DOWEX Ion Exchange Resins

Sampling and Analysis of DOWEX Resins

SYSTEM OPTIMIZATION SERVICES (SOS) for the sweetener industry helps you extend the life of resins.

The best way to extend the life of DOWEX* ion exchange resins and maintain high syrup quality is to detect problems before they seriously impair resin performance. When a problem is detected early, we can generally recommend rejuvenation steps or adjustments in your process that will return your resin to an acceptable level of performance.

That's why we encourage processors to take advantage of our SOS services for the sweetener industry. This analytical service covers every critical operating characteristic of your resin. These analyses allow us to help you maximize the remaining usable life of the resin. Each time you send samples to our lab you'll receive a complete report which includes itemized listings of the operating characteristics as well as recommendations for remedial steps if required. We also maintain a historical database on your resins which can prove extremely valuable in predicting or troubleshooting possible problems.

Our lab offers one of the most complete analytical services available for producers of nutritive sweeteners. In addition to the standard tests (see Table 1), we have the capability of running a wide variety of non-standard tests to assist you in troubleshooting your system. Syrup samples can also be evaluated for resin-related quality problems.

Sampling intervals and methods

We recommend that all beds be sampled at least every 6 months. For mixed beds, sampling should be done every 2 to 3 months. We will be happy to help you determine the best intervals for testing your particular system.

Sampling is usually performed after regeneration and after the bed has been allowed to settle. It's important to obtain a core sample because backwashing typically causes the best resin to end up at the top of the bed and the worst resin at the bottom. Sampling either of these zones won't give you an accurate, average sample of the bed.

One sampling method is to use a grain thief with a drained bed. Siphoning may also be used. Fluidize the bed slowly and start drawing the resin through the siphon hose. Then pull the siphon hose up through the bed at a constant rate to capture resin from each level in the bed (see Figure 1).

Table 1: Standard testing services available

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DOWEX Ion Exchange Resins
Resin sampling kits help simplify the process

The Ion Exchange Resin Analysis Kit for the Sweetener Industry is provided for your convenience as part of SOS services for the sweetener industry. Within the kit, you will find complete instructions for labeling, ordering, and mailing as well as shipping labels. Please contact your Dow representative for a schedule of services.

System profiling helps you fine-tune your system

System profiling is another service available to users of DOWEX ion exchange resins. We start by taking syrup samples at various points in the system over a complete cycle. The special battery of tests we perform on these samples gives us the information we need to help you fine-tune your system for economical operation and consistently high syrup quality. Please contact your Dow technical representative for more information on this service.

Key resin properties and their significance

Water Retention Capacity (WRC) - The water retention capacity is a measure of the amount of water held inside the resin bead. Too little water can mean slow kinetics, while too much water can mean high sweetwater generation. In an ideal situation, the WRC will not change much over time.
For cation resins, decrosslinking of the resin backbone, accelerated under oxidative conditions, will cause an increase in WRC. When the H form WRC of DOWEX MONOSPHERE® 99 separation resin has reached 63%, the decreased performance that accompanies this high WRC may warrant change-out of the resin. Anion resins are much less likely to require change-out based on a change in WRC, although a highly fouled resin may exhibit a decreased WRC. At that point, the fouling should be addressed by clean-up.

**Weak Base Capacity (WBC)** - The weak base capacity is a measure of the number of weak base sites available on an anion resin. For weak base anion resins, the WBC is the critical parameter indicating the ability of the resin to remove acids. For strong base anion resins, the WBC is negligible initially but may increase as the salt-splitting sites are converted to weak base sites during use.

**Salt-Splitting Capacity (SSC)** - The salt splitting capacity is a measure of the number of sites acting as a strong base on the anion resin. For weak base anion resins, the SSC is a minor component of the capacity that is fouled away. It is important for controlling the swell of the resin, but a SSC that is too high can cause syrup degradation products. As with WRC, SSC must be carefully balanced for optimal performance.

For strong base anion resins, the SSC is the major component of the resin capacity. It is these sites which act in concert with the strong acid sites of the cation resin to perform mixed bed polishing. As the strong base anion resin ages, the SSC decreases. Some of it is converted to weak base capacity, but this type of capacity does not ensure adequate performance in a mixed bed. In fact, if the WBC is more than 25% of the TEC, bed change-out should be evaluated, regardless of the absolute TEC value.

**Total Exchange Capacity (TEC)** - The total exchange capacity is a measure of all the ion exchange sites on a resin. For strong acid cation resins, all of the sites act as strong acids, and one number, the TEC, is reported. As the resin ages, their TEC decreases. When the TEC of DOWEX 88 cation resin reaches 1.40 meq/ml, the resin has probably reached the end of its economical life.

As discussed above, there are two types of capacity, weak and strong base, for anion resins. They are summed to give the TEC value. For strong base anion resins, plants will probably experience quality problems if they let the TEC drop to 0.65 meq/ml. For weak base anion resins such as DOWEX 66, the economically useful life generally ends at 1.20 meq/ml.

**Percent Capacity in Ca²⁺ Form** - The separation resin must be in the desired ionic form for maximum performance. DOWEX MONOSPHERE 99 is used in the Ca²⁺ form to separate glucose and fructose. Our laboratory analyzes the amount of Ca²⁺ on the resin by atomic absorption and reports the percentage of the sites in the Ca²⁺ form. For optimal performance, at least 95% of the capacity should be in this form. If the percentage is low and performance isn’t satisfactory, the resin may need recalcifying.

**Weak Base Dynamic Test** - This test of weak base anion resin kinetics yields two numbers, rinse volume and operating capacity. The test can be critical to understanding resin performance since the resins are used dynamically in the plant. The results can be independent from results under static conditions and are important to a total understanding of resin performance.

Rinse volume is the amount of water required to rinse the resin down to a conductivity of 50µS/cm after caustic regeneration. High rinse volumes indicate organic fouling of the resin. A program of regular cross-regeneration will help prevent fouling. Unless the resin is kept very clean, it may later need to be changed out based simply on rinse requirements depending on the water balance of the plant.

Operating capacity (Op Cap) is a measure of the ion exchange sites available under dynamic conditions that, in our test, stress the kinetics beyond normal operating conditions. This op cap result should be compared with benchmark values established when the resin was new. As weak base anion resins age, rinse volumes increase while operational capacity decreases. Your Dow technical representative will help you interpret the test results, based on historical plant performance and experience.

**How to get more information on DOWEX products and Dow support services**
To learn more about DOWEX products or Dow technical support services, request additional literature, or get help resolving a particular problem, simply call us. You’ll talk with someone who understands your needs and can provide the prompt, personal service you deserve.
**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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