**DOWEX Ion Exchange Resins**

**Preventing Biological Growth on Ion Exchange Resins**

Ion exchange resins in demineralization applications are subjected to extreme changes in pH during regeneration, which hinders biological growth. Most biological growth problems are caused by inactivity of the resin during extended storage or else under pH neutral conditions, such as water softeners or non-regenerated mixed beds in ultrapure water production. In order to minimize the potential for biofouling, inactive systems should be stored in a biostatic solution such as concentrated NaCl. Please note that this complete exhaustion is acceptable for most demineralizer applications, but undesirable for ultrapure water applications. The recommended procedure is as follows:

1. After exhaustion and a thorough backwash, the resin is ready for lay-up.
2. Apply a 15%-25% NaCl solution to the bed, and fill the vessel so that no air is present. The concentrated salt solution will minimize biological growth.
3. Upon reactivation of the vessel, the resin will need to undergo a double or triple regeneration.

**Cleaning Biological Growth from Ion Exchange Resins**

**Regenerated Resin Systems**

(Demineralization, Water Softening)

In cases where biological growth has occurred, an extended air scour followed by a double regeneration may be able to restore the resins to a usable condition. If this procedure is not successful, there are two disinfection procedures which can be used. Oxidative damage can occur from each type of treatment, so these procedures should be considered as a last resort.

**Procedure 1: Peracetic acid disinfection of ion exchange resins**

Peracetic acid has a wide-band action for removing micro-organisms and is an effective treatment for the disinfection of both cation and anion exchange resins. To ensure good disinfection without damage to the resins, it is important to control the concentration, temperature and contact time of the chemical. The recommended procedure is as follows:

1. Put resin into exhausted form.
2. Prepare peracetic acid solution of 0.2% concentration or 2% H₂O₂.
3. For anion resins, apply 2 g peracetic acid/liter resin (57 g/ft³) by passing 1 bed volume of the solution at ambient temperature through the resin bed during a 30-60 minute contact time. Measure the peracetic acid or residual H₂O₂ in the effluent and stop when it reaches a level of around 10% of the inlet concentration.
4. For cation resins, 2-4 g peracetic acid/liter resin (57-113 g/ft³) can be applied using 1-2 bed volumes of the 0.2% solution over 30-60 minutes.
5. Rinse out with 4 bed volumes DI water over a period of approximately 1 hour, until no peracetic acid is detectable in effluent.
6. Make a double regeneration of the resin.
Procedure 2: Chlorine disinfection of ion exchange resins
Sodium hypochlorite or bleach cleaning is a very intense treatment for sterilizing and removing organic contaminants on cation exchange resins. As a result, this treatment should be carefully controlled in order to prevent possible resin damage (de-crosslinkage /defunctionalization). Note that chlorine can be explosive under certain conditions.

The recommended procedure for cation resins is as follows:
1. Regenerate the resin (H\(^+\) form). If the resin has iron or other metal contamination, pretreat with around 2 bed volumes 10% HCl solution.
2. Ensure that the resin is completely exhausted by treating with brine solution (for strong acid cation resins) or caustic (for weak acid cation resins), as any residual H\(^+\) on the resin can lead to the generation of free chlorine gas. Take care to allow for resin swelling.
3. Use a sodium hypochlorite solution of 0.10% concentration (1,000 ppm).
4. Apply 5 g free Cl\(_2\) per liter resin by passing 2 bed volumes of the NaOCl solution at ambient temperature down through the resin bed with a 30-45 minute contact time. Allow the resin to soak in the solution for 1-2 hours.
5. Rinse out with 1-2 bed volumes DI water.
6. For the most effective treatment, apply more solution, repeating step 4. Perform a final rinse with 3-4 bed volumes DI water (until no Cl\(_2\) is detectable in effluent).

The recommended procedure for anion resins is as follows:
1. Put resin into exhausted (Cl\(^-\)) form. If the resin has iron or other metal contamination, pretreat with around 2 bed volumes of 10% HCl solution.
2. Use a sodium hypochlorite solution of 0.05% concentration (500 ppm).
3. Apply 2 g free Cl\(_2\) liter resin by passing 2 bed volumes of the NaOCl solution at ambient temperature through the resin bed with a 30-45 minute contact time. Measure the effluent and stop if free Cl\(_2\) reaches a level of around 10% of the inlet concentration.
4. Rinse out with 3-4 bed volumes DI water (until no Cl\(_2\) is detectable in effluent).

Ultrapure Water Applications

In ultrapure resin systems, it is not desirable to exhaust the resin or to introduce ionic species, such as peracetate, Na or hypochlorite, so Procedures 1 and 2 should not be used. Methods that can be applied are to expose the resin to hot water at 80-90°C (175-195°F) for 2 hours or ozone treatment at a concentration < 10 ppb for up to 1 hour at 20°C (70°F). An alternative is to use hydrogen peroxide in Procedure 3. This method can also be used for regenerated resin systems.

Procedure 3: Hydrogen peroxide disinfection of ion exchange resins
Hydrogen peroxide is an effective treatment for sterilizing both cation and anion exchange resins. To ensure good disinfection without damage to the resins, it is important to control the concentration, temperature and contact time of the chemical.

The recommended procedure is as follows:
1. Prepare hydrogen peroxide solution of 2% concentration.
2. For cation resins, apply 20 g hydrogen peroxide/liter resin by passing 1 bed volumes of the solution at ambient temperature down through the resin bed (20-30 minutes contact time).
3. For anion resins, 10 g hydrogen peroxide/liter resin can be applied using 0.5 bed volumes of the 2% solution over 20-30 minutes.
4. Rinse out with DI water until essentially no hydrogen peroxide is detected in the effluent (minimum 1 hour). If the resin is heavily contaminated, it may be necessary to repeat the treatment.
DOWEX Ion Exchange Resins
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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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