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Why Shouldn't We Rebed This Ion Exchange Unit?

Planning, Executing Your Resin Rebed Needs

When approaching a rebed of an ion exchange unit it is important to determine if it is the best course of action, how you will remove the resin from the vessel and your plan to load the new resin. The need to rebed an ion exchange unit can be the result of problems with effluent quality, operating capacity and/or run lengths. These problems arise from changes in operating procedures, incoming water composition, resin loss or resin age.

Auditing, Planning

Determining if the rebed is necessary is the most important step. Resin loss through backwash, gradual capacity loss and effluent quality are reasonably good reasons to replace the resin. If it improves the reliability of the water treatment system and it is economically viable, you should consider replacement.

The question you really should ask yourself is, "Why *shouldn't* we rebed this ion exchange unit?" Replacing resin can be an expensive, time-consuming task. You should take a look at the operating costs vs. the cost of replacing the resin.

Analyze the operating costs now against when the resin was new. The chemical savings associated with new resin may not outweigh the cost of the rebed. All ion exchange resins lose capacity over time. Eventually the economics will favor resin replacement, but it could be more than a year away.

The deterioration of an ion exchange unit's performance may have nothing to do with the resin itself. Many chemical and physical variables can affect the performance of ion exchange resins. Chlorine attack, osmotic shock and high inlet water temperatures physically can degrade the structure of the resin beads. Under these conditions, the resin beads will crack and break down further to become resin fines. These resin fines, along with particulate matter, can create pressure drop through the resin bed or channeling. Other contaminants such as oils and organic compounds can foul ion exchange resin if present in the feedwater. Exposure to these conditions eventually will result in poor effluent quality and short run lengths.

Investigate the original design of the units, operating procedures and age of the resin. Verify the information is accurate. The solution to the problem may lie in the design instead of actual operation.

Money may be better spent on improving the pre- or post-treatment to eliminate some of the above variables from the equation. This may enhance the overall performance of the water treatment system, which, over time, can extend the life of the ion exchange resin and reduce the frequency of resin replacement.

One of the best ways to determine the condition of an ion exchange resin is by extracting a resin sample. Core samples are best and most representative of the resin bed. The results of the resin analysis will help you determine if the problems with effluent quality or run lengths are due to the resin. Many times the resin is functioning and the problems are associated with changes in operating procedure or inlet water composition. Consult your resin supplier for the proper sampling methods and having the resin sample analyzed.

Removal, Disposal

Key to preparing to perform a rebed is determining what you have to work with at the customer site. A site visit is invaluable, so take notes. You need to know where you will be able to get water, electricity and air as well as where the floor drains are. Note the distance from the units to your work area, measure the tank dimensions and note all of the tank openings. Audit the design specification to determine the internal distribution system and if any subfill will be needed with the resin. Be aware of your customer's safety procedures as you work in the designated area. This information will help formulate your plan.

The biggest question to get answered is "How will I get the resin out?" Some large or steel tanks may have a blind flange or a drain port near the bottom. These ports make it easy to remove the resin by sluicing. Most small or fiberglass tanks won't have either of the aforementioned ports. If this is the case, resin removal will take place by hose from the top of the tank through a manway or top flange with a resin pump, eductor or siphon. (See Figures 1 and 2.) Always be careful when you are working around the top of the resin vessel. Be sure you do not crack or damage the internal distributor systems with hoses or pumps. Make sure any bolts, flashlights, etc., are secured so they do not have an opportunity to fall into the resin vessel.

With your removal plan in place, you will need to determine where you will put the old resin and how will it be disposed. The transfer of resin can involve a lot of water. You will need to put the water/resin combination into a drainable container. The use of drainable supersacks, bins or a dumpster will aid in this process. It is a good idea to make a screened, dewatering distributor. This can be submerged in the resin and the water pumped or siphoned out, leaving only the resin behind to be disposed. You want to use containers that are movable and as few of them as possible. The bottom line is to get the water out so you don't pay for disposal.

Ion exchange resins usually are considered non-hazardous. The material safety data sheets (MSDS) of standard salt from ion exchange resins indicate they have a zero rating for toxicity, fire and reactivity hazard. However, this applies only to new, uncontaminated resins; hydrogen form cation resin; hydroxide form anion resin; or materials collected on the resin beads that, during service, can change the resin's hazard rating.

For example, if a resin is used to remove heavy metals from a wastewater stream, it can be considered a hazardous waste unless the resin is fully stripped of the metals. Have the resin tested for metals and check with authorities before disposing of the resin.

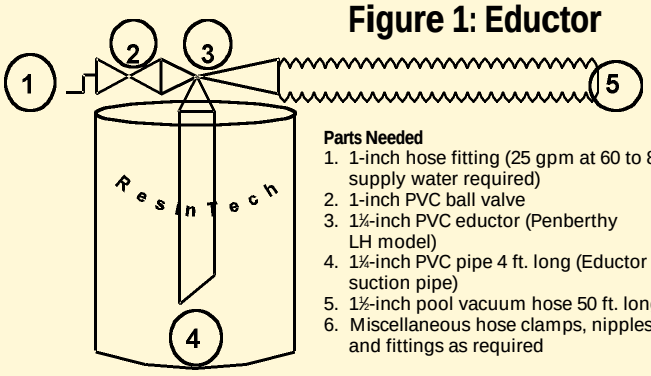
Resins used to process tap water or potable water sources normally contact only non-hazardous dissolved solids such as hardness and alkalinity. These resins normally can be disposed of as ordinary trash so long as they are pH neutral and in the exhausted, salt form. This may require rinsing the bed with several bed volumes of 5 to 15 percent sodium chloride solution or making sure the units are exhausted before you remove the resin from the vessel. Otherwise, cation resins in the hydrogen form may have too low a pH for disposal, while anion resins in the hydroxide form may have too high a pH. Always check with authorities before disposing of resin.

Loading

The following procedure pertains to a single-bed ion exchange unit— assuming you will be loading the resin through a top manway or flange. If your only access to the tank is from the side, you will need to follow a modified procedure. Mixed- and strata-bed ion exchange units also will follow modified procedures. In either case, consult with a resin vendor or original equipment manufacturer for proper loading procedures.

The overall performance of an ion exchange unit depends on successful loading. The following steps are meant

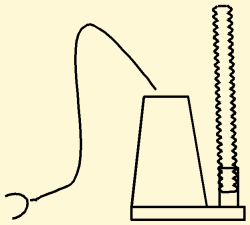
Figure 1: Eductor



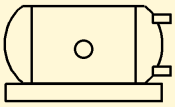
Parts Needed

1. 1-inch hose fitting (25 gpm at 60 to 80 psig supply water required)
2. 1-inch PVC ball valve
3. 1¼-inch PVC eductor (Penberthy LH model)
4. 1¼-inch PVC pipe 4 ft. long (Eductor suction pipe)
5. 1½-inch pool vacuum hose 50 ft. long
6. Miscellaneous hose clamps, nipples and fittings as required

Figure 2: Pumps



Submersible Sump Pump



Air Driven Double Diaphragm Pump

to be a general guide and enlighten those who haven't performed large rebeds. Nothing can replace experience or time-tested procedures. Do what you know works and what you are comfortable with.

After removing the old resin or before filling a new vessel with resin, follow these steps.

Rinse and clean the inside of the resin vessel to remove any dirt and remaining resin to prevent any quality problems that can occur from contamination. Do your best to inspect the internals and lining for damage or wear. If you haven't encountered any distribution problems and it looks normal from the top, don't enter the vessel. You are better off leaving well enough alone than entering the tank and damaging the internals.

If part or all of the subfill or support bed is missing, replace as needed, measure it to ensure the proper height and level it off if it is uneven. (The subfill is the medium below the distribution system that fills the void space in the bottom dome. A support bed is a medium that actually covers the laterals to promote proper water distribution. It also will prevent the resin from escaping.)

Many manufacturers of resin vessels design their units differently. Sometimes nothing is needed at all. Consult the engineering specifications to determine what is needed at the bottom of the tank.

Note the ionic form the resin is in before you begin transfer. Sodium form cation resin will swell 5 to 9 percent when converted to the hydrogen form. Anion resin will swell from 10 to 20 percent when converted to the hydroxide form. The resin specification sheet will tell you how much the resin will swell when regenerated into the desired ionic form.

Be sure to have the proper resin volume in the tank to ensure efficient regeneration when it is put into service and to avoid problems with pressure drop and resin loss through backwash. Most importantly, consult the MSDS to determine the proper personal protective equipment, especially when hydrogen or hydroxide form resins are involved.

Fill the vessel approximately half way with water. If you are loading anion resin and it is supplied in the hydroxyl form, only softened or deionized water should be used. This will prevent calcium carbonate from precipitating. Add new resin through the manway or flange of the vessel. Do this gently and carefully so you don't damage the internals. (If the resin is supplied in drums, an eductor or resin pump can be used to transfer it into the vessel.)

When you feel you are nearing the end, let the resin settle and measure the bed depth. In many cases, the amount of resin you thought you needed will either be too much or not enough. This is where you will want to take the future swelling into account. This is a critical point when you rebed counter-current or packed bed ion exchange units. Too much or too little resin can affect the regeneration efficiency and effluent quality.

Open the backwash water inlet valve to clean the resin and remove any fines. Drain the overflow water through the open manway. Check the manufacturers specification to determine the proper backwash rates. Backwash for approximately 30 minutes. Watch the resin level through the open manway to avoid backwashing out any whole beads. This is an important step because newer internal distributor systems are screened and will not allow fines or particulate matter to pass through. This will cause distribution problems when in service.

Drain the water through the rinse outlet valve or drain until the water level is several inches above the bed. Measure the distance from the top of the vessel to the top of the resin bed to ensure proper bed depth. (You may have to do this during the rebed to remove water used in the transfer.) Calculate the bed height and record it for future reference. Slowly fill the vessel with water, venting off trapped air. Follow with double regeneration if applicable.

Summary

The success of a rebed is the result of proper planning and the execution of that plan. Approaching the job by determining if the rebed is necessary, how you will remove and dispose of the resin, and the proper loading of the resin will result in a better working ion exchange system and a satisfied customer.

About the Author
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