INDION® N-IP

Description

INDION NIP is a Type 2 strong base anion exchange resin in bead form having benzyl dimethyl-ethanol-ammonium groups. These groups are less strongly basic than those in Type 1 resins, resulting in a higher regeneration efficiency with lower operating costs.

INDION NIP is based on cross-linked polystyrene, and has an isoporous structure.

INDION NIP has a high capacity for the natural organic matter present in some surface waters and has excellent resistance to poisoning by this organic matter.

Characteristics

Appearance	:	Transluscent red brown beads
Matrix	:	Styrene -EDMA copolymer
Functional Group	:	Benzyl dimethyl ethanol amine
Ionic form as supplied	:	Chloride
Total exchange capacity	:	1.2 meq/ml, minimum
Moisture holding capacity	:	45 - 53 %
Shipping weight *	:	690 kg/m^3 approximately
Particle size range	:	0.3 to 1.2 mm
> 1.2 mm	:	5.0%, maximum
< 0.3 mm	:	1.0%, maximum
Uniformity co-efficient	:	1.7, maximum
Effective size	:	0.45 to 0.55 mm
Volume change	:	Cl to OH, 6 % approximately
Maximum operating temperature	:	40^0C
Operating pH range	:	0 to 14
Resistance to reducing agents	:	Good
Resistance to oxidizing agents	:	Generally good, chlorine should be absent

* Weight of resin, as supplied, occupying 1 m^3 in a unit after backwashing & draining.

Applications

Two stage de-ionising

INDION NIP is recommended as the anion exchange resin in the second stage of a de-ionising pair with INDION 225 cation exchange resin in the first stage.

When used in a two stage de-ionising plant upstream of mixed bed unit, INDION NIP will protect the strong base anion exchange resin in the latter unit against organic fouling. At the same time, it will assist in the production of final treated water with a low residual of organic matter.

INDION NIP is particularly recommended for use in a two stage de-ionising plant for the removal of mineral acid anions and some silica, while keeping running costs down.

If treated water with the lowest possible level of residual silica is required, two stage treatment should be followed by mixed bed de-ionising using a Type 1 anion exchange resin such as INDION FFIP.

Mixed bed de-ionsing

When treated water of highest possible quality is required, INDION 225 strong acid cation exchange resin is used with INDION FFIP in a mixed bed unit. A mixed bed is often operated as the last unit in a de-ionising stream to act as a polisher for producing water of highest quality.

Typical operating data

Two stage/multiple stage de-ionising	Co-flow regeneration	Counter current regeneration
Bed depth	0.75 m minimum	1.0 m minimum
Treatment flowrate	60 $m^3/h\ m^2$ maximum	60 $m^3/h\ m^2$ maximum
Pressure loss	Refer Figure 7	Refer Figure 7
Bed expansion	Refer Figure 8	Refer Figure 8
Backwash.....................................	3 $m^3/h\ m^2$ for 5 minutes or till effluent is clear	3 $m^3/h\ m^2$ for 5 minutes or till effluent is clear*
Regenerant	Sodium Hydroxide (2-4% w/v)	Sodium Hydroxide (2.4% w/v)
Regenerant flowrate	3-18 $m^3/h\ m^2$	4.5- 18 $m^3/h\ m^2$
Regenerant injection time	30 minutes minimum	30 minutes minimum
Slow rinse	2.5 to 3 bv at regenerant flow rate	2 to 3 bv at regenerant flow rate
Final rinse.....................................	7.5 bv at service flowrate	5 bv at service flow rate

* After a set number of regenerations
1 bv (bed volume) = 1 m^3 fluid/m^3 resin.

Operating exchange capacity

Coflow regeneration
Two stage de-ionising

The operating exchange capacity of INDION NIP when used as the anion exchange resin in two stage de-ionising system is dependent upon:

- The regeneration level employed (see Figure 1)
- The composition of the water to be treated, specifically the concentration of mineral acid anions (SO_4/EMA %) and the silica content.
- The exhaustion rate (see Figure 2)

Figure 1 shows typical capacities obtained with a de-ionsing system using INDION 225 strong acid cation exchange resin in the first stage followed by a degasser and INDION NIP anion exchange resin in the second stage and employing co-flow regeneration.

Effect of sulphate and EMA

The operating exchange capacities (Figure1) are shown as a function of regeneration level for various percentages of SO_4/EMA and at EMA values around 100-200 ppm $CaCO_3$.

Effect of exhaustion rate

The capacity data is related to exhaustion times greater than nine hours. Figure 2 shows the variation of capacity with exhaustion time.

In selecting the operating conditions of INDION NIP, consideration should be given to the expected treated water quality. Figure 3-6 shows average treated water quality that can be expected from this resin. These are related to the regeneration level, the temperature of the regenerant and the ratio of silica to total anions in the feed.

Countercurrent regeneration (CCR)
Two stage de-ionising

The operating exchange capacity of INDION NIP when used as the anion exchanger in a two stage De-ionising system is dependent upon:

- The regeneration level employed
- SO_4/EMA %
- Silica content (SiO_2/TA)
- Exhaustion rate

Figure 9 shows typical capacities obtained with a de-ionising system using INDION 225 strong acid cation exchange resin in the first stage followed by a degasser and INDION NIP anion exchange resin in the second stage and employing countercurrent regeneration.

The operating exchange capacities (Figure 9) are shown as a function of regeneration level and refer to an end point silica of 150 ppb over the average silica residual obtained during the run. The capacities are determined with a feed containing zero sodium slip and ratio of silica to total anion of 10% .

The capacity data apply to exhaustion times greater than 9 hours. Refer Figure 2 for the variation of capacity with exhaustion time.

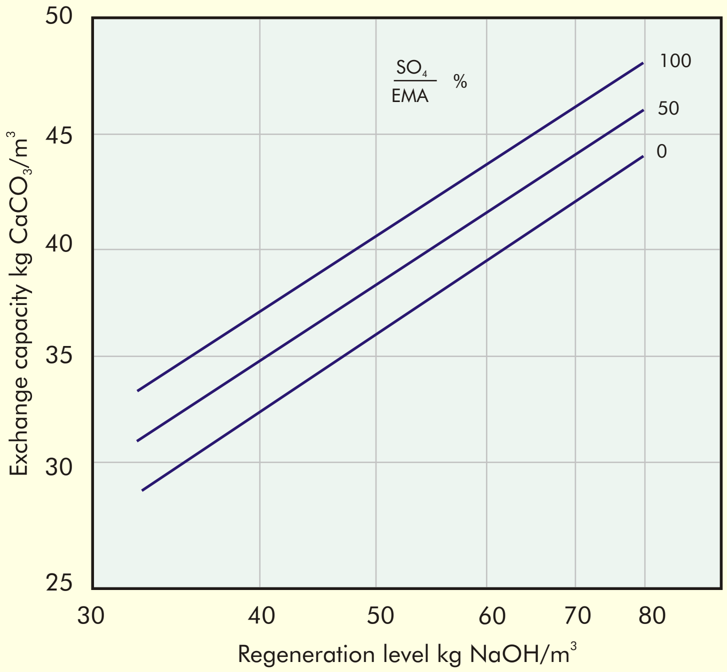
Figure 10 gives the correction factor for SO_4/EMA % to be applied to the operating exchange capacity obtained from Figure 9 .

Figure 11 gives the correction factor for SiO_2/TA % to be applied to the operating exchange capacity obtained from Figure 9 .

In selecting operating conditions of INDION NIP, consideration should be given to the expected treated water quality. Figures 12 & 13 show average treated water quality that can be expected from the resin. These are related to the regeneration level, and the ratio of silica to total anions in the feed with the temperature of regenerant at 25 ° C.

OPERATING EXCHANGE CAPACITY

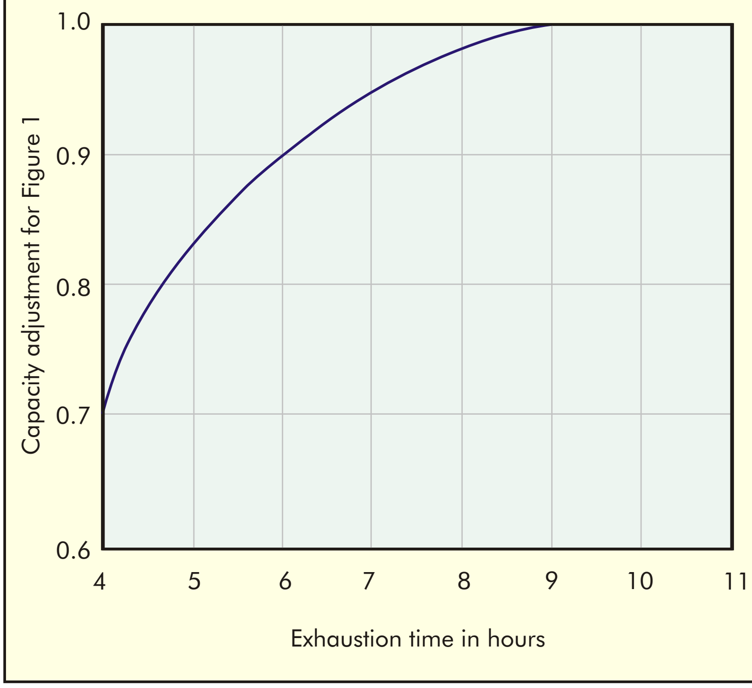
Figure 1



EMA = Equivalent Mineral Acidity

CAPACITY ADJUSTMENT FOR EXHAUSTION TIME

Figure 2



Treated water quality

Two stage de-ionising

The quality of the treated water from a two stage de-ionising plant using INDION N-IP as the anion exchange resin is determined by:

- The regeneration level employed.
- The temperature of the regenerant used for the anion exchange resin.
- The level of sodium ion leakage from the cation (hydrogen) exchange resin.
- The silica to total anions ratio of the water fed to the anion exchange resin.

Sodium ions leaking from the cation exchanger resin are converted to NaOH as the water passes through the anion exchange stage.

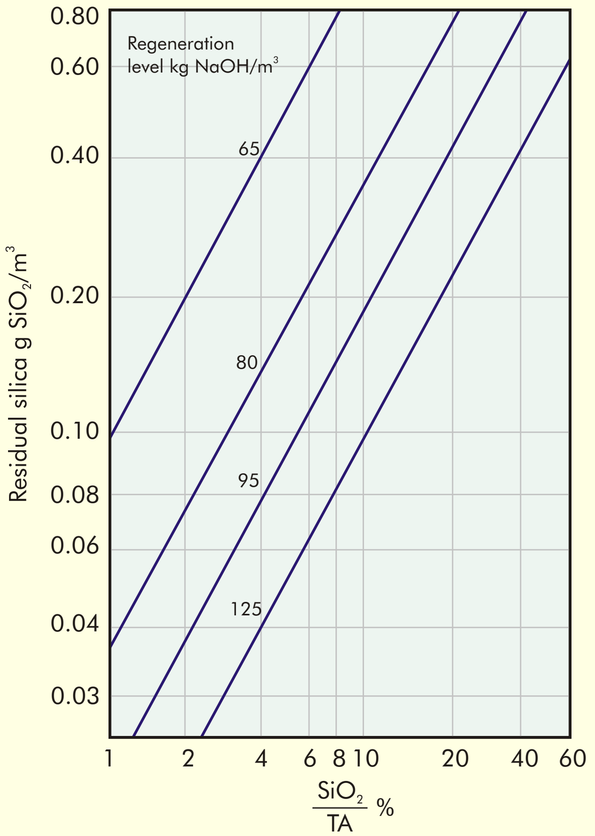
Each mg/1 of sodium leakage, expressed as $CaCO_3$, increases the electrical conductivity of the water leaving the anion exchange stage by approximately 5 microsiemens/cm at 20° C

The values for silica residual in the treated water at various regeneration levels and temperatures can be obtained from Figures. 3 6.

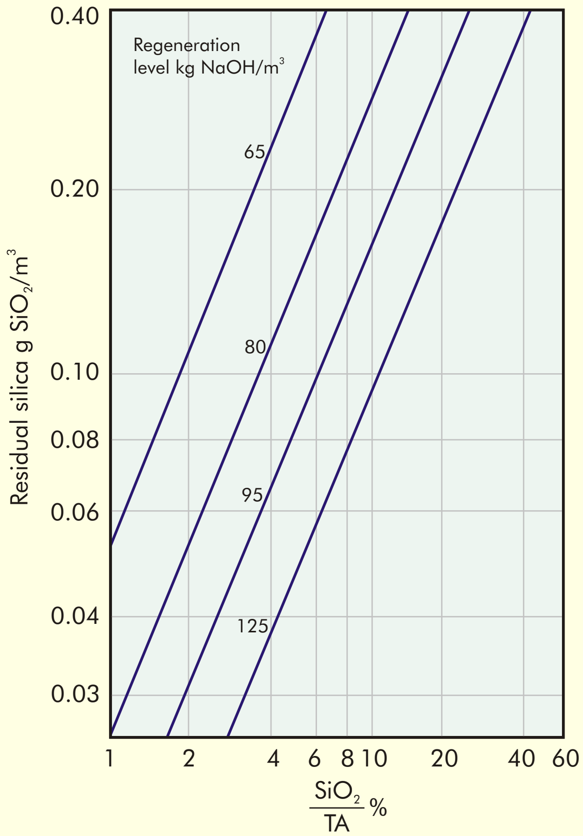
These values assume zero sodium slip and for every 1 mg/l of sodium leakage as $CaCO_3$, the residual silica will increase by 25%.

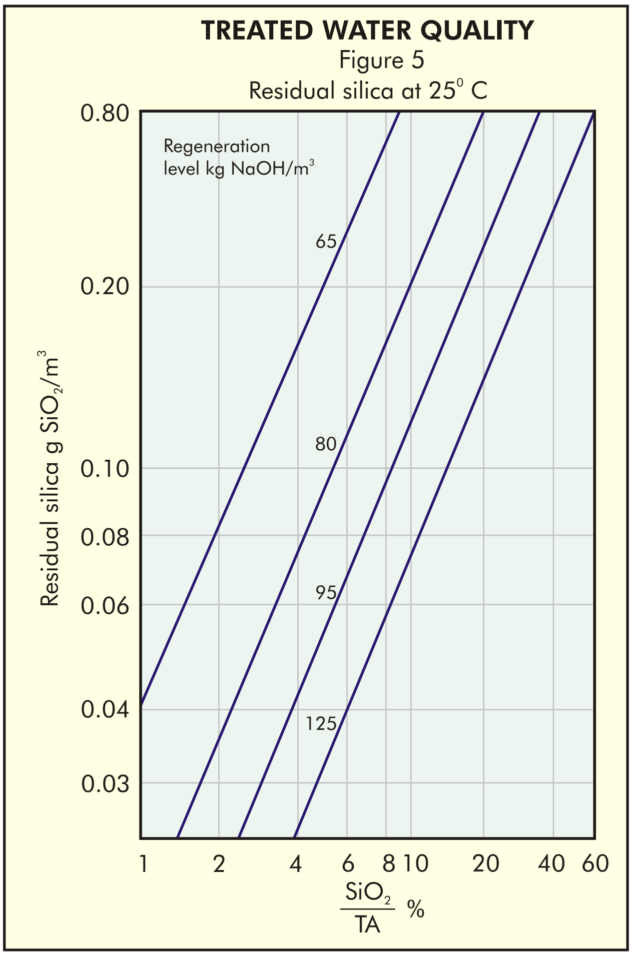
The values for silica residual in the treated water at various regeneration levels can be obtained from Figures 12 & 13 for countercurrent regeneration at a temperature of 25° C

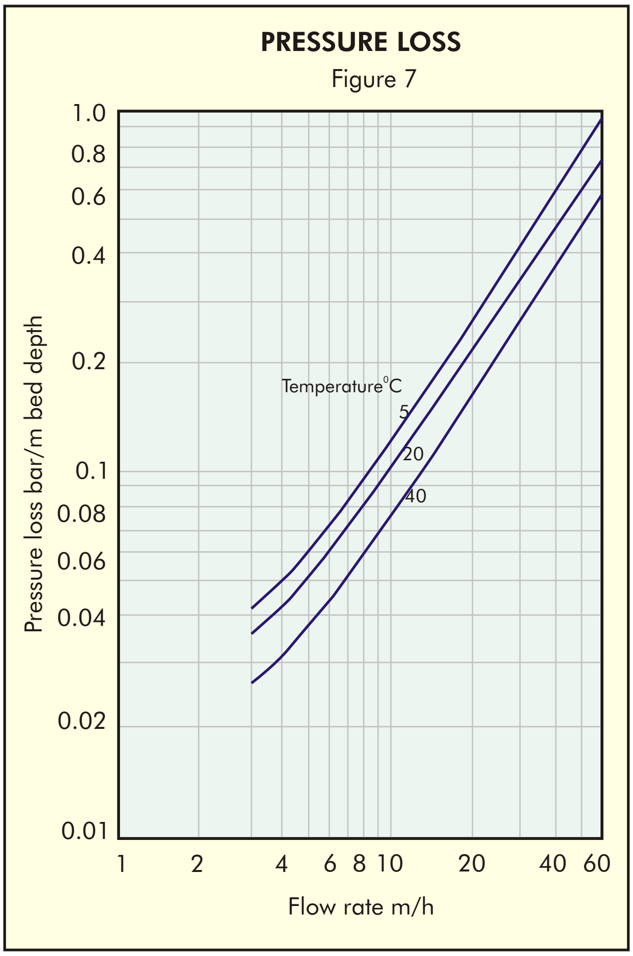
TREATED WATER QUALITY
Figure 3
Residual silica at 5° C

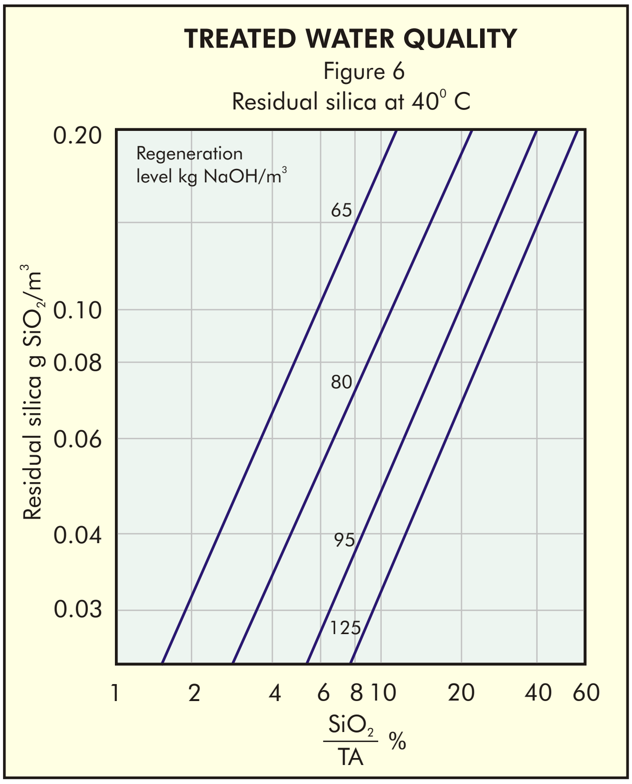


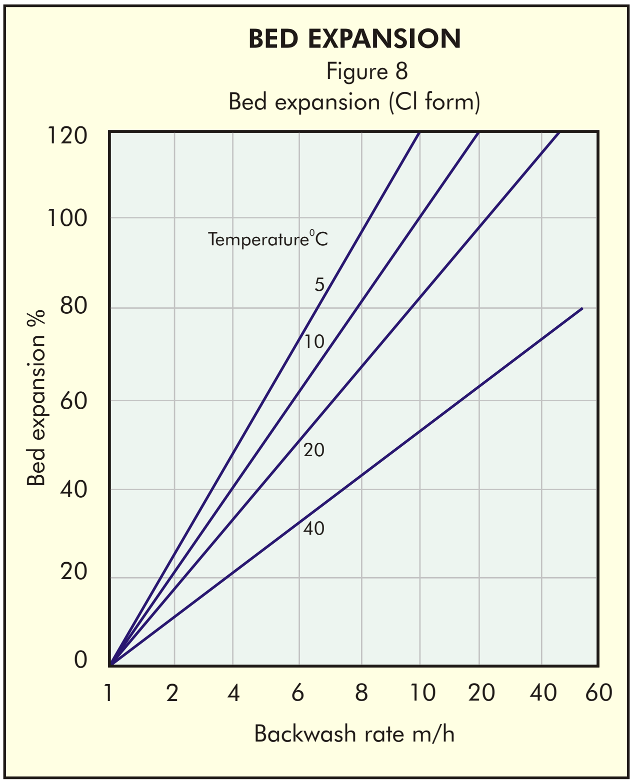
TREATED WATER QUALITY
Figure 4
Residual silica at 15° C




TREATED WATER QUALITY
Figure 5
Residual silica at 25° C
Regeneration level kg NaOH/m³
65
80
95
125
Residual silica g SiO₂/m³
0.80
0.20
0.10
0.08
0.06
0.04
0.03
1 2 4 6 8 10 20 40 60
SiO₂ / TA %


PRESSURE LOSS
Figure 7
Temperature °C
5
20
40
Pressure loss bar/m bed depth
1.0
0.8
0.6
0.4
0.2
0.1
0.08
0.06
0.04
0.02
0.01
1 2 4 6 8 10 20 40 60
Flow rate m/h


TREATED WATER QUALITY
Figure 6
Residual silica at 40° C
Regeneration level kg NaOH/m³
65
80
95
125
Residual silica g SiO₂/m³
0.20
0.10
0.08
0.06
0.04
0.03
1 2 4 6 8 10 20 40 60
SiO₂ / TA %


BED EXPANSION
Figure 8
Bed expansion (Cl form)
Temperature °C
5
10
20
40
Bed expansion %
120
100
80
60
40
20
0
1 2 4 6 8 10 20 40 60
Backwash rate m/h

Operating exchange capacity

Countercurrent regeneration (CCR) Two stage de-ionising

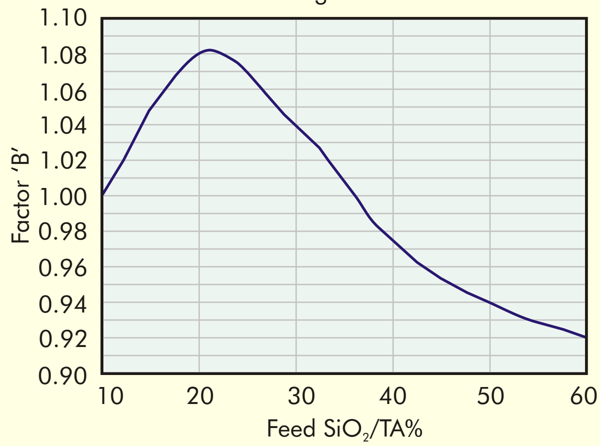
The operating exchange capacity of Indion NIP in two stage de-ionising is obtained by multiplying the basic capacity value from Figure 9 by the correction factors A & B from Figures 10 & 11.

Silica residuals in treated water

The expected average silica residuals are shown in Figure 12 with a correction factor given in Figure 13 for Feed silica. These average silica residuals will be exceeded by 150 ppb SiO_2 at the end of the run.

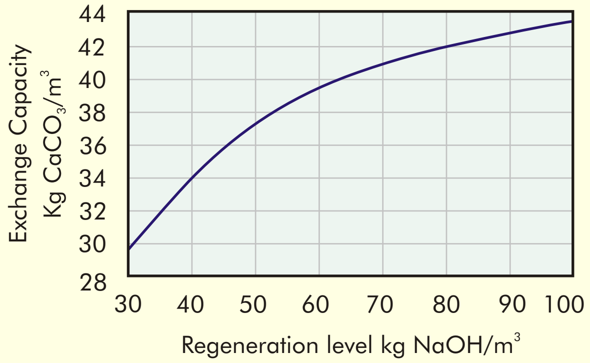
CCR - FACTOR 'B' FOR FEED SiO_2

Figure 11



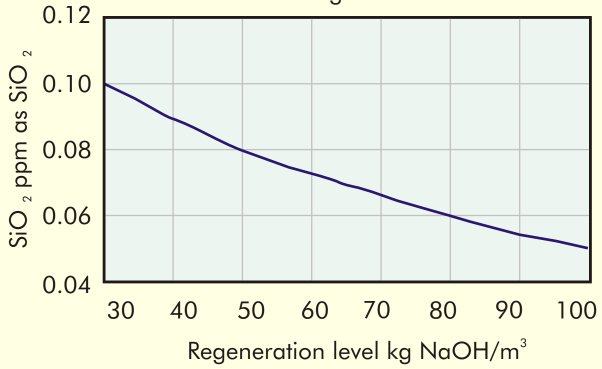
BASIC EXCHANGE CAPACITY - CCR

Figure 9



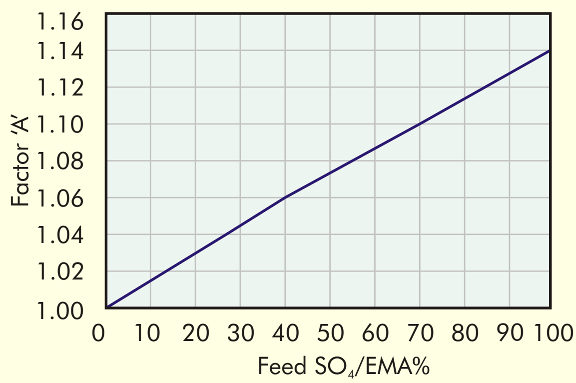
CCR - BASIC SiO_2 LEAKAGE - Lek^0

Figure 12



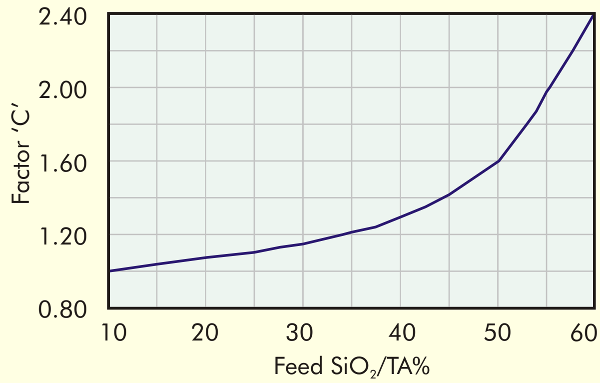
CCR - FACTOR 'A' FOR FEED SO_4

Figure 10



CCR - FACTOR 'C' FOR FEED SiO_2/TA

Figure 13



Use of good quality regenerants

All ion exchange resins are subject to fouling and blockage of active groups by precipitated iron. Hence the iron content in the feed water should be low and the regenerant sodium hydroxide must be essentially free from iron and heavy metals. All resins, especially the anion exchangers are prone to oxidative attack resulting in problems such as loss of capacity, resin clumping, etc. Therefore sodium hydroxide should have as low a chlorate content as possible. Good quality regenerant of technical or chemically pure grade should be used to obtain best results.

Packing

HDPE lined bags	25/50 lts	LDPE bags	1 cft/25 lts
Super sack	1000 lts	Super sack	35 cft
MS drums with liner bags	180 lts	Fiber drums with liner bags	7 cft

Storage

Ion exchange resins require proper care at all times. The resin must never be allowed to become dry.

Regularly open the plastic bags and check the condition of the resin when in storage. If not moist, add enough clean demineralised water and keep it in completely moist condition. Always keep the resin drum in the shade. Recommended storage temperature is between 20° C and 40° C.

Safety

Acid and alkali solutions are corrosive and should be handled in a manner that will prevent eye and skin contact. If any oxidising agents are used, necessary safety precautions should be observed to avoid accidents and damage to the resin.

INDION range of Ion Exchange resins are produced in a state of the art ISO 9001 and ISO 14001 certified manufacturing facilities at Ankleshwar, in the state of Gujarat in India. This product data sheet (issue 09/2008) replaces previous issues.

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