Aldex Ion Exchange Resins

Resin Service Life Guidelines

The following data may be used to determine the resin service life for the below listed Aldex Chemical resins. The wear-out of the resin is affected by system variables and other influencing factors such as temperature, resin transfer and foulants. Therefore, we can only provide this information as a guide and not as fixed resin specifications. Under mild operating conditions and with strict control of the ion exchange plant operations, it may be possible to extend the expected service life of the resins discussed below.

Strong Base Anion Exchange Resin Service Life

The service life of Strong Base Anion (SBA) exchange resins varies based on resin type. Type 2 resins will lose their strong base capacity about twice as fast as their total capacity. Acrylic resins lose their strong base capacity about 1.5 times as fast as total capacity.

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
Styrenic Gel Type 1	5%	3%	6 years
Styrenic Gel Type 2	7%	3%	6 years
Styrenic Macroporous Type 1	5%	2%	7 years
Styrenic Macroporous Type 2	7%	2%	5 years
Acrylic	6%	2%	5 years

Notes: Chlorine (Cl_2) can be the cause of rinse issues, capacity loss and decrosslinking. Organic fouling can also occur. The temperature limit for Strong Base Anion Type 2 (Macroporous and Gel) and Acrylic resins is 35 °C (95 °F).

Influencing Factors That Affect Resin Service Life

Resin service life can be difficult to predict due to the many parameters that can affect the resin for any given water treatment installation. Some of these influencing factors are listed below for reference.

Pre-treatment
Resin pretreatment can help prevent possible contamination from foulants and suspended solids that occur when water systems are inactive.

Temperature
Prolonged exposure to extreme temperatures can cause anion resin degradation resulting in decreased service life.

Cycle length
Shorter cycles create more osmotic stress than longer cycles resulting in increased attrition loss.

Flow rate
Higher flow rates create higher pressure drops resulting in decreased resin life span.

Oxidants
Oxidative environments will cause resin de-crosslinking and loss of functional groups, causing shorter resin life.

Iron, calcium, barium
Soft metals such as iron, calcium and barium can precipitate in the resin beads.

Organic fouling
Organic fouling of anion resins can be potentially irreversible and would require resin replacement.

Other foulants
Oil/grease, polyelectrolytes, and other contaminants can foul the resin potentially requiring early replacement.

Resin transfer frequency
The frequency of resin transfer can cause mechanical stress on the water treatment system.

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Wear-out Through Mechanical and Chemical Damage

The following tables show the resin service life through chemical and mechanical damage in operation. In industrial water treatment applications, typical resin lifetimes can range from 5 to 7+ years for a cation exchange resin and 3 to 6 years for anion resins.

Weak Acidic Cation Exchange Resin Service Life

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
All resins	10%	3%	7 years

Notes: Weak Acid Cation (WAC) resins with a high Hydrogen (H) to Sodium (Na) swelling cannot be used in the Sodium (Na) or Ammonium (NH_4) forms. Beware of bacteria, Iron (Fe) and Calcium Sulfate ($CaSO_4$) fouling.

Strong Acidic Cation Exchange Resin Service Life

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
Gel Type, standard DVB	3%	3%	7+ years
Gel Type, high DVB	2%	2%	7+ years
Macroporous	2%	2%	7+ years

Notes: Beware Iron (Fe) fouling (Sodium cycle) and Calcium Sulfate ($CaSO_4$) fouling (Sulfuric acid regeneration) and decrosslinking if Chlorine (Cl_2) is greater than 1.0 mg/L for Stong Acidic Cation (SAC) resins.

Weak Base Anion Exchange Resin Service Life

The capacity loss of WBA resins in the first year can be higher (~ 6 to 8 %). WBA and SBA Type 2 resins will lose their strong base capacity about twice as fast as their total capacity. Acrylic resins lose their strong base capacity about 1.5 times as fast as total capacity.

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
Styrenic	3%	4%	6 years
Acrylic	2%	4%	6 years

Notes: Chlorine (Cl_2) can be the cause of rinse issues. There is risk of Silica (SiO_2) fouling during regeneration for all WBA resins. Aldex WBA Acrylics resins are quite resistant to organic fouling.

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Inert Resin Service Life

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
All	0%	0%	15 years

Notes: There is risk of losing inert resin with a density smaller than one.

Mixed Bed Resin Polishing Service Life

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
SAC	3%	3%	8 years
SBA	5%	3%	6 years

Notes: Oxidants must be completely avoided. There is risk of organic fouling. Acrylic SBA resins used in mixed beds are temperature sensitive.

Condensate Polishing Service Life

Resin Type	Attrition loss per annum	Total capacity loss per annum	Expected operating service life
SAC	3%	3%	7 years
SBA Gel Type	7%	6%	6 years
SBA Macroporous	5%	6%	6 years

The condensate polishing information above is only valid if the following can be controlled:

1. The pressure drop can never exceed 250 kPa (36 psi).
2. The service flow rate is less than 125 m/h (50 gpm/ft^2) *and* less than 125 BV/h (15 gpm/ft^3).
3. No instantaneous flow changes greater than 12 m/h (5 gpm/ft^2).
4. Temperature is never greater than 50 °C (120 °F).
5. Temperature is less than or equal to 35 °C (95 °F) for greater than or equal to 90% of operation.
6. No instantaneous temperature changes greater than 15°C (30 °F)
7. No oil, grease or hydrocarbons.
8. O_2 is less than 100 µg/L (ppb).
9. Cl_2 is less than 20 µg/L (ppb).
10. The maximum number of resin transfers in resin life are:
    - SAC Macroporous: 600 transfers
    - SAC Gel Type: 300 transfers
    - SBA Macroporous: 300 transfer
    - SBA Gel Type: 200 transfers

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