Protect the resin

By Peter Meyers

Peter Meyers is technical director for ResinTech Inc. of West Berlin, N.J. ResinTech is an ion exchange resin manufacturer and, through its two divisions Aries and ACM Company, also offers activated carbon, inorganic selective exchangers, cartridge filters and PEDI regeneration services. Mr. Meyers has more than 35 years of experience covering a wide range of ion exchange applications from demineralizers, polishers and softeners to industrial process design and operation. He can be reached at (856) 768-9600 or by e-mail at pmeyers@resintech.com.

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Ion exchange resins are susceptible to damage just like other plastics.

This article, which started out as a story on winterizing ion exchange systems such as water softeners, morphed into a discussion of some of the things that can be done to protect ion exchange resin from harm. Simply put, ion exchange resins are "tiny plastic beads that take salt out of water and put other salts back in." The plastic is the same material that phonograph records used to be made of, nowadays the jewel case a CD is stored in might be made of styrene plastic, although not the CD itself.

This is relevant because ion exchange resins, being plastic, are susceptible to damage by the same sorts of things as other plastics. What happens if a jewel case gets stepped on? It breaks of course. What happens if plastics get exposed to the sun? They get damaged by the UV light and ozone. What happens to plastic left for a long time in a swimming pool? Chlorine weakens it and eventually breaks it down chemically.

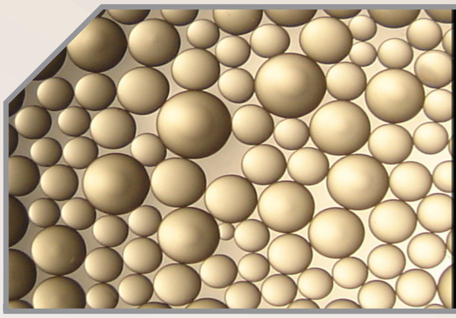
The same sorts of things damage resins. If enough force is put on a resin bead, it will break. Sunlight, ozone, chlorine, exposure to air — all these things damage resin over time. All these types of damage are fairly unlikely to happen when a resin is safely encased inside a tank; therefore, the safest place for the resin is inside the tank it came in.

Sterilization

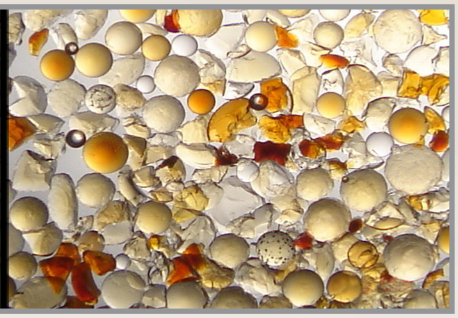
So what can happen to a resin when it is sitting inside a tank? It's warm, dark and wet in there — a great place for bacteria to grow. While bacteria may seem dangerous, almost all of them are harmless. We are surrounded by bacteria and they outnumber us by billions or trillions to one. In most cases, harmless bacteria build up in a resin bed and then stabilize, never doing any harm. And most of the time an ion exchange bed that is left in the tank for a long time will be just fine. Yes, there will be some bacteria in the resin, but they probably won't cause any harm.

Don't like that answer? Let's consider sterilizing the resin. If one could boil the resin, that would be good; pasteurization remains a very effective way to sterilize things including resins. But it is impractical and if the resin temperature isn't taken up real close to 212° F, there might not be a complete kill. So we are left with chemical means. And this is where we start getting ourselves into trouble. The most common sterilizing chemical is bleach. The problem with bleach is that it reacts with plastics such as ion exchange resin and damages them. That's bad, but what is worse is that the chemicals that are created in the reaction between bleach and ion exchange resins are poisonous, all either known or suspected carcinogens. Hydrogen peroxide and ozone are better than bleach, but not by much.

For any ion exchange system that has known issues with contaminants in the feed, frequent regeneration is the second most important thing that can be done to save the resin.



New resin gaussian distribution.



Physically damaged resin.

Immersion

What else can happen to the resin while it sits in that tank? Well, it can freeze. So what? Does it hurt resin if it freezes? Suffice it to say that freezing resin is way overrated; it takes dozens of freeze thaw cycles before any damage is noticeable. What about the tank, control head and piping? Those are another story. Freezing could cause the water to swell and break things, just like it will break water piping in cold climates. There are a few good choices here. Choice one is to insulate and maybe heat trace so the piping and control head don't freeze. Another is to drain out the water or blow it out with air similar to what is done with sprinkler systems.

What about the resin? A lot of resin specification sheets warn about allowing resins to dry out. Again, this is way overrated. Yes, if resin is put in an oven and all the water is baked out of it, it will shrink to about half its regular size. When a user goes to re-wet it, the resin will swell suddenly and probably break. And if a pile of resin is left out in the sun, it will go bad fairly quickly. So, don't do that. It's a bit difficult to get all the water out of a tank and even harder to get all the water out of a resin.

This leads to the simplest and easiest way of protecting a resin bed when it is not in use. Simply leave it full of the brine solution used to regenerate the resin. Brine is one of the oldest known ways to preserve food; a nice high salt concentration keeps bacteria from growing and also protects against freezing. Brine will not hurt the resin and when it is time for the ion exchange system to be placed back into service, it only needs to be rinsed out before the system is ready for use.

To sum up about winterizing, either protect from freezing or blow the water out of the piping, leave the resin immersed in brine solution to protect against bacteria growth and be done with it.

Making resin last

The other part of this article is about saving the resin during use, making it last as long as possible. It is probably best to start with a list of don'ts. Don't put things into the resin that damage it. Start with things like bleach. It may be acceptable as an emergency measure to clean badly fouled resin when all else fails, but utterly horrible as a first choice. Bleach is not very effective, damages the resin and leaves behind poisonous chemicals that are difficult to purge from the resin.

Another really bad idea is to use antifreeze to protect a resin bed from freezing. Over the years, I've seen the antifreeze card played more than once or twice. Some companies' technical literature used to recommend this as a viable way to protect resins from freezing. It might not be so bad if commercial antifreeze didn't contain chemicals designed to protect car motors from corrosion, but the contaminants in antifreeze aren't exactly good for resin or for people and antifreeze itself is somewhat poisonous. Yes, it will work and yes, it's a lousy idea.

Chlorine is the active ingredient in bleach and is present in trace amounts in most potable water supplies. Chlorine is well known to degrade ion exchange

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resins, which then release low levels of poisonous chemicals. So don't do that. Use granular carbon or other means of removing chlorine ahead of the ion exchange system. Aside from not doing anything really ill-advised like filling up the resin bed with antifreeze, removing chlorine from the feedwater is the most important thing you can do to protect the resin from harm.

The other very helpful thing one can do is to regenerate often and use a sufficient quantity of brine to do a good job cleaning the resin. Yes, this goes against current policy in a lot of states and many softeners have salt saving cycles. Remember the description of ion exchange from the beginning of the article? The part about taking salts out of water and putting other salts back in? Resins are ionic sponges — they adsorb contaminants. Not just the targeted contaminant, but other ones as well. Regeneration is the sole means of getting things to come back out of the resin. This is the first line of defense against resin poisoning or fouling. For any ion exchange system that has known issues with contaminants in the feed, frequent regeneration is the second most important thing that can be done to save the resin.

Should one use a resin cleaner or buy salt that contains a cleaner? Maybe, but be careful. Cleaners that contain citric acid or phosphates are acceptable for cation resins used in water softeners, but will irreversibly poison anion resins used for nitrate removal or for organic traps. And, cleaners may not work very well, especially if the resin bed has gotten so fouled up that water doesn't flow through the beads equally. It is far better to attack the problem from the front end and eliminate the contaminants that aren't good for resin before they ever reach the beads.

To go in the direction of prevention, one has to start looking to the feedwater and what is in it that is bad for the resin. These are generally the same things that make the water undesirable for drinking. High levels of iron and manganese, suspended solids, high color, bad smell, etc. are all common contaminants of water supplies. They may not be a health risk and therefore the people that treat the drinking water may not be too concerned about them. But they are not only unpleasant to drink, they are generally bad for ion exchange systems too. Anything that plugs up a resin bed, coats the plastic beads or gets inside and doesn't come back out is likely to reduce the efficiency, and life, of the ion exchange resin. It is best not to let it get into the resin in the first place.

And, making sure end users select a company that installs and services the ion exchange system is an important element. Market your service as one that works and lives in the area and maintains a good working knowledge of the problems and solutions that work for your particular water supply. After all, this is science. WT