PUROLITE

# A-501P

## Macroporous Strong Base Anion Exchange Resin

(FOR THE REMOVAL OF COLLOIDAL SILICA)

Technical Data

## PRODUCT DESCRIPTION

**Purolite A-501P** is a unique strong base type 1 anion exchange resin which has been developed for the removal of colloids especially colloidal silica. The pore size distribution has been optimised to ensure highest capacities for colloidal silica and hydrous metal oxides, including iron oxides, thus providing an added dimension in treating water to levels of absolute purity. The regenerability is excellent and **Purolite A-501P** may be regenerated time after time without large resin losses. This is because **Purolite A-501P** has an especially high mechanical strength for this type of product. **Purolite A-501P** finds use in the semiconductor, medical and pharmaceutical fields.

### Typical Physical and Chemical Characteristics

| | |
|---|---|
| **Polymer Structure** | **Macroporous crosslinked polystyrene** |
| **Appearance** | **Spherical beads** |
| **Functional Group :** | **$R\text{-}(CH_3)_3N^+$** |
| **Ionic Form - as shipped** | **Chloride – $Cl^-$** |
| **Total Capacity ($Cl^-$ form) min** | **0.5 eq/l** |
| **Moisture Retention - as shipped** | **70-75%** |
| **Bead Size Range (micron)** | **+1000 < 2%, -425 < 1%** |
| **(U.S. Standard Screen)** | **18-40 mesh** |
| **Shipping Weight** | **590-610 kg/m$^3$ (37-38 lb/ft$^3$)** |
| **Breaking Weight** | **40g/bead** |
| **Average Pore Diameter Angstroms** | **40-80K** |
| **Average Porosity** | **1.0 ml/g** |
| **Temperature Limit** | **60° C (140° F)** |

NOTE : This material is extremely tough for this type of product. However because extremely large pores and pore volume are necessary for this application, some surface attrition is inevitable. Thus the product should be handled carefully, at flow rates not exceeding the maxima recommended at any time. At times during operation a cloudyness of treated solution may occur. This does not cause any lasting problem because it is removed by the ion exchange polishing mixed bed system which follows. Any remaining traces will be removed by filtration.

## STANDARD OPERATING CONDITIONS

| OPERATION | RATE | SOLUTION | MINUTES | AMOUNT |
|---|---|---|---|---|
| Service | 8-32 BV/h<br>1-4 gpm/ft$^3$ | Influent water<br>to be treated | - | - |
| Backwash | 1-3 m/h<br>2-3gpm/ft$^2$<br>(10-20°C)<br>(50-68°F) | Influent water | 10-20 | 0.5-2 BV<br>3-12 gal/ft$^3$ |
| Acid | 2 BV/h<br>0.25gpm/ft$^3$ | 5%-10%<br>HCl | 20-60<br>6.25 lb/ft$^3$ | 100g HCl/l |
| Rinse slow | 2 BV/h<br>0.25 gpm/ft$^3$ | Influent water | 20-60 | 1-2 BV<br>8-16 gals/ft$^3$ |
| Caustic Regeneration | 2 BV/h | Influent water<br>0.25gpm/ft$^2$ | 60/80 | 130g NaOH/l<br>8 lb/ft$^3$ |
| Rinse slow | 2 BV/h<br>0.25 gpm/ft$^3$ | Influent water | 30-60 | 1-2 BV<br>8-16 gal/ft$^3$ |
| Rinse fast | 8-32 BV/h<br>1-4gpm/ft$^3$ | Influent water | 30-45 | 6-8 BV<br>50-70 gal/ft$^3$ |

**Backwash expansion 50-75%**
**Design Rising Space 100%**

## REGENERATION

The colloidal materials adsorbed by **Purolite A-501P** are, because of their nature, more difficult to remove than anions typically loaded during standard ion exchange reactions. Often they are colloids composed of both silica (insoluble in dilute acids) and transition metals (insoluble in dilute alkali). Hence it is necessary to treat with both acid and alkali to solubilise and remove these colloids. Long contact time is recommended, particularly with caustic regeneration, as recommended above. Depending on the nature of the colloids, it may be necessary to regenerate with hot sodium hydroxide (50°C)

## PRINCIPAL APPLICATIONS

### Protection of High Pressure Boilers

Colloidal silica may pass through the demineralisation train, and unlike ionised silica, is consequently concentrated and deposited in the boiler.
Where the boiler is of high pressure type, the colloidal silica increases the risk of corrosion and it is necessary to use a pressure lower than the design pressure of the boiler, thus increasing the blow down. A more economic approach is to incorporate a unit containing **Purolite A-501P** at the end of the demineralisation chain.

### Ultra Pure Water

There are several areas in which the electronics industry needs to use ultra pure water in manufacturing processes. The process water must be purified by removal not only of the ionic impurities, but also of all other impurities, such as suspended matter and colloids. The end of the water treatment cycle consists of an ultra filtration membrane unit. The use of a small column containing **Purolite A-501P** prior to the membrane will significantly prolong its life, while at the same time afford the possibility for obtaining even higher purity water in terms of silica and metals residuals.

### Treatment of Radioactive Circuits of Nuclear Power Stations

The impurities of these circuits are often removed by the use of ion exchange resins. However, it can be deduced that a certain proportion of the impurities are present, at least partially in colloidal form. This is notably the case for cobalt and silver compounds. These active colloids are not strongly held on conventional ion exchangers. The inclusion of **Purolite A-501P** resolves this problem both elegantly and economically.

## PRINCIPLE OF OPERATION

In general, because of the significant difference in pore diameter, macroporous resins are more resistant to fouling by organic matter, and other contaminants than gel resins. However there are no conventional resins capable of remove colloids efficiently.

**Purolite A-501P** has been developed especially for the elimination of colloids: the pores are much larger than those of a conventional macroporous resin (Purolite A-500, or A-500P). Hence the colloids are reversibly adsorbed together with organic matter, which renders the resin less sensitive to organic fouling.

Studies have shown that macroporous resins with a narrow pore distribution have a greater resistance to osmotic shock : the pore diameter range of **Purolite A-501P** is therefore concentrated in the range of 40,000 to 140,000 angstroms, see fig.3

Consequently the mechanical resistance of **Purolite A-501P** is perfectly acceptable for a resin endowed with this pore size range optimised for colloids removal. In fact, the pore size has been chosen to obtain best adsorption possible for the majority of colloids typically found in the water to be treated. Unlike other resins of this type, **Purolite A-501P** has a single distribution peak centred with majority of pores in the narrow range of 60-80,000 Angstroms.

## HYDRAULIC CHARACTERISTICS

The pressure drop or headloss across a properly classified bed of ion exchange resin depends on the particle distribution, bed depth, and voids volume of the exchange material, as well as on the viscosity (and hence on the temperature) of the the influent solution. Factors affecting any of these parameters, for example the presence of particulate matter filtered out by the bed, abnormal compaction of the resin bed, or the incomplete classification of the resin spheres will have an adverse effect and result in increased headloss.

Dedending on the quality of the influent water, the application and the design of the plant, service flow rates may vary from 8-32 bed volumes/hour (1-3 gpm/ft$^3$). Typical pressure drop data is given in fig.1.

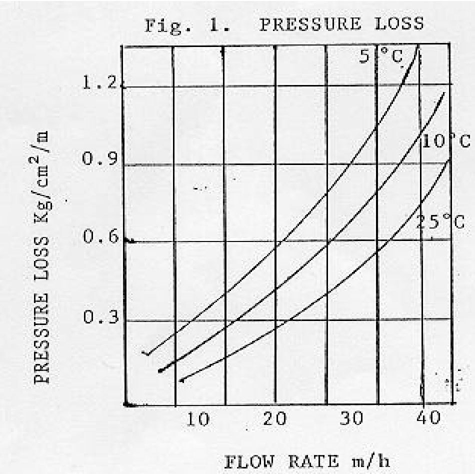

Fig. 1

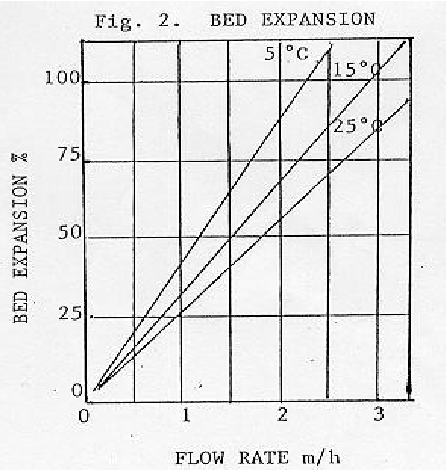

Fig. 2

During upflow backwash, the resin bed should be expanded in volume by between 50% and 70%. This operation will free it from any particulate matter, clear the bed of bubbles and voids, and reclassify the resin particles ensuring minimum resistance to flow. Bed expansion increases with flow rate and decreases with temperature, as shown in fig.2. Care should be taken to avoid over expansion of the bed.

## CONVERSION OF UNITS

1 m/h(cubic metres per square metre per hour)

= 0.341 gpm/ft.$^2$
= 0.409 U.S.gpm/ft.$^2$

1 kg/cm.$^2$/m (kilograms per square cm.per metre of bed)

= 4.33 psi/ft.
= 1.03 atm./m
= 10 ft. $H_2O$/ft.

Fig3. PORE VOLUME AS A FUNCTION OF PORE DIAMETER.