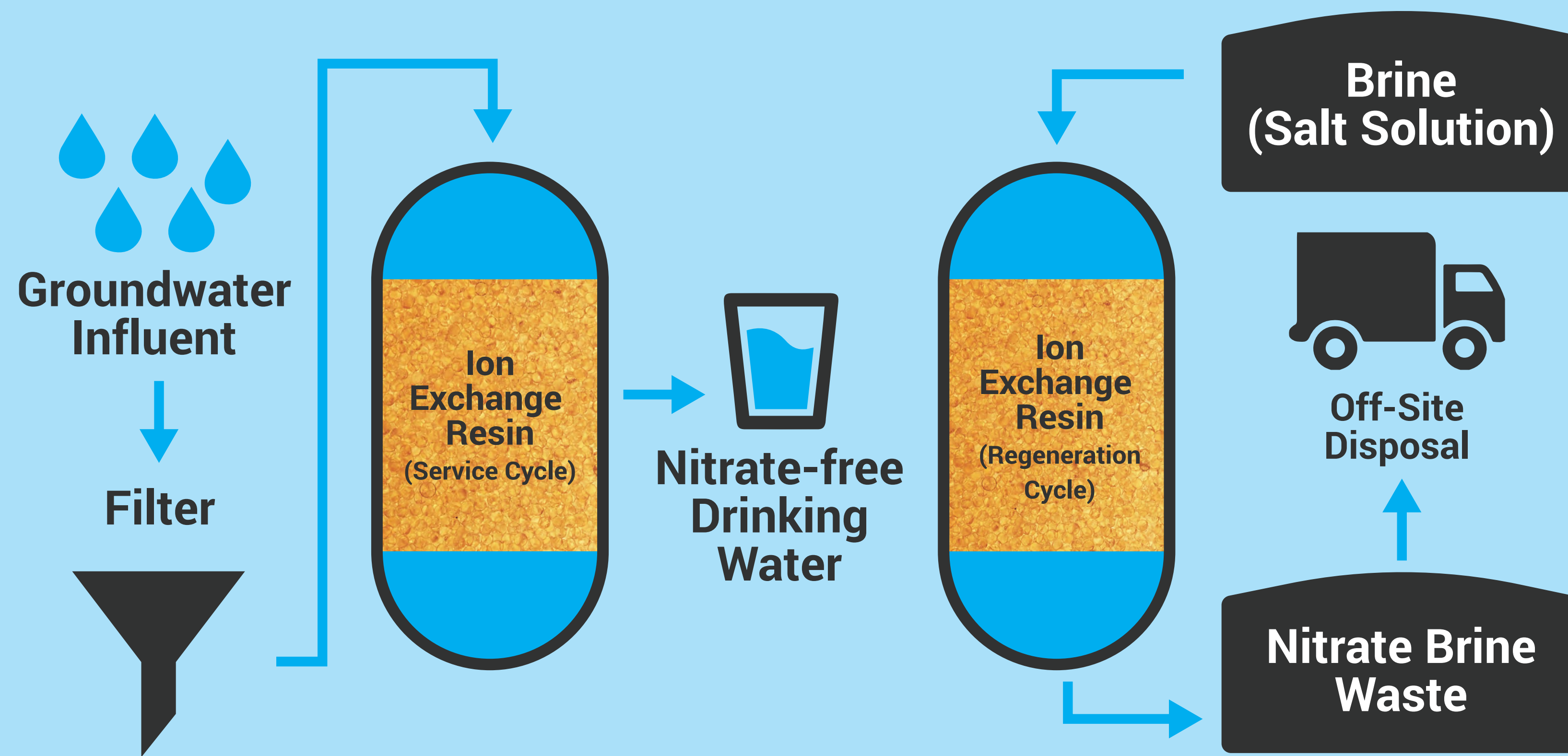


# How Does Ion Exchange Work for Nitrate?

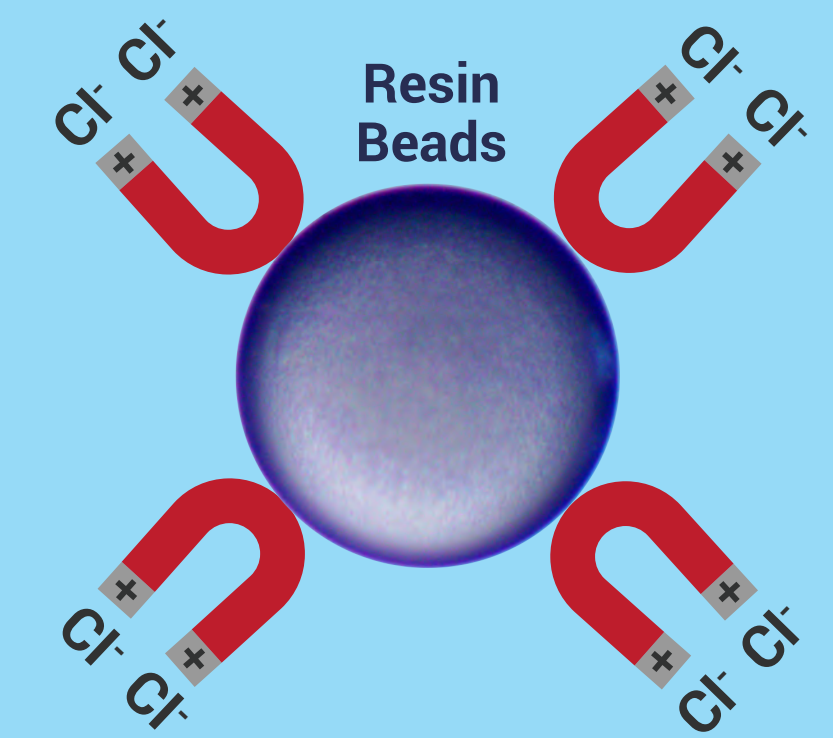
## Total Dissolved Solids (TDS) in Water

- Water, H<sub>2</sub>O, is a mixture of H<sup>+</sup> and OH<sup>-</sup> and many salts that dissolve which are called total dissolved solids or TDS.
- A salt is a combination of negatively charged anions and positively charged cations.
- Nitrate is a negatively charged anion, also known as NO<sub>3</sub><sup>-</sup>.



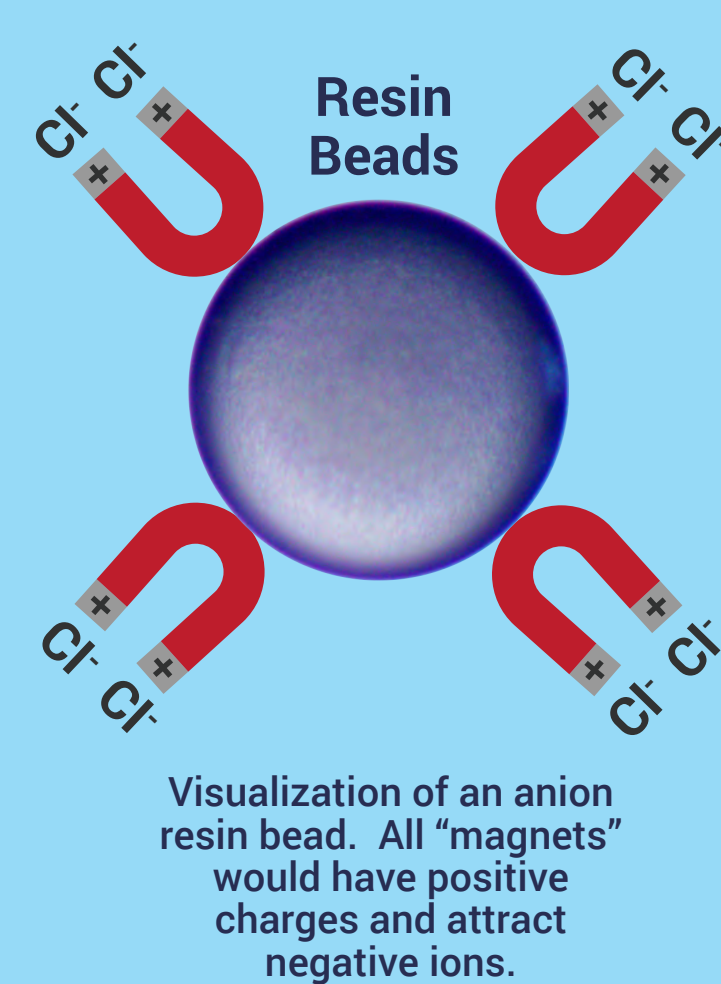
## Service Cycle

- Now that the resin bead is back in the chloride form, the resin bed is ready to be put back into service.
- The Service Cycle will last until enough flow passes through the bed to trigger another Regeneration Cycle.



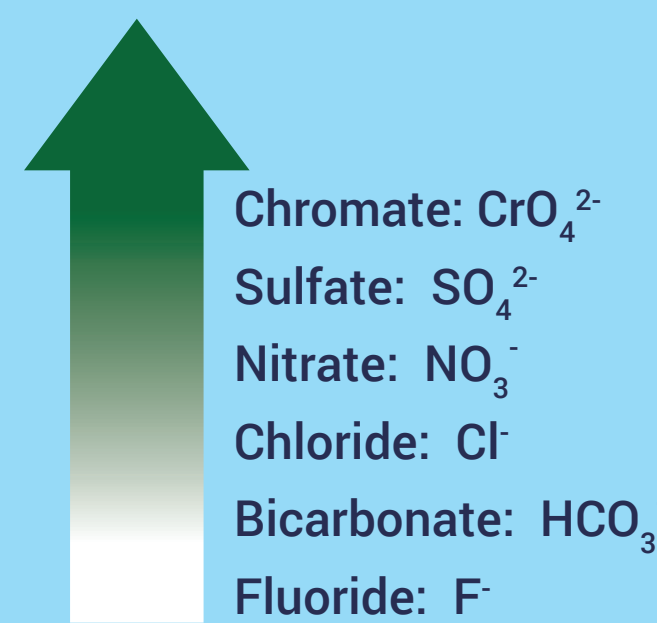
## Anion Resin Bead

- The bead itself is a plastic polymer. It is tightly crosslinked to create a very hard structure.
- On the bead, there are immobile and insoluble positively charged cations that attract negatively charged soluble ions in the water.
- Anion resins often come in the chloride form – meaning they exchange a chloride ion for another negatively charged ion based on selectivity.



## Typical Anion Resin Selectivity

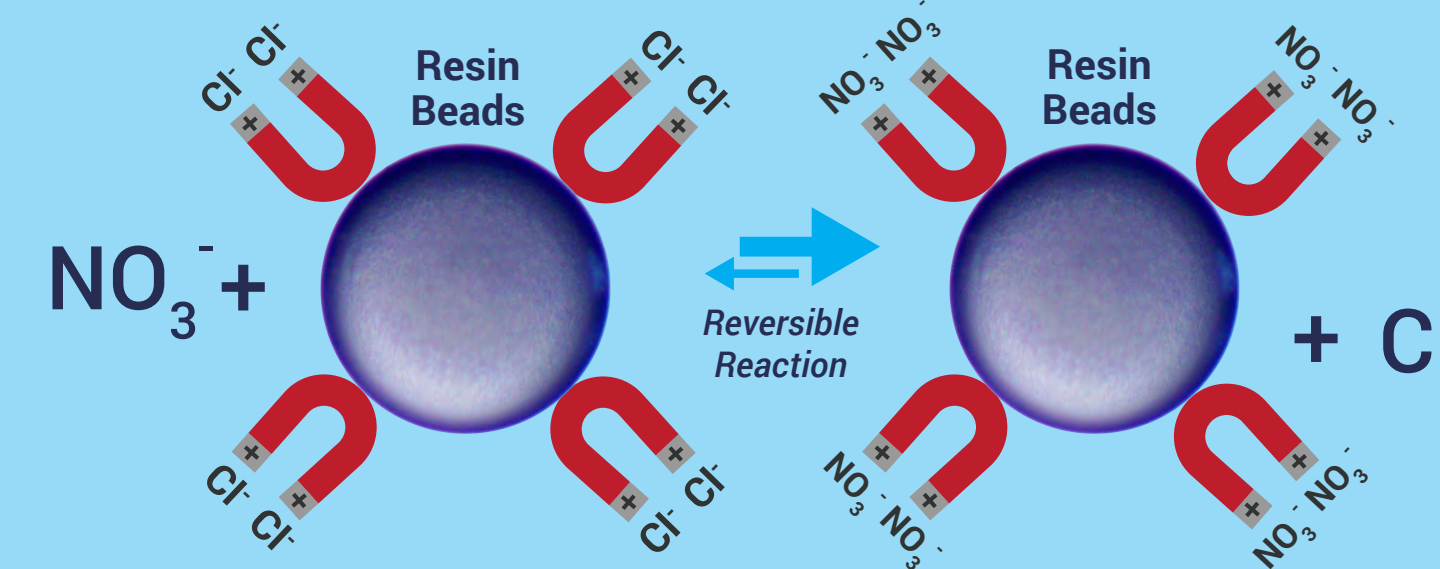
- Ion exchange resin is more selective for some ions over others.
- The order of selectivity is shown to the right. What this means is the resin will exchange a chloride ion for anything above it, like a nitrate ion.
- The other TDS or total dissolved solids in the water like sulfate compete for space on the resin bead and affect throughput. These quickly replace chloride on the bead.



Chromate: CrO<sub>4</sub><sup>2-</sup>  
 Sulfate: SO<sub>4</sub><sup>2-</sup>  
 Nitrate: NO<sub>3</sub><sup>-</sup>  
 Chloride: Cl<sup>-</sup>  
 Bicarbonate: HCO<sub>3</sub><sup>-</sup>  
 Fluoride: F<sup>-</sup>

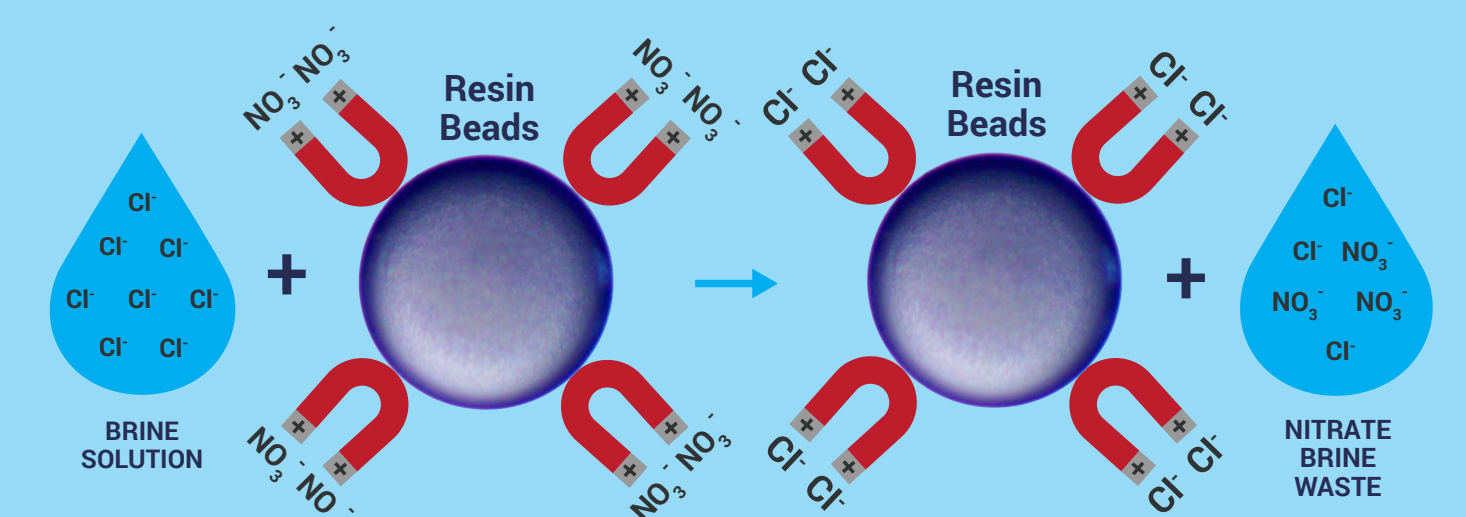
## Mechanism

The nitrate anion becomes strongly attracted to the resin. The chloride is released forming a harmless salt.



## Regeneration Cycle

Because the ion exchange mechanism exists in equilibrium, the reaction is reversible. If the environment of the resin bead changes so that there are excess chlorides, as in a brine solution, the bead can be restored to the chloride form.



The resultant nitrate brine waste has a nitrate and chloride concentration. Waste is hauled off.