DOWEX MONOSPHERE™ 99 K/350 Chromatographic Separation Resin
Separation Resin Primarily Used for the Purification of Sugar from Beet Molasses

Description
DOWEX MONOSPHERE™ 99 Chromatographic Separation Resins are strong acid cation resins manufactured in a process that produces an extremely uniform particle size. This family of resins was specifically developed for use in simulated moving bed (SMB) chromatographic systems for the recovery and purification of sweeteners.

DOWEX MONOSPHERE™ 99 K/350 Chromatographic Separation Resin was developed for the recovery and purification of beet sugar for use in SMB chromatographic systems that are limited due to pressure drop. It is specifically designed with a good combination of particle size and rapid kinetics for excellent separator performance and has been used for decades for beet molasses desugarization.

Applications
- Beet molasses desugarization
Typical Properties

Physical Properties
- Copolymer: Styrene-divinylbenzene
- Matrix: Gel
- Type: Strong acid cation
- Functional Group: Sulfonic acid
- Physical Form: Amber, translucent, spherical beads

Chemical Properties
- Ionic Form as Shipped: $K^+$
- Total Exchange Capacity: $\geq 1.5$ eq/L (H$^+$ form)
- Water Retention Capacity: $58 – 62\%$ (H$^+$ form)

Stability
- Whole Uncracked Beads: $\geq 98\%$

Density
- Particle Density: $1.28$ g/mL
- Shipping Weight: $833$ g/L

Typical Bead Size Distribution §
(Light Obscuration Instrument Particle Size)

<table>
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<tr>
<th>K$^+$</th>
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<tbody>
<tr>
<td>Particle Diameter: $355 \pm 15$ µm</td>
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<tr>
<td>Broad Range: $320 – 385$ µm, $\geq 90%$</td>
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<tr>
<td>Narrow Range: $340 – 375$ µm, $\geq 75%$</td>
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<td>Fine Beads: $&lt; 312$ µm, $\leq 4%$</td>
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<tr>
<td>Coarse Beads: $&gt; 413$ µm, $\leq 4%$</td>
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§ For additional particle size information, please refer to the Particle Size Distribution Cross Reference Chart (Form No. 177-01775).

Suggested Operating Conditions

Beet Molasses ($K^+$ form)
- Syrup Temperature: $80 – 85^\circ$C ($176 – 185^\circ$F)
- Syrup pH: $7 – 12$
- Dissolved Oxygen Concentration
  - Recommended: $< 0.1$ ppm
  - Maximum: $0.25$ ppm
- Simulated Moving Bed Operation: With optimized tuning (annually)

It is strongly advised to remove oxygen from feed streams and elution water going into the chromatographic separation resin. Limiting the oxygen concentration to less than $0.1$ ppm ($0.25$ ppm maximum) will help maximize resin life.
Hydraulic Characteristics

Estimated bed expansion of the 350-µm size of DOWEX MONOSPHERE™ 99 Chromatographic Separation Resin as a function of backwash flowrate at 25°C (77°F) is shown in Figure 1. Data for DuPont’s 320-µm chromatographic separation resin is also provided for comparison. The flowrate necessary to achieve a desired bed expansion for other water temperatures can be calculated with the provided equations.

Estimated pressure drop data for the 350-µm size of DOWEX MONOSPHERE™ 99 as a function of service flowrate and concentration of 42% HFCS (50% D.S. and 30% D.S.) is shown in Figure 2. Data for DuPont’s 320-µm chromatographic separation resin is also provided for comparison.

Thermal expansion of the 350-µm size of DOWEX MONOSPHERE™ 99 in the K+ ionic form as a function of temperature is shown in Figure 3.

Figure 1: Backwash Expansion
Temperature = 25°C (77°F)

Figure 2: Pressure Drop
Syrup (42% HFCS) Concentration = 30% D.S., 50% D.S.

For other temperatures use:

\[ F_T = F_{25°C} [1 + 0.008 (1.8T_{°C} - 45)], \text{ where } F \equiv \text{m/h} \]

\[ F_T = F_{77°F} [1 + 0.008 (T_{°F} - 77)], \text{ where } F \equiv \text{gpm/ft}^2 \]

Figure 3: Thermal Expansion
**Product Stewardship**

DuPont has a fundamental concern for all who make, distribute, and use its 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 DuPont products— from the initial concept and research, to manufacture, use, sale, disposal, and recycle of each product.

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Please be aware of the following:

- **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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