PUROLITE®
ION EXCHANGE RESINS

ISO 9002 BSI REGISTERED FIRM FM 40352

A-103S

Macroporous Weak Base Anion Exchange Resin

(For the demineralization of sugar solutions)

Technical Data

PRODUCT DESCRIPTION

Purolite A-103S is a macroporous poly (vinylbenzyl) tertiary amine exchanger of moderate porosity, specially developed for use in the demineralization of juices from the beet, cane and liquid sugar industries. Its (relatively high) basicity permits adsorption of organic acids of pKa values up to about 5, and its macroporous structure results in excellent resistance to both osmotic shock and organic fouling. As a result, many of the high molecular weight color bodies present are also removed, (in beet sugar juices, the reduction in color may be 80% or more), and these color bodies can readily be eluted during the regeneration. This can be carried out with low amounts of caustic soda, ammonia, or soda ash to give high operating capacities. The resin, with its macroporous styrene-divinylbenzene matrix, not only possesses good rinse characteristics, but its high total exchange capacity ensures high ash-removal figures (often >75% of total), with significant savings in running cost thanks to its excellent regeneration efficiency.

Where both the ionic concentration and color are particularly high in the influent juice, the more porous version of this resin, **Purolite A-100S**, is recommended as an alternative.

Typical Physical & Chemical Characteristics	
Polymer Matrix Structure	Macroporous Styrene-divinylbenzene
Physical Form and Appearance	Opaque near-white spherical beads
Whole Bead Count	95% min.
Functional Groups	Tertiary amino
Ionic Form, as shipped	Free base
Shipping Weight (approx.)	650 g/l (41 lb/ft^3)
Screen Size Range: - U.S. Standard Screen	16 - 40 mesh, wet
Particle Size Range	+1.2 mm <2%, -0.42 mm <2%
Moisture Retention, FB form, Cl^- form,	40 - 45% 48 - 55%
Reversible Swelling FB → Cl^-	25% max.
Specific Gravity, moist FB Form moist Cl^- Form	1.04 1.06
Total Exchange Capacity, Cl^- form, wet, volumetric dry, weight	 1.6 meq/ml min. 4.1 meq/g min.
Strong Base %	12 - 20
Operating Temperature, Cl^- Form	100ºC (212ºF) max.
pH Range, Stability	0 - 14
pH Range, Operating	0 - 8

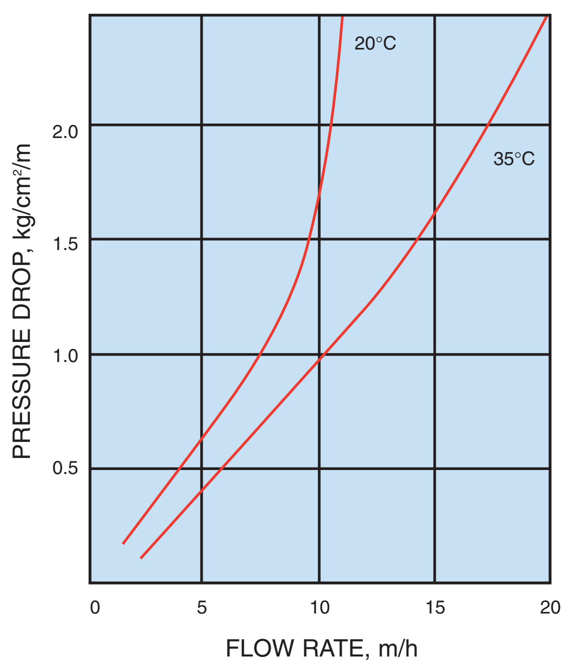
HYDRAULIC CHARACTERISTICS

The pressure drop (headloss) across a properly classified bed of ion-exchange resin depends on the particle size distribution, bed depth, and void volume of the exchanger, and on the flowrate and viscosity (and hence on the temperature) of the influent solution. Anything 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 an increased headloss.

Pressure drop figures obtained on thin sugar juice, at 12°Brix and temperatures of 20°C, (68°F), and 35°C, (95°F), correspond to those for 5°C and 20°C respectively in water itself, and are given in the graph below for **Purolite A-103S**.

During upflow backwash, the resin bed should be expanded in volume by 50%, in order to free it from any particulate matter in the influent solution, to clear the bed of bubbles and voids, and to reclassify the resin particles as much as possible, ensuring minimum resistance to flow. Since both viscosities and densities of the influent in special applications systems will vary quite widely, backwash expansion figures are not given here, but for dilute aqueous solutions the expansion as a function of flowrate is essentially similar to that of **Purolite A-103S** on backwash after rinse with demineralized water.

PRESSURE DROP IN 12°BRIX THIN JUICE



Conversion of Units	
1 m/h (cubic meters per square meter per hour)	= 0.341 gpm/ft^2 = 0.409 U.S. gpm/ft^2
1 kg/cm^2/m (kilograms per square cm per meter of bed)	= 4.33 psi/ft = 1.03 atmos/m = 10 ft H_2O/ft

CHEMICAL STABILITY

Purolite A-103S is insoluble in acids, alkalies, and all common solvents. Most salt forms and the free base are stable at elevated temperatures, and may be used in continuous service at temperatures up to about 90°C (ca. 195°F) without significant change occurring. However, exposure to free chlorine, and certain oxidizing agents such as peroxides may lead to loss in exchange capacity as the result of ongoing chemical reaction, and should therefore be avoided.

APPLICATIONS TO SUCROSE

The principal sources of sucrose are sugar cane and sugar beet, which are crushed or shredded respectively before extraction with hot water to obtain the impure sugar juice. The first purification step on this juice is the removal of both soluble and colloidal impurities by the addition of lime, followed by precipitation of the calcium as calcium carbonate by carbonation with CO_2. After filtration, and cooling to minimize sucrose breakdown catalyzed by H^+ ions from the cation exchanger, the thin juice at a concentration of 10 - 15°Brix may be demineralized using a strong-acid cation exchanger, **Purolite C100S**, followed by a weak-base anion resin such as **Purolite A-103S** or **Purolite A-100S**. The elimination of the residual Ca^{++} ions and much of the residual color results in increased yields of higher purity sugar at the crystallization stage. With liquid sugar solutions, where no additional purification on crystallization can take place, effective demineralization and decolorization are essential for high-purity products.

Regeneration of a **Purolite A-103S** (or **A-100S**) unit is normally carried out with 2% caustic soda at about 4 bed volumes (b.v.) per hour, after a 1.5 b.v. "sweetening off" and backwashing. Following a rinse with water, and "sweetening on" with a further 1.5 b.v. of the thin decationized juice, the unit is ready to recommence service. The run is monitored by conductivity and color, and a lifetime of approximately 1000 cycles may be expected (depending on the characteristics of the juice being treated) before performance is seriously affected.

APPLICATIONS TO OTHER SUGARS

Purolite A-103S may also be used in the demineralization of high-solids glucose liquors, or HFCS (high fructose corn syrups), where a strongbase anion resin cannot be used in the OH^- form because of color formation by the so-called Maillard reaction. Regeneration with 5% soda ash, or better 2.5% ammonia, will minimize OH^- formation on the small amount of quaternary groups which may be present. Ammonia is preferred because of its lower cost, ease of recovery, and the lower rinse requirements accompanying its use. Since the influent solutions are, in general, relatively high viscosity liquids (a 50°Brix solution at about 30°C has a viscosity of about 10 cp.), the temperatures used are higher than with the thin juices to obtain suitable flow rates. The macroporous structure of **Purolite A-103S** is designed to resist both the osmotic and thermal shocks arising from this mode of operation.

OTHER APPLICATIONS

Deionization of sorbitol solutions is carried out in essentially the same way as for solutions of sugar. The efficient removal of formic acid from quite concentrated solutions of formaldehyde at temperatures up to 60 - 65°C can be achieved, provided that multivalent cations of iron and other transition metals are absent. Operating capacities of 45 - 50g HCOOH per l of resin (2.8 - 3.0 lb./ft^3) have been recorded, depending on the influent temperature, concentration, and the regeneration level of the exchanger.

PUROLITE®
ION EXCHANGE RESINS

WORLDWIDE OFFICES

USA: www.puroliteUSA.com
International: www.purolite.com

U.S.A.
The Purolite Company
150 Monument Road
Bala Cynwyd, PA 19004
Phone: (1) 610-668-9090
Toll Free: 800-343-1500
Telefax: (1) 610-668-8139
Email: sales@puroliteUSA.com

TEXAS
The Purolite Company
1700 West Loop South
Suite 740
Houston, TX 77027
Toll Free: 800-562-6488
Telefax: (1) 713-627-7890

CANADA
The Purolite Company
625 Wabanaki Drive
Unit #2
Kitchener, Ontario N2C 2G3
Toll Free: 800-461 -1500
or (1) 519-896-6674
Telefax: (1) 519-896-6679

UNITED KINGDOM
Purolite International Limited
Kershaw House
Great West Road
Junction with Lampton Road
Hounslow, TW5 OBU
Sales Phone: (44) 181 -570-4454
Telefax: (44) 181-572-7726

European Marketing
Phone: (44) 181-577-1222
Telefax (44) 181-577-1136

GERMANY
Purolite Deutschland GmbH
Harkort Strasse 25
40880 Ratingen
Phone: (49) 2102-46033
Telefax: (49) 2102-443663

FRANCE
Purolite International SARL
34 Avenue Matignon
75008 Paris
Phone: (33) 1-4256-4563
Telex: 648856
Telefax: (33) 1-4563-3826

SPAIN
Purolite Iberica S.A.
Parc Tecnologic del Valles
Centre Empreses Noves Tecnologies
08290 Cerdanyola del Valles (Barcelona)
Phone: (34) 3-582-0266
Telefax: (34) 3-582-0268

EGYPT
Purolite International Middle East
Cairo Liaison Office
12 Obour Gardens
Fifth Floor, App. No. 55
Salah Salem Street
Nasr City, Cairo
Phone: (20) 2-4021477
Telefax: (20) 2-4021478

ITALY
Purolite International S.r.l.
Viale Coni Zugna 29
20144 Milan
Phone: (39) 02-481-8145
Telefax: (39) 02-4801-2359

ROMANIA
Purolite Romania
International Business Center Modern
B-dul Carol I No. 34-36
5th Floor
Bucharest, Sector 2
Phone: (40) 1-250-5053/5028
Telefax: (40) 1-250-5999

POLAND
Head Office
Radus Spolka z o.o.
ul Przebendowskich 33
81-543 Gdynia
Phone/Fax (48) 58-6248118

GLIWICE
Radus Spolka z o.o.
ul Górnych Walów 25
44-100 Gliwice
Phone: (48) 32-315-931
Telefax: (48) 32-315-931

SLASK
Radus Spolka z o.o.
ul 3 Maja 3/33
32-600 Oswiecim
Phone: (48) 33-425-603
Telefax: (48) 33-425-603

CZECH & SLOVAK REPUBLICS
Purolite International
Nad Mazankou 17
182 00 Prague 8
Phone: (420) 2-688-1086
Telefax: (420) 2-688-1086

RUSSIA
Head Office
Purolite International
10th Floor
36 Lyusinovskaya Street
Moscow
Phone: (7) 095-564-8120
Telefax: (7) 095-564-8121

ST. PETERSBURG
Purolite International Limited
12 Building A Tambovskaya St.
St. Petersburg
192007 Russian Federation
Phone: (7) 812-327-8530
Telefax: (7) 812-327-9079

KAZAKHSTAN
Purolite RH Limited
Office 205
240 Dostyk AV.
Almaty 480051
Phone: (7) 3272-641-234
Telefax: (7) 3272-641-234

SINGAPORE
Purolite International (Singapore)
PTE Limited
32-04 The Concourse
300 Beach Road, 199555
Phone: (65) 297-0889
297-1453
Telefax: (65) 297-1986

CHINA
Head office
Purolite (China) Company, Ltd.
Chengguan Town
Deqing County
Zhejiang Province 313200
Phone: (86) 572-842-2908
Telefax: (86) 572-842-3954

TAIWAN
Purolite International
16F-2, No. 191
Fu-hsing N. Road,Taipei
Phone: (886) 2-546-7078
Telefax: (886) 2-546-7069

MEXICO
Purolite International, S.A. De C.V.
World Trade Center
Montecito 38, Piso 33,Oficina-19
Mexico D.F. 03810
Phone: (52) 5-488-0904
Telefax: (52) 5-488-0906

UKRAINE
Purolite International Limited
2 Korolenko Street.
Dnepropetrovsk 320070
Phone: (38) 0562-320-065
0562-320-066
Telefax: (38) 0562-320-067

KOREA
Purolite International (Korea) LLC
Dae Yeon Bldg., Suite 403
943-30 Daechi-dong
Kangnam-gu, Seoul
Phone: (82) 2-3453-7062/7063
Telefax: (82) 2-3453-7064

A-103S/1299/SOP