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Episode 48 Resin Refresher

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Topic 1 – How long will the resin last?

- In the presence of oxidants cations may last 3 to 5 years; anion resins under the same conditions may last 1 to 2 years.
- Cation
    - Crosslinking holds the bead together. When the crosslinking starts breaking down the resin won't perform as well as new.
    - Exposure to any oxidant impacts the resin bead – chlorine, chloramine, peroxide, ozone, permanganate. One oxidant not frequently mentioned is oxygen.
        - Oxygen in the presence of iron or heat will speed up degradation of cation resin.
    - If there is no iron, chlorine, chloramine, etc. present in the water softening resin can last more than 20 years.
    - Cation resin swells and contracts during regeneration. This is not a factor in the degradation of the resin.
    - As the crosslinking breaks down the resin swells. This is also an indicator of lower capacity.
    - Functional Groups
        - The closer together functional groups are, the more selective they are.
        - A 10 percent crosslink cation or macroporous with 12 to 15% crosslink has more functional groups than an 8% and 6%.
        - As the crosslinking breaks down the functional groups are spreading apart and hardness removal is less efficient resulting in increased hardness leakage. (The amount of calcium and magnesium ions not being removed by the softener toward the end of the cycle.)
        - A 6% will work well where there are no oxidants present. Otherwise choose an 8% or 10% crosslinked resin.
- Anion
        - The degradation mechanism of anion is not decrosslinking. The functional group is attacked and goes away. A Type 2 strong base anion converts to a weak base functional group.
        - Chlorine in water is hypochlorous acid. Bleach is sodium hypochlorite and hypochlorite is an anion. Anion resin removes this from the water ionically and it can be regenerated off. Permanganate will also regenerate off.
            - In applications where a chlorine residual is required be sure to apply it after the anion bed.
- We recommend using activated carbon to remove chlorine or chloramine prior cation/anion beds.

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Topic 2 - Iron Fouling

- Cation resin is a big, charged anion (so it attracts cation ions) and anion resin is actually a big, charged cation (so it attracts anion ions). These resins will attract ionic substances such as ferrous iron Fe^{+2} (clear water iron), and naturally occurring organic matter such as tannins.
    - Cation resin will remove calcium, magnesium, and ferrous iron (Fe^{+2}).
    - During the regeneration process the clear water iron converts to ferrous iron (Fe^{+3}).
        - The brine in the brine tank has been sitting around getting exposed to oxygen. When you expose water to air, it comes to equilibrium with oxygen at a rate of about 8-10 ppm depending on the water temperature.
    - During regeneration the oxygen is present and converts the ferrous iron to ferric iron. To avoid build up on the resin an additive can be used in the brine.
- If iron is not removed ahead of softener resin it will stick to the resin and build a layer of mud, or crud or dirt in the resin itself.
- Compensated Hardness
    - If there is clear water iron in the water the softener must be regenerated more often.
    - For every part per million of iron add 4 or 5 grains of hardness.
        - 5 grains of hardness with 2 ppm of iron would be 5 plus 4 plus 4 or 9 grains. Size up the softener based on 9 grains, not 5.

Topic 3 -Resin Color

- Color does not affect the performance of the resin.
- The resin is black because it is processed longer and at a higher temperature to create the dark bead.
- If the black cation is “bleached” it is an indicator of the resin wearing out.

https://www.wqrf.org/map.html

USGS Water Data Map

https://dashboard.waterdata.usgs.gov/app/nwd/?region=lower48&aoi=default

WQA National Convention

https://www.wqa.org/convention

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