

Active sites within **anion ion exchange resin** are the **positively charged functional groups** on the resin beads that are specifically designed to **attract and hold negatively charged ions (anions)** from a liquid stream.

What They Are:

- In **anion exchange resins**, these active sites are typically **quaternary ammonium groups** ($-NR_4^+$), where R can be various organic chains.
 - The positive charge on the nitrogen atom attracts negatively charged ions like **chloride (Cl^-)**, **sulfate (SO_4^{2-})**, **nitrate (NO_3^-)**, **bicarbonate (HCO_3^-)**, and **silica (SiO_2)** from water.
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Types of Active Sites in Anion Resin:

1. **Strong Base Anion (SBA) Resin**
 - Contains **quaternary ammonium groups**
 - Effective across a wide pH range
 - Removes **strongly and weakly dissociated acids**, including **silica and CO_2**
 2. **Weak Base Anion (WBA) Resin**
 - Contains **tertiary amine groups**
 - Removes **strong acids** like **sulfuric and hydrochloric acid**, but not weakly dissociated acids
 - Not effective in neutral or basic pH environments
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How It Works:

- The resin beads are pre-loaded with a **counter-ion** (often hydroxide, OH^- , or chloride, Cl^-).
 - When the resin comes in contact with water containing unwanted anions, these anions **exchange places** with the counter-ion at the active sites.
 - The unwanted anions bind to the resin, and the counter-ion is released into the water.
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Why Active Sites Matter:

- **Resin capacity** depends on the number and availability of active sites.
- **Fouling (e.g., organic fouling)** can block these sites, leading to reduced performance.
- Regular maintenance or resin cleaning (like with RTI's cleaning protocols) can help **restore access to fouled active sites**.