Setting the Organic Trap

Specialized anion resins can effectively remove tannins and iron.

Organic substances can have complex molecular structures making their removal from domestic water supplies a difficult and sometimes frustrating challenge. However, specialized anion ion-exchange resins can be used to adsorb organics, effectively removing their effect on water.

Organic substances, especially tannins and organically bound iron, are found in almost all water supplies.

Tannins:

- Tannins are a byproduct of decayed vegetation. Decayed plant and animal matter produce humic and fulvic acids.
- Tannins are most prevalent in coastal or low-lying marshy areas. Their presence contributes to a range of color in water from yellow to tea-stain
- Although not a health risk, tannins are aesthetically unpleasing in a water supply. Their yellow color can stain clothing, cause odor in the hot water lines.
- Tannins may contribute to the formation of disinfection byproducts, such as trihalomethanes (THMs), in chlorinated water supplies.

Organically Bound Iron (Heme Iron):

- Iron can complex with organics to produce organically bound or heme iron.
- Heme iron's presence in water can range from clear to light pink.
- Heme iron is a particularly frustrating substance due to the fact that it masquerades as iron and cannot be removed with conventional oxidation media or cation exchange softeners. This is because the organic binds and encapsulates the iron, effectively altering its ionic properties.

Testing

Testing is the first step to effectively treatment of water with tannins and heme iron.

- They are possibly the most difficult contaminants to accurately measure, partly because they fluctuate in concentrations, depending on conditions, such as droughts, floods or seasonal variations and demands on the source water supply.
- Tannin test kits are available from many suppliers.
- A heme iron test kit may be more difficult to obtain. Also, heme iron usually is found in concentrations less than 1 part per million (ppm), making it even more difficult to measure.
- A more comprehensive test is measuring total organic carbon (TOC), which is highly recommended for high-purity applications.
- Most organic test results are expressed in ppm.
- Due to the complex nature of tannin and heme iron, dealers should find several test applications, commonly referred to as pilot studies, in their geographical location. This is the only practical method to determine the best-suited OT resin for your selling territory.

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Resins

Ion exchange manufacturers have developed ion exchange resins that effectively and economically remove organics. These resins are commonly referred to as organic traps (OT) or organic scavengers.

- All OT resins are anionic, and most organics exhibit anionic properties, making them removable by ion exchange. However, **in most cases organics are actually adsorbed and desorbed** from the resin bead.
- The adsorb/desorb function is more a mechanical process than an ion exchange process. Picture each resin bead as a tiny sponge. As it scavenges organic molecules from the water, the bead swells. When brine is introduced, the resin bead contracts, squeezing the organic out of the bead. Some resins are spongier than others.
- An OT resin's capacity is a function of its water retention - the higher the water retention, the higher the capacity.
- Most organic trap resins range from 55 to 64 percent water retention.
- Some high- capacity OT resins are designed with as much as 75% water retention, making them the best performers. OT resins designed with high water retention sacrifice bead integrity. To obtain high water retention, manufacturers must design resins with lower crosslinking, which is the internal structure that gives resins their strength.
- Unfortunately, the highest-capacity OT resin will ultimately have a shorter life span. Moreover, high-water-retention resins are the most expensive, in some cases costing 50 percent more than standard-capacity OT resins.

The Trap Closes - Putting OT Resin to Work

OT systems function and resemble the average domestic water softener.

- Choose a quality control valve, which enables you to program the regeneration cycle times.
- Most resin manufacturers recommend design service flow rates of 1 to 4 gallons per minute per cubic foot (gpm/cf). This may be a bit conservative but use common sense when sizing and estimating the service requirements of your application.

Dual Bed Systems

Since flow rates in many homes are intermittent, the average home may only have a peak flow rate of 6 gpm at different times of day. Therefore, the average OT system may require no more than 1 cf of bed. In some situations, dealers forgo the expense of utilizing a separate OT system and make a dual-bed system by placing as little as one-third (1/3) of a cubic foot of OT resin on top of a cation bed.

- A dual-bed system is possible because OT resins are much lighter than cation resins and will remain at the top of the bed.
- When using a dual bed, the raw water hardness should not exceed 15 grains per gallon and alkalinity should not exceed 250 ppm. High levels of hardness can produce a bicarbonate precipitate that will coat the cation resin, rendering it useless.
- In an upflow brining system, the precipitate will form on the upper screen and control valves, possibly reducing water flow.

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Single Bed Systems

A dual bed is not recommended when iron is greater than 3 ppm.

- A single organic trap system should be placed after the water softener and iron removal systems.
- pH values greater than 8.0 should be avoided because OT resins perform better in a slightly acidic environment.
- In any system design, an upper distributor screen is recommended to prevent backwashing the resin to drain, especially if you are using OT in a dual bed.
- OT resins range from 16 to 50 mesh. Choose a distributor screen with a .010-.013 slot size (the industry standard).
- A gravel underbedding is also recommended to help distribution and flow rates. Use 1/4"x1/8" or 1/16"x1/8" gravel.

Brine Cycle

The most important aspect of an OT system design is the brine cycle. Most organics like tannins take much longer to elute off the resin bead.

- The minimum duration that brine should dwell in the bed is 30 minutes.
- No more than 10 pounds of salt are required to regenerate 1 cubic foot of OT resin.
- OT resins require frequent brining (no less than every three days), so avoid demand-regenerated control valves.
- If possible, program the brine cycle to "stall" 20 minutes into the cycle. This will give the brine a chance to elute the organics off the resin. In some systems, brine stalling is impossible or unnecessary, but it is recommended if it can be incorporated into your system.
- Use the smallest injector possible. A small injector will allow the brine to dwell longer within the resin bed.

Sulfur Like Odors

If customers are experiencing a sulfur-like odor exclusively from their hot water lines, the problem is most likely sulfate-reducing bacteria. By applying an OT system as a dual bed or as a separate system, the odor will be eliminated.

- Theoretically, the OT's ability to dealkalize will starve the bacteria of its meal of sulfates, eliminating the sulfur smell produced in the water.
- Remember, this works only when odor is detected in the hot water.

pH

Anion resins have weak dealkalizing capabilities. If you have low alkalinity, < 50 and low TDS < 100 the pH of the water may drop a full point. There is no easy fix for it. Be sure to check pH as part of the pilot test. Depending on the result you may need to install an acid neutralizer, which would increase the pH but also the hardness, or a soda ash system to increase pH and avoid the increase in hardness.

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Cleaning and maintaining the resin bed

Resin fouling can be avoided with the periodic addition of resin cleaners. However, even the most carefully applied organic trap (OT) system may eventually foul.

- The return of color in the conditioned water is the best indication of a fouled resin bed.
- The restoration of a fouled bed is achieved by using commercially available resin cleaners such as phosphoric or citric acids.
- All cleaners should be applied as a warm solution (not to exceed 95 degrees Fahrenheit). The conditioner should be regenerated once before applying resin cleaners.
- When applying the warm acid solution (one pound per cubic foot), periodically check the pH of the drain line.
- When a significant decrease is measured, bypass the system, and allow the solution to soak for a minimum of two to three hours. This should allow enough time for the acid to elute the foulants out of the resin beads.

If after several cleaning attempts the resin fails to perform, you should consider resin replacement or redesign of the conditioner and pay close attention to why the system fouled.

Purolite Organic Trap/Scavenger Resins (in stock)

Purolite A502P	Macroporous Poly Styrene
Purolite A850	Polyacrylic Gel
Purolite A860	Polyacrylic Macroporous
Purolite Tanex	Styrene & Acrylic Crosslinked with DVB

Tannin concentrations and their effects

Level	Concentration in parts per million (ppm)	Color of Raw Water
Low	Less than 0.05 ppm	Faint Tinge of Yellow
Moderate	0.05-2.0 ppm	Darker Golden Yellow (Ginger Ale)
High	3 ppm	Light Tea Color
Extremely High	5 ppm	Dark Tea Color

BRINE SQUEEZE TO CLEAN FOULED RESIN BEDS

Most **improperly applied resins foul within 48 hours**. However, even the most carefully applied OT resins may eventually foul. **An indicator of a fouled bed is loss of capacity and random slugs of colored water during peak flow rates**.

The most effective method to clean a fouled resin bed is **warm brine squeezing.**

You need the following supplies:

- A clean 5-gallon bucket
- 10 pounds of solar salt
- One pound of citric acid.

The process:

1. Place citric acid and solar salt in the brine tank.
2. Add 5 gallons of warm water (no hotter than 100ºF, 90ºF for Gel Acrylics)
3. Mix thoroughly.
4. Place brine line in bucket, cycle control valve to brine draw position.
5. Hold the drain line until it feels warm.
6. Stop and bypass the control.
7. Let the solution soak for a minimum of two hours
8. Let the control valve complete its cycle.

If your resin is still fouled after two brine squeezes consider it permanently fouled. You should then reevaluate the application.