBERLITE FPX66 Adsorbent  | High extraction capacity and solvent recovery    |
| <b>Whey, Gelatin, and Glycerin Deashing</b> | DOWEX MONOSPHERE™ 88 SAC Resin paired with DOWEX MONOSPHERE 66 WBA Resin | Deashing and decolorizing                        |
| <b>Dairy Concentration and Desalting</b>    | DOW HYPERSELL™ Elements  | Effective dewatering or production concentration |



## Dow Expertise

A Key Ingredient in Food and Beverage Processing



### DOW DIRECTOR<sup>SM</sup> Services

Working with Dow is easy and convenient. Whenever you choose Dow resins, you get expert support from Dow ion exchange technical service and development teams.

For more involved issues, Dow offers a full range of DIRECTOR<sup>SM</sup> Services to help you achieve optimal performance from your resin, system, and plant operations. DIRECTOR Services place our extensive knowledge and experience at your disposal. These services can complement your R&D innovation team, lighten the burden of your system start-up and staff training, and support the ongoing operation and maintenance of your system.



[Contact DOW  
DIRECTOR<sup>SM</sup>  
Services](#)

#### Request a Sample of Dow Ion Exchange Products

Small orders of Dow ion exchange resins, polymeric adsorbents, chelating resins, and copolymers can be ordered online through the Octochem website.

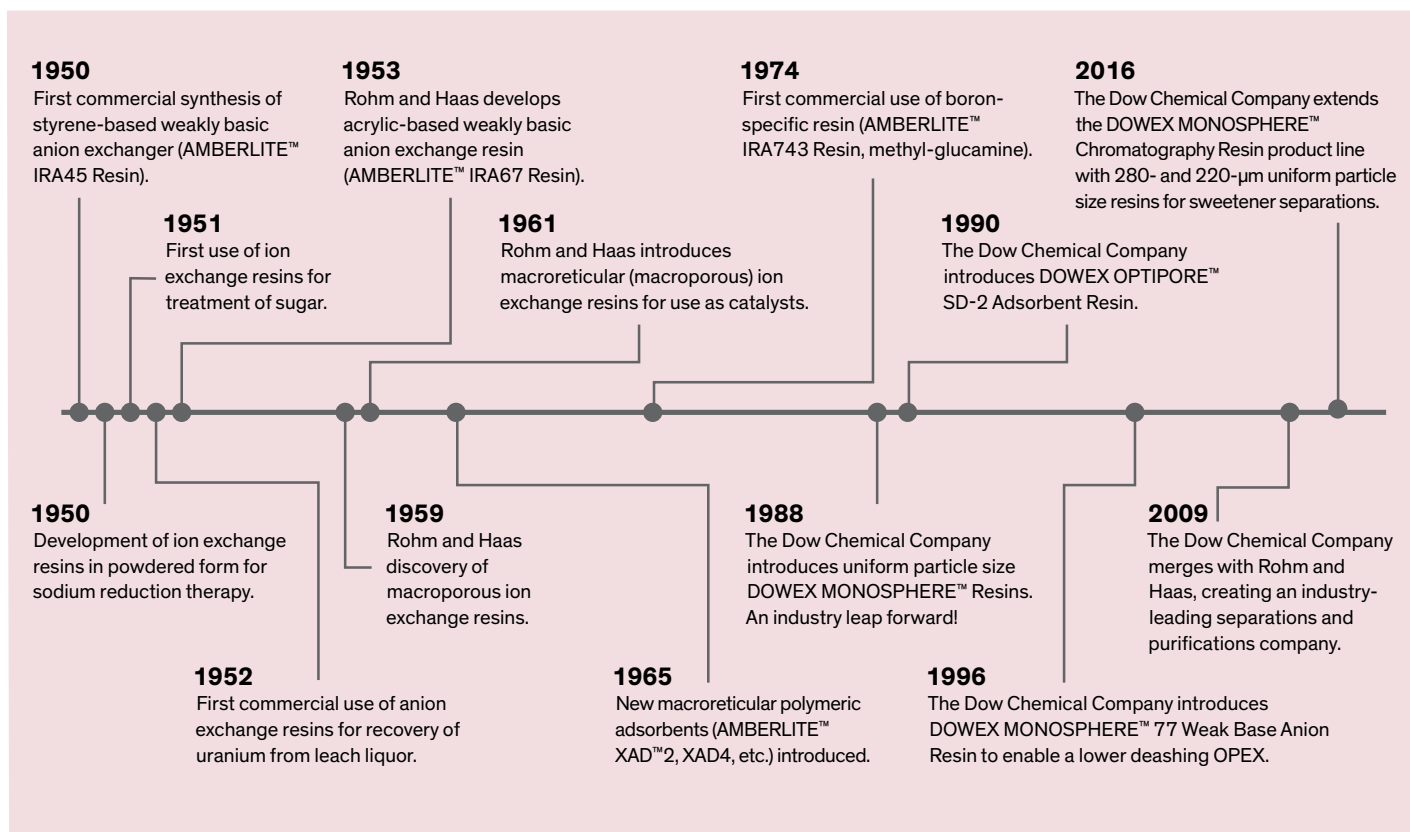


[Request  
a Sample  
Online](#)

## Innovation to Meet Future Customer Needs

The Dow research and development process starts with you. By proactively communicating with our customers and listening to your unmet needs, we are able to work to develop products that lower your cost of production and deliver the most economical approach to new and/or difficult separations.

Dow's commitment to the food and beverage industries is demonstrated through our multiple research and product development centers around the world. These technology centers have delivered innovative new technologies. See below for a timeline of some of our most significant breakthroughs over the past 60+ years.



### Regulatory Compliance

The resins here may be subject to food contact application restrictions in some countries. For country-specific food contact compliance statements, regulatory datasheets, and information on dietary rules, please contact [Dow's customer information group](#).



Dow has a fundamental concern for all who make, distribute, and use our products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with Dow products - from initial concept and research to manufacturing, selling, using, disposing, and recycling each product.

## Global Presence

With a large global manufacturing footprint, strong R&D expertise, and technical support services and systems, we supply market-leading volumes with high quality. Dow partners with you, our customer, to understand unmet needs and develop tailored solutions.

### Research & Development

Chauny, France\*  
Collegeville, PA\*  
Edina, MN\*  
Huzhou, China  
Thuwal, KSA\*  
Midland, MI\*  
Shanghai, China\*  
Tarragona, Spain\*\*

### Commercial Operations

Accra, Ghana  
Algiers, Algeria  
Al-Khobar, KSA  
Astana, Kazakhstan  
Bangkok, Thailand  
Budapest, Hungary  
Dubai, UAE  
Horgen, Switzerland  
Istanbul, Turkey  
Johannesburg, South Africa  
Kuala Lumpur, Malaysia  
Lagos, Nigeria  
Moscow, Russia  
Mumbai, India  
Nairobi, Kenya  
Rheinmünster, Germany  
São Paulo, Brazil  
Seoul, Korea  
Sydney, Australia  
Tokyo, Japan  
Warsaw, Poland

### Manufacturing

Chauny, France  
Edina, MN  
Fombio, Italy  
Huzhou, China  
Jubail Industry City, KSA  
Menlo Park, CA  
Midland, MI  
Qingpu, China  
Soma, Japan

\*DW&PS Technology Center

\*\*Global Water Technology Center

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**WARNING:** Oxidizing agents such as nitric acid attack organic ion exchange resins under certain conditions. This could lead to anything from slight resin degradation to a violent exothermic reaction (explosion). Before using strong oxidizing agents, consult sources knowledgeable in handling such materials.

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