



WTP Design by Computer

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Presentation Content

- Design brief + influent water
- Ground rules + introduction to the software
- Water analysis
- Plant layout
- Treated water specification
- The design
 - Resin choice and design margin
 - Flow rate and cycle time
 - Optimising rinse volumes and regeneration levels
 - Vessel sizing
 - Adjusting for neutral effluent
- Outputs
- Other design options + OPEX comparison

Design Brief

Client requires demineralised water sourced from deep borehole.

Plant design requirements are for 80 m³/h flow. Operators work an 8 hour shift pattern.

Proposed option is counter-current packed bed SAC – degasser – SBA with separate polishing MB

Outline treated water specification is:

	Conductivity (μScm^{-1})	Silica (ppb)
Average	1	20
End point	2	50

Influent Water

Cations (ppm CaCO ₃)	Anions (ppm CaCO ₃)	Other info
Ca ²⁺ : 200	HCO ₃ ⁻ : 150	SiO ₂ (reactive): 10 ppm
Mg ²⁺ : 75	Cl ⁻ : 50	TOC: 0.1 ppm
Na ⁺ : 50	NO ₃ ⁻ : 30	pH: 7.2
K ⁺ : 5	SO ₄ ²⁻ : 100	EC: 430 μScm ⁻¹
Fe ³⁺ : 0.1		
Total Cations: 330.1	Total Anions: 330	

Ground Rules – Plant Design

- SAC – WBA
 - For partially demineralised water 10 – 30 μScm^{-1} spec.
 - SAC – SBA
 - Most common combination – can incorporate DG
 - SAC – WBA - SBA
 - WAC – SAC - WBA
 - WAC – SAC – SBA
 - WAC – SAC – WBA – SBA
- More complex, higher CAPEX systems but lower OPEX due to higher regeneration efficiency of WAC/WBA when high EMA
- Resin can be housed in separate vessels or layered in the same vessel
- Degasser commonly used when alkalinity > 1 meq/l (50 ppm as CaCO_3)
 - DG located before WBA for acrylic WBAS, and after for polystyrenic WBAs

Ground Rules – Resin Choice / Grade

Anion resin selection:

- Reactive silica level
 - T1 sty/acr > T2 sty/bif.
- Operating (working) capacity
 - Bif > T2 sty > acr > T1 sty
- Operating flow rate (BV/h)
 - poss. acr bead deformation
- Organics load
 - Acr/bif > T1 sty > T2 sty
- Operating temperature
 - T1 sty > T2 sty > bif. > acr

Cation resin selection:

- Usually 8 % xlinked gel SAC, either in Na or H form.
- Macro resins usually used only in demanding conditions

WAC/WBA resins

- Used in separate vessels or in layered (stratified) beds
- Std + graded products available
- Acr WAC, both sty+acr WBA available

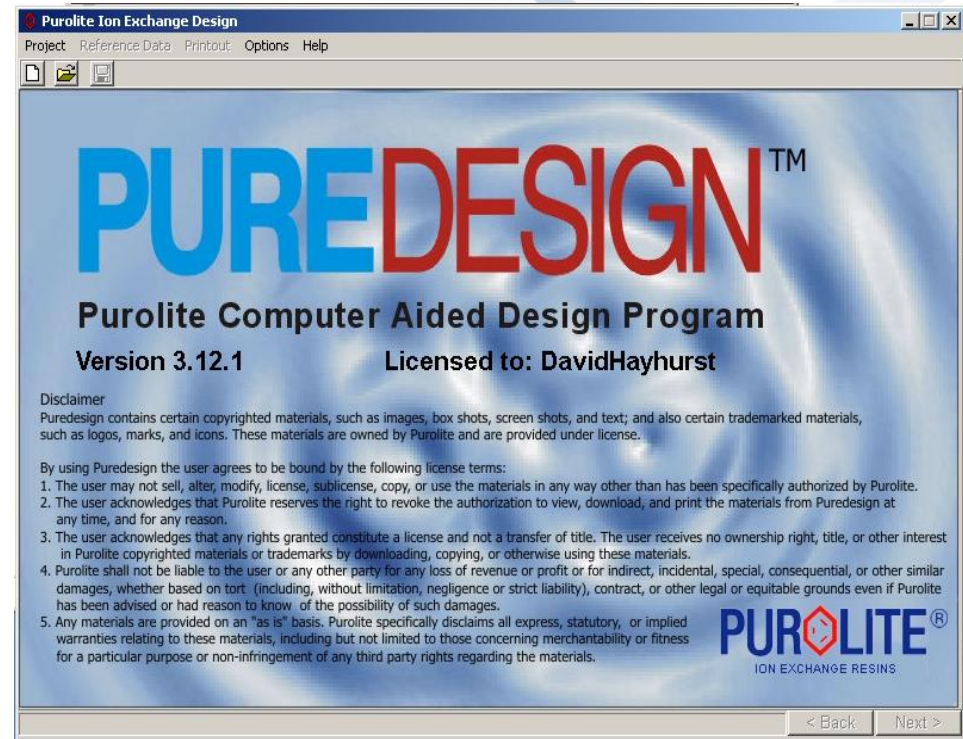
Resin grades:

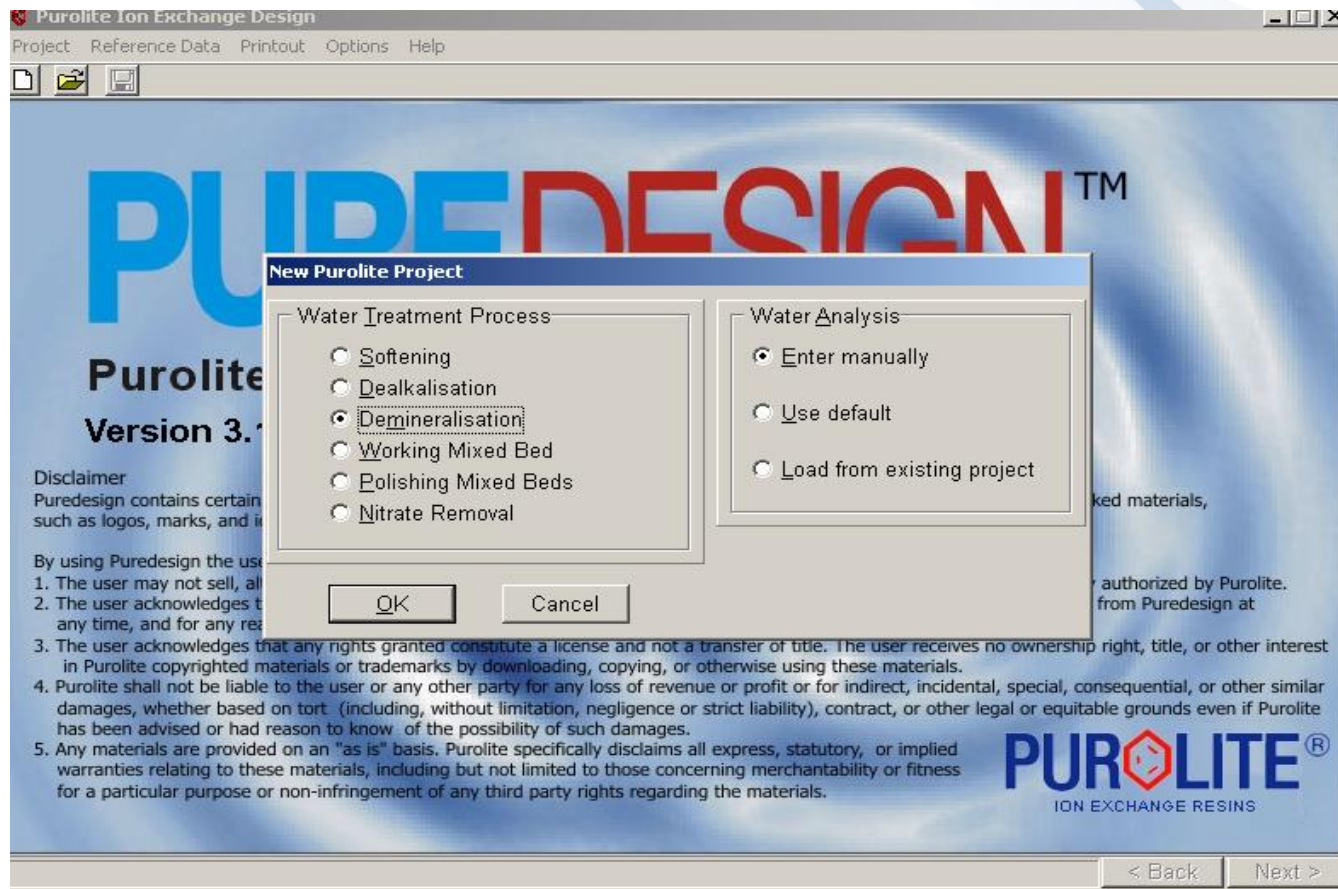
- Standard or Puofine for co-flow
- Puopack for counter-flow
- DL for stratified beds

Ground Rules – Regeneration

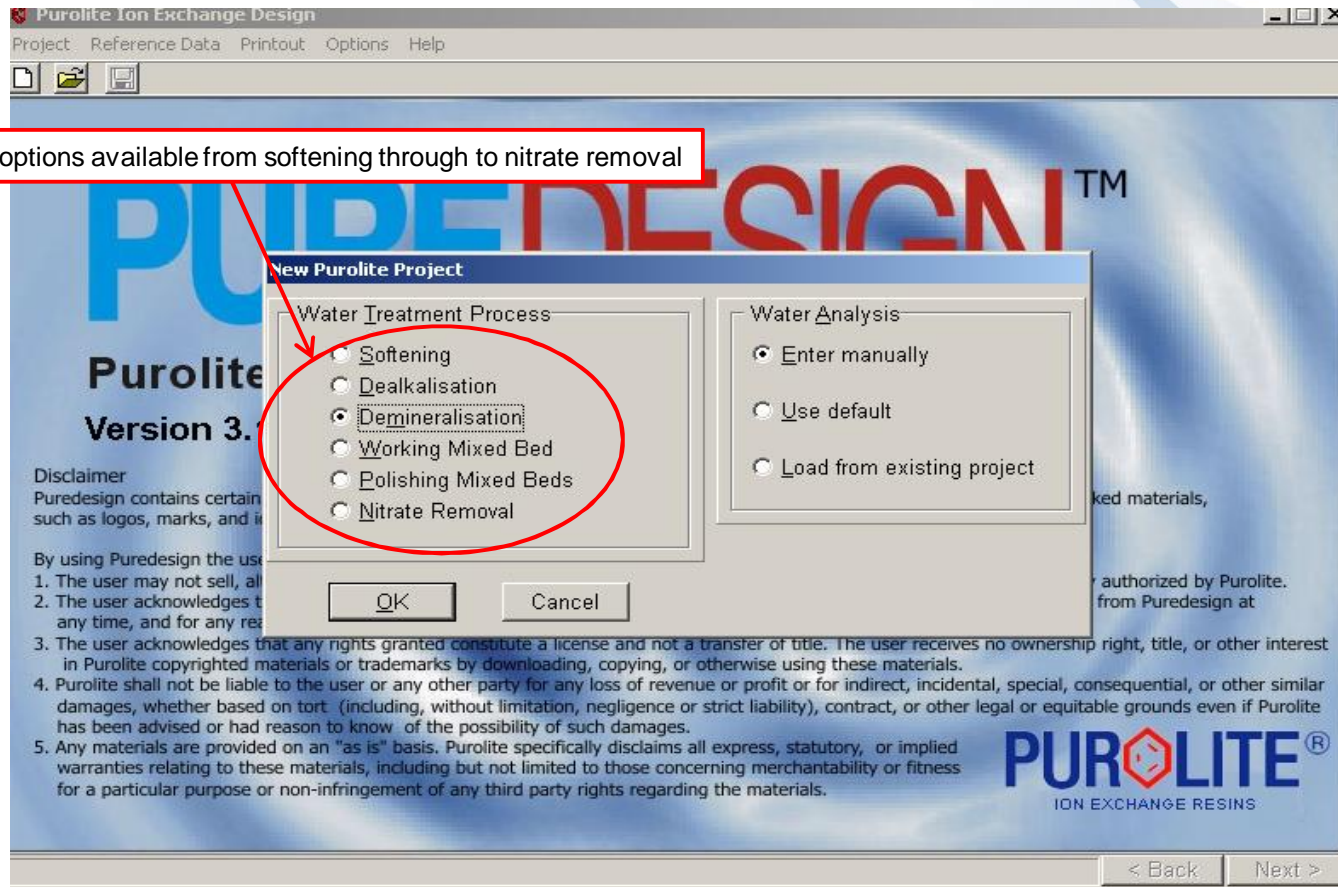
- WAC / SAC – HCl or H₂SO₄
 - Note Puredesign assumes 2-step regeneration with H₂SO₄ + displays average acid strength – if single addn., add 5 % to design margin
- WBA / SBA - NaOH
 - Minimum level of 65 g/l for organic fouling waters
- Options include co or counter flow regeneration, backwashed or packed bed
- Standard rinses:
 - co-flow 2 BV slow, 4-6 BV fast
 - counter-flow 2 BV slow, 2BV fast for cation, 3-4 BV fast for anion
- Neutral effluent achievable by balancing regen levels

- Provides theoretical model of plant
- Enables optimisation of equipment, service and regeneration conditions for given raw water and treated water specification
- Allows system modification to mimic the effects of changed raw water/treated water specification

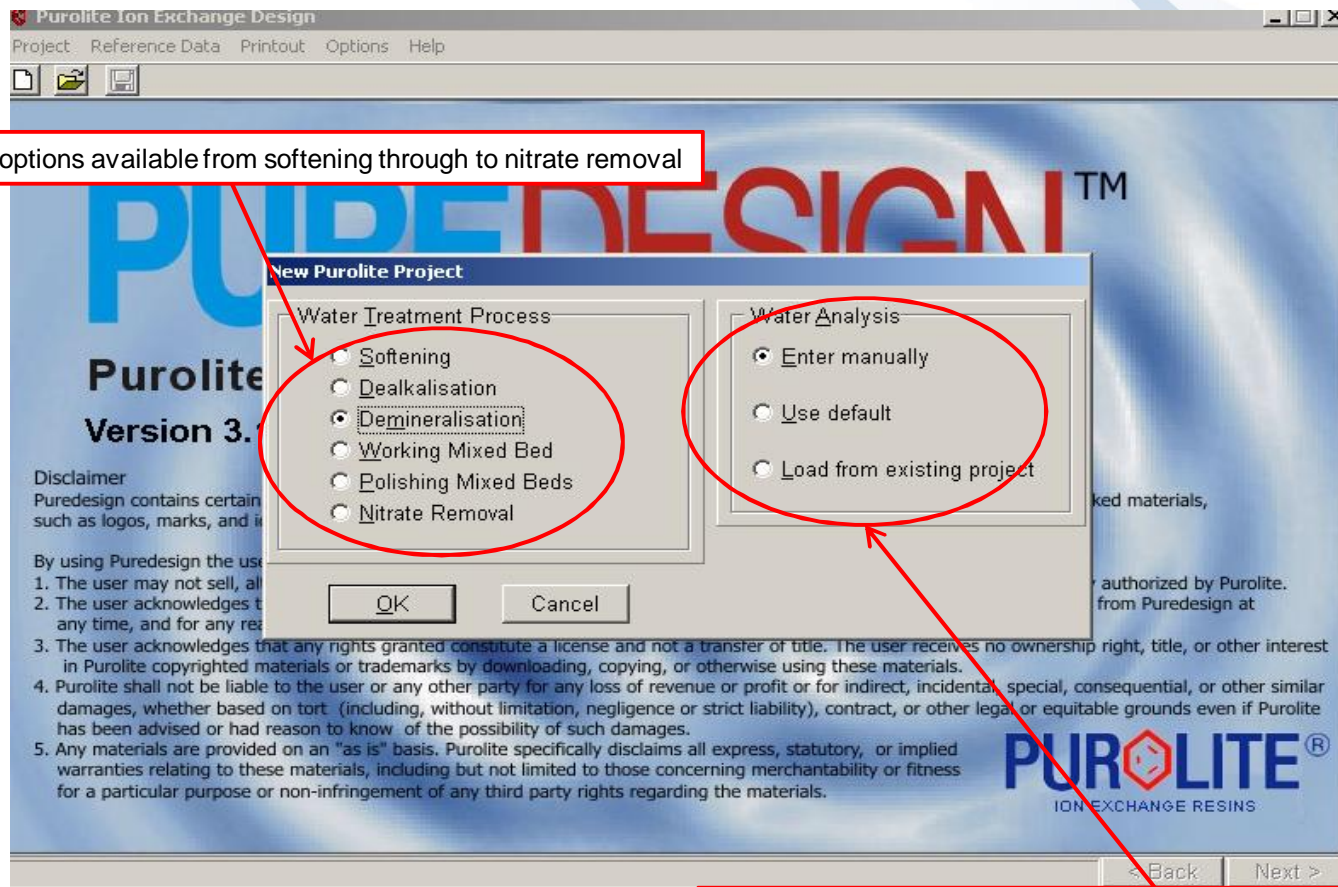




Choice of process options available from softening through to nitrate removal



Choice of process options available from softening through to nitrate removal



Water analysis option allow for both manual entry and load from memory to facilitate multiple iterations of design

Water Analysis On Screen

Purolite Ion Exchange Design <Model Design v1>

Project Reference Data Printout Options Help

Influent Water Data : Demineralisation

Origin Pretreatment

Temperature °C pH Conductivity μS/cm

Dissoly. Solids ppm CaCO₃ Total Alkalinity ppm CaCO₃

Total Hardness ppm CaCO₃ Equiv. Mineral Acid. ppm CaCO₃

Detailed Water Analysis

Set all ions unit to

CATIONS		ANIONS	
Calcium	<input type="text" value="200.00"/> ppm CaCO ₃	Bicarbonates	<input type="text" value="150.00"/> ppm CaCO ₃
Magnesium	<input type="text" value="75.00"/> ppm CaCO ₃	Carbonates	<input type="text" value="0.00"/> ppm CaCO ₃
Sodium	<input type="text" value="50.00"/> ppm CaCO ₃	Chlorides	<input type="text" value="50.00"/> ppm CaCO ₃
Potassium	<input type="text" value="5.00"/> ppm CaCO ₃	Sulfates	<input type="text" value="100.00"/> ppm CaCO ₃
(1) Iron	<input type="text" value="0.10"/> ppm CaCO ₃	Nitrates	<input type="text" value="30.00"/> ppm CaCO ₃
(2) Others	<input type="text"/> ppm CaCO ₃	Others: Weak	<input type="text"/> ppm CaCO ₃
		(3) Strong	<input type="text"/> ppm CaCO ₃
Tot. Cations	<input type="text" value="330.10"/> ppm CaCO ₃	Tot. Anions	<input type="text" value="330.00"/> ppm CaCO ₃

ppm CaCO₃ ppm CaCO₃ ppm TOC

Water Analysis On Screen

Purolite Ion Exchange Design <Model Design v1>

Project Reference Data Printout Options Help

Influent Water Data : Demineralisation

Origin: Pretreatment:

Temperature: °C pH: Conductivity: μS/cm

Dissolved Solids: ppm CaCO₃ Total Alkalinity: ppm CaCO₃

Total Hardness: ppm CaCO₃ Equiv. Mineral Acid: ppm CaCO₃

Detailed Water Analysis

Set all ions unit to:

CATIONS			ANIONS		
Calcium	<input type="text" value="200.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	Bicarbonates	<input type="text" value="150.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
Magnesium	<input type="text" value="75.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	Carbonates	<input type="text" value="0.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
Sodium	<input type="text" value="50.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	Chlorides	<input type="text" value="50.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
Potassium	<input type="text" value="5.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	Sulfates	<input type="text" value="100.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
(1) Iron	<input type="text" value="0.10"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	Nitrates	<input type="text" value="30.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
(2) Others	<input type="text"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	Others: Weak	<input type="text"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
Tot. Cations	<input type="text" value="330.10"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>	(3) Strong	<input type="text"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>
			Tot. Anions	<input type="text" value="330.00"/>	<input type="text" value="ppm CaCO<sub>3</sub>"/>

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Several units available when entering water analysis, standardisable with 'set all ions to' button

Water Analysis On Screen

Purolite Ion Exchange Design <Model Design v1>
Project Reference Data Printout Options Help

Influent Water Data : Demineralisation

Origin: Pretreatment:

Temperature: °C pH: Conductivity: μS/cm

Dissolved Solids: ppm CaCO₃ Total Alkalinity: ppm CaCO₃

Total Hardness: ppm CaCO₃ Equiv. Mineral Acid: ppm CaCO₃

Detailed Water Analysis

Set all ions unit to:

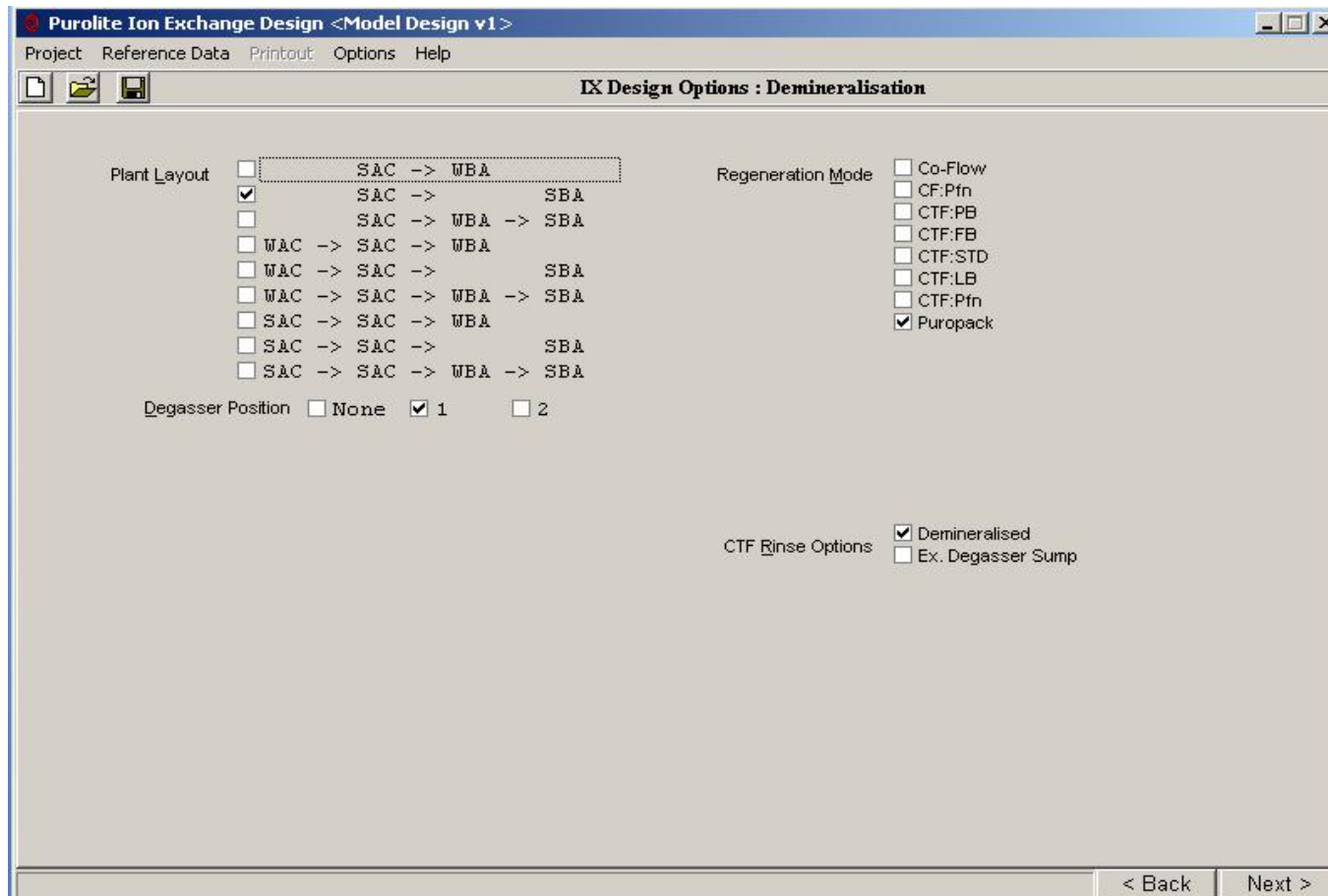
CATIONS		ANIONS	
Calcium	<input type="text" value="200.00"/> ppm CaCO ₃	Bicarbonates	<input type="text" value="150.00"/> ppm CaCO ₃
Magnesium	<input type="text" value="75.00"/> ppm CaCO ₃	Carbonates	<input type="text" value="0.00"/> ppm CaCO ₃
Sodium	<input type="text" value="50.00"/> ppm CaCO ₃	Chlorides	<input type="text" value="50.00"/> ppm CaCO ₃
Potassium	<input type="text" value="5.00"/> ppm CaCO ₃	Sulfates	<input type="text" value="100.00"/> ppm CaCO ₃
(1) Iron	<input type="text" value="0.10"/> ppm CaCO ₃	Nitrates	<input type="text" value="30.00"/> ppm CaCO ₃
(2) Others	<input type="text"/> ppm CaCO ₃	Others: Weak	<input type="text"/> ppm CaCO ₃
Tot. Cations	<input type="text" value="330.10"/> ppm CaCO ₃	(3) Strong	<input type="text"/> ppm CaCO ₃
		Tot. Anions	<input type="text" value="330.00"/> ppm CaCO ₃

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Note water temperature – assumed for deep borehole

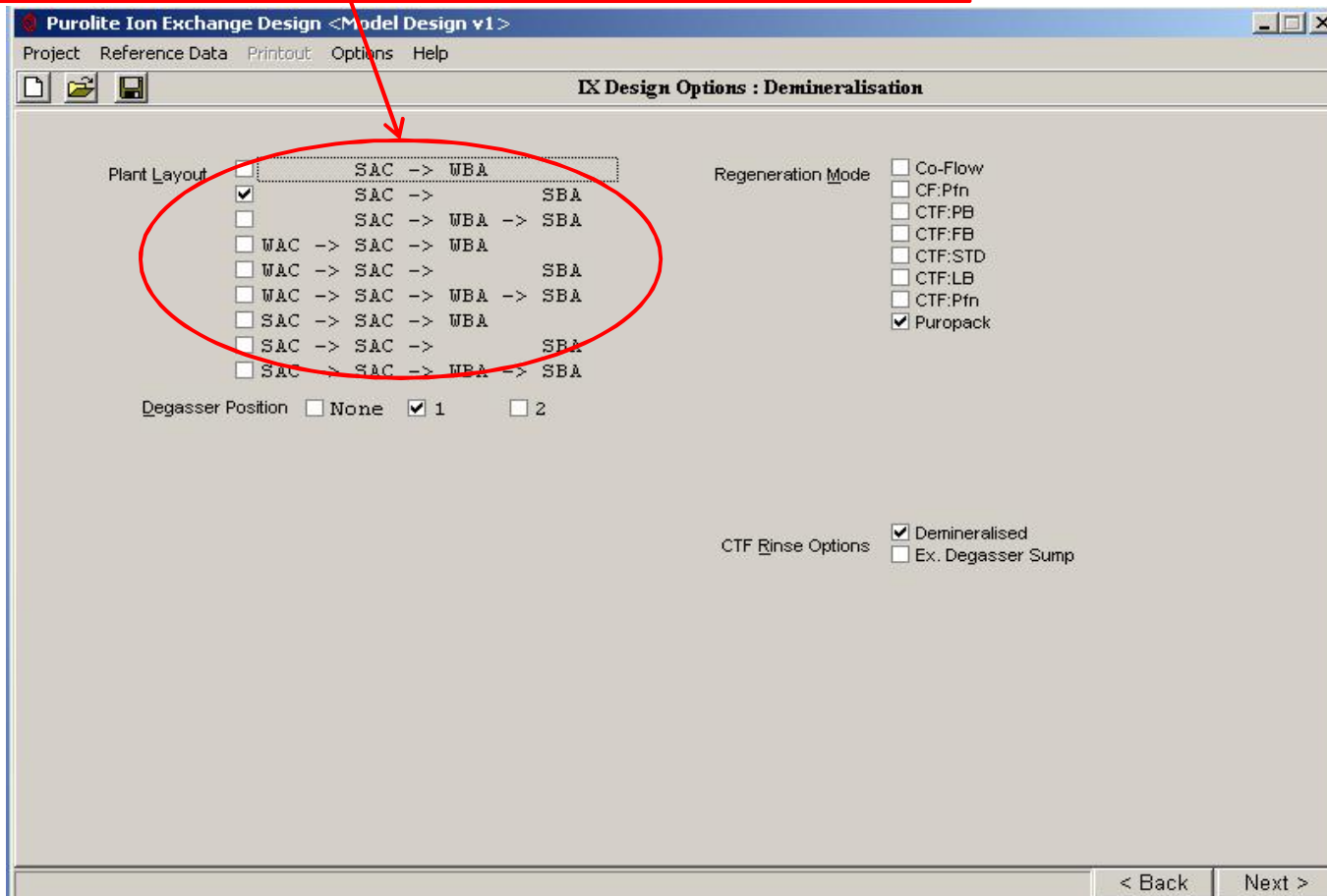
Several units available when entering water analysis, standardisable with 'set all ions to' button

Plant Layout



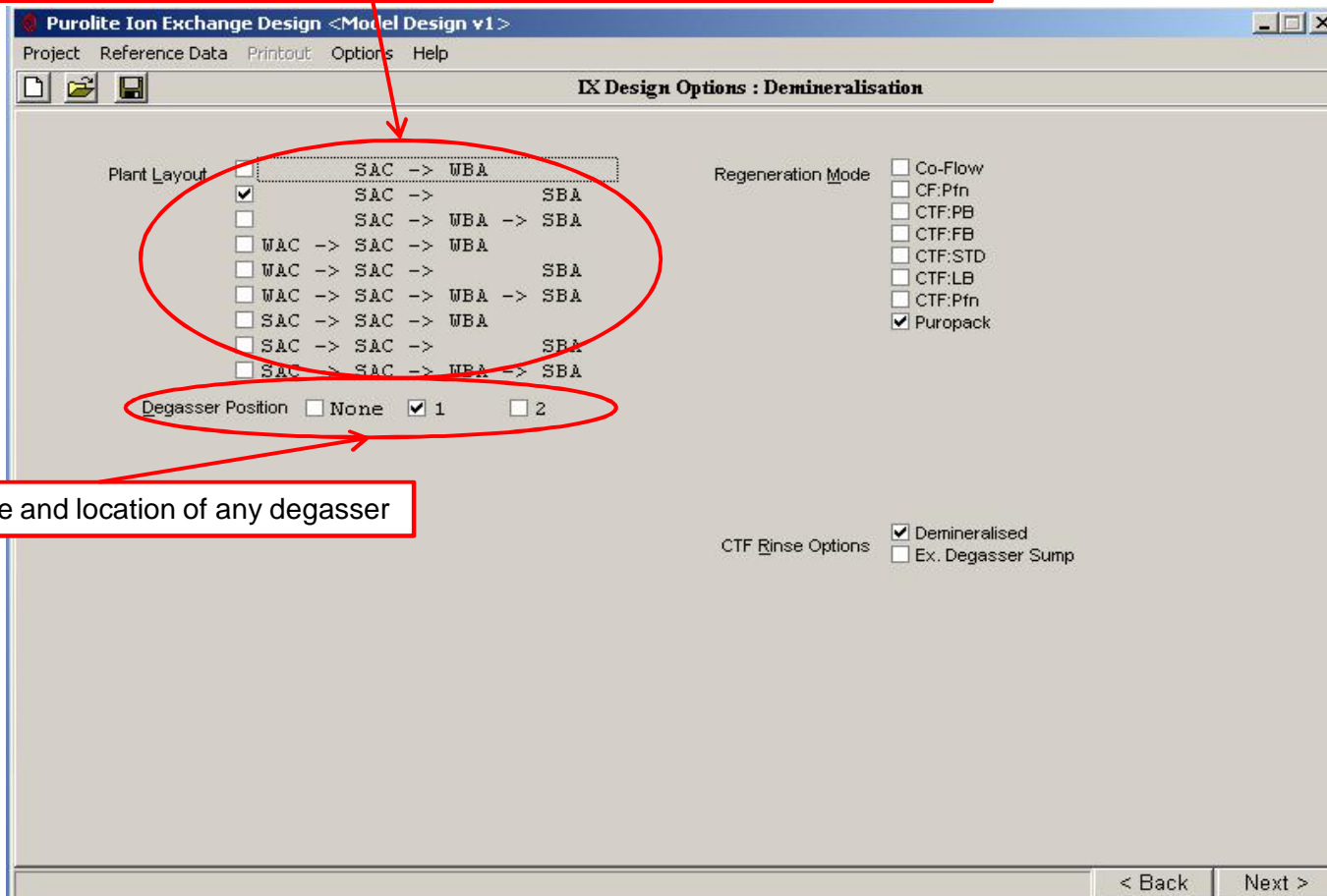
Plant Layout

Plant layout can be specified with regard to CAPEX vs OPEX and treated water requirements



Plant Layout

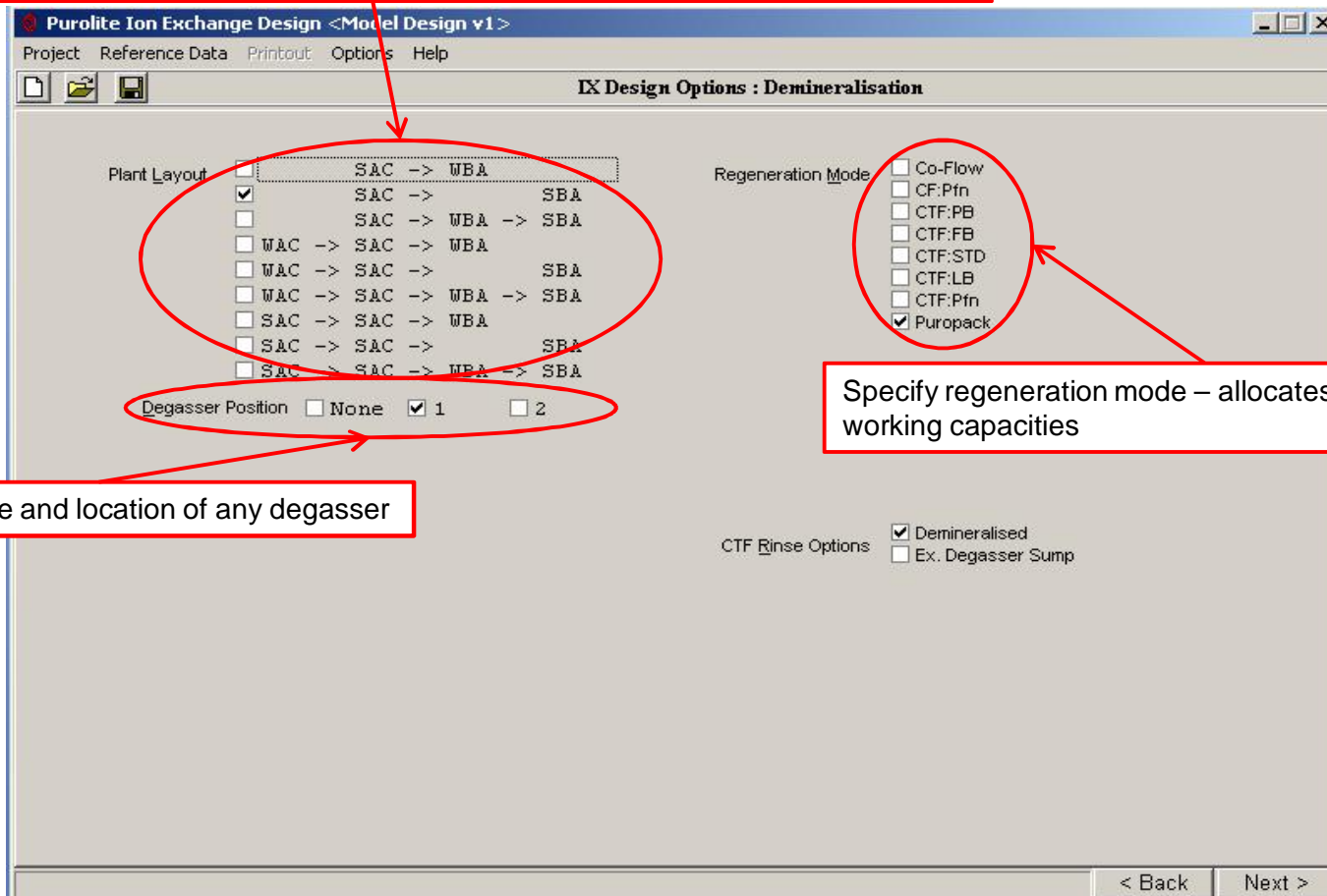
Plant layout can be specified with regard to CAPEX vs OPEX and treated water requirements



Define presence and location of any degasser

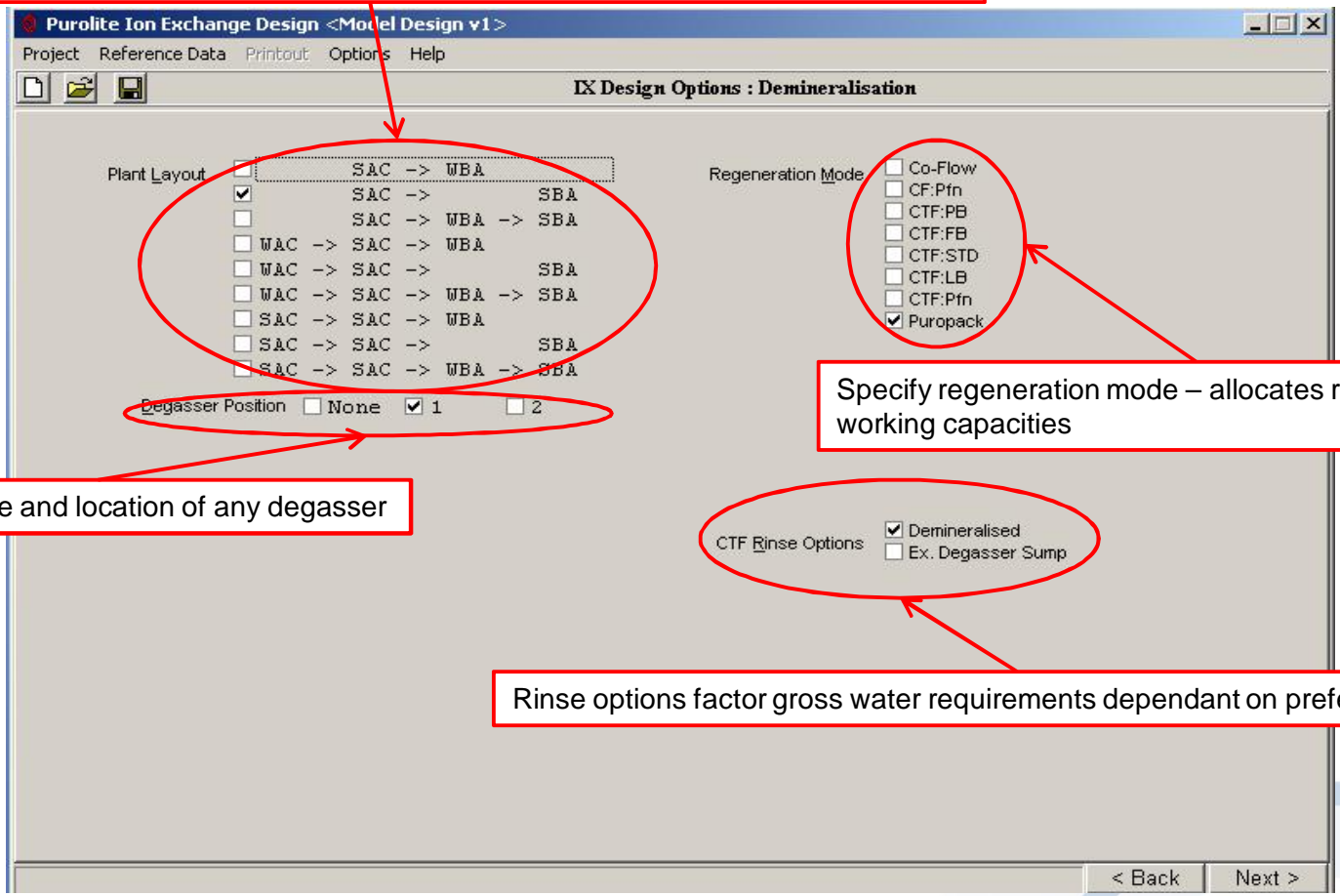
Plant Layout

Plant layout can be specified with regard to CAPEX vs OPEX and treated water requirements



Plant Layout

Plant layout can be specified with regard to CAPEX vs OPEX and treated water requirements



Treated Water Specification

Purolite Ion Exchange Design <Model Design v1>

Project Reference Data Printout Options Help

Treated Water Characteristics : Demineralisation : SAC -> DEG -> SBA

Average Conductivity	1.00	µS/cm	Average Silica Leakage	20.0	ppb SiO ₂
Endpoint Conductivity	2.00	µS/cm	Endpoint Silica Leakage	50.0	ppb SiO ₂
CO ₂ Residual After SAC Filter	3.0000	meq/l			
After Degasser	0.2000	meq/l			

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The Design

Purolite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time: 12.0 h Flow Rate: m3/h Net Run: m3

SBA Resin: A-400 Grade: PP Rel. Flow Rate: BV/h Ionic Load: eq

Regeneration Mode: Puropack Theoret. Capacity: eq/l Gross Load: m3

Regenerant: NaOH Design Factor: 1.00 Capacity: eq/l Organic Load: g/l

Level (R 100%): 50.0 g/l Temperature: 25 °C Resin volume: l Round: On Off

Concentration (%): 4.0 Dilution Water: m3 Bed Depth: 1400 mm Round: Metric Imperial None

Total (100%): kg Slow Rinse: 3.000 BV Vessel Diameter: mm

% of Theory (calc.): Fast Rinse: 0.000 BV Cross-section Area: m2

Excess: eq Linear Velocity: m/h

Pressure Drop: kPa

Leakages

Conductivity: µS/cm Sodium: ppb Na

Silica: ppb SiO2

SAC SBA

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The Design – Resin Choice and Design Margin

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculations

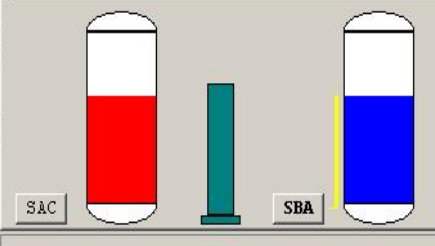
Cycle Time 12.0 h

SBA Resin A-200 Grade PP

Regeneration Mode A-200
Regenerant A-400 A-500
Level (R 100%) A-510 PPA-850 PPA-870
Concentration (%) 4.0
Total (100%) kg
% of Theory (calc.)
Excess eq

h Factor 0.85
Temperature 25
Dilution Water
Slow Rinse 3.00
Fast Rinse 0.00

Leakages
Conductivity $\mu\text{S/cm}$ Sodium
Silica



Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculations

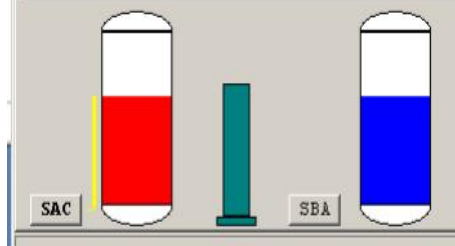
Cycle Time 12.0 h

SAC Resin C-100H Grade PP

Regeneration Mode C-100
Regenerant C-100H C-150 C-150H
Level (R 100%)
Concentration (%) 5.0
Total (100%) kg
% of Theory (calc.)
Excess eq

h Factor 0.90
Dilution Water
Slow Rinse 3.00
Fast Rinse 0.00

Leakages
Conductivity $\mu\text{S/cm}$ Sodium
Silica



The Design – Resin Choice and Design Margin

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculations

Cycle Time 12.0 h

SBA Resin A-200 Grade PP

Regeneration Mode A-200

Regenerant A-400 A-500 A-510 PP A-850 PP A-870

Level (R 100%) Temperature 25

Concentration (%) 4.0 Dilution Water

Total (100%) kg Slow Rinse 3.00

% of Theory (calc.) Fast Rinse 0.00

Excess eq

Factor 0.85

Leakages
Conductivity $\mu\text{S/cm}$ Sodium
Silica

SAC SBA

Select resin choice based on raw water constituents and operating temperature

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculations

Cycle Time 12.0 h

SAC Resin C-100H Grade PP

Regeneration Mode C-100

Regenerant C-100H C-150 C-150H

Level (R 100%) Dilution Water

Concentration (%) 5.0 Slow Rinse 3.00

Total (100%) kg Fast Rinse 0.00

% of Theory (calc.)

Excess eq

Factor 0.90

Leakages
Conductivity $\mu\text{S/cm}$ Sodium
Silica

SAC SBA

The Design – Resin Choice and Design Margin

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculations

Cycle Time 12.0 h

SBA Resin A-200 Grade PP

Regeneration Mode A-200

Regenerant A-400 A-500 A-510 PPΔ-850 PPΔ-870

Level (R 100%)

Concentration (%) 4.0

Total (100%) kg

% of Theory (calc.)

Excess eq

Factor 0.85

Temperature 25

Dilution Water

Slow Rinse 3.00

Fast Rinse 0.00

Leakages

Conductivity μS/cm

Sodium

Silica

SAC SBA

Select resin choice based on raw water constituents and operating temperature

Specify design margin for each bed – note lower cation margin

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculations

Cycle Time 12.0 h

SAC Resin C-100H Grade PP

Regeneration Mode C-100

Regenerant C-100H C-150 C-150H

Level (R 100%)

Concentration (%) 5.0

Total (100%) kg

% of Theory (calc.)

Excess eq

Factor 0.90

Temperature 25

Dilution Water

Slow Rinse 3.00

Fast Rinse 0.00

Leakages

Conductivity μS/cm

Sodium

Silica

SAC SBA

The Design –Flow Rate and Cycle Time

Purelite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	12.0 h	Flow Rate	80.0 m3/h	Net Run	960.0 m3
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	13.2 BV/h
Regeneration Mode	Puropak	Theoret. Capacity	0.75 eq/l	Ionic Load	4057 eq
Regenerant	NaOH	Design Factor	0.85	Gross Load	1015.7 m3
Level (R 100%)	50.0 g/l	Capacity	0.64 eq/l	Organic Load	0.198 g/l
Temperature	25 °C	Resin volume	6400 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Dilution Water	7.4 m3	Bed Depth	1439 mm	Metric	<input checked="" type="checkbox"/>
Concentration (%)	4.0	Slow Rinse	3.000 BV	Imperial	<input type="checkbox"/>
Total (100%)	320 kg	Fast Rinse	0.000 BV	None	<input type="checkbox"/>
% of Theory (calc.)	197	Vessel Diameter	2400 mm	Round	<input type="checkbox"/>
Excess	3941 eq	Cross-section Area	4.45 m2	Linear Velocity	18.0 m/h
		Pressure Drop	35.7 kPa		

Leakages

Conductivity	0.50 µS/cm	Sodium	15.5 ppb Na
		Silica	4.2 ppb SiO2

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Purelite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	12.0 h	Flow Rate	80.0 m3/h	Net Run	960.0 m3
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	12.2 BV/h
Regeneration Mode	Puropak	Theoret. Capacity	1.07 eq/l	Ionic Load	6684 eq
Regenerant	HCl	Design Factor	0.90	Gross Load	1013.9 m3
Level (R 100%)	55.0 g/l	Capacity	0.96 eq/l	Organic Load	0.198 g/l
Temperature	25 °C	Resin volume	6950 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Dilution Water	6.5 m3	Bed Depth	1702 mm	Metric	<input checked="" type="checkbox"/>
Concentration (%)	5.0	Slow Rinse	3.000 BV	Imperial	<input type="checkbox"/>
Total (100%)	382 kg	Fast Rinse	0.000 BV	None	<input type="checkbox"/>
% of Theory (calc.)	157	Vessel Diameter	2300 mm	Round	<input type="checkbox"/>
Excess	3797 eq	Cross-section Area	4.08 m2	Linear Velocity	19.6 m/h
		Pressure Drop	38.6 kPa		

Leakages

Conductivity	0.50 µS/cm	Sodium	15.5 ppb Na
		Silica	4.2 ppb SiO2

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The Design –Flow Rate and Cycle Time

Introducing a cycle time generates a basic model with a series of default set points

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help
Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	12.0 h	Flow Rate	80.0 m3/h	Net Run	960.0 m3		
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	13.2 BV/h	Ionic Load	4057 eq
Regeneration Mode	Puropack	Theoret. Capacity	0.75 eq/l	Gross Load	1015.7 m3		
Regenerant	NaOH	Design Factor	0.85	Capacity	0.64 eq/l	Organic Load	0.198 gal
Level (R 100%)	50.0 gal	Temperature	25 °C	Resin volume	6400 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Concentration (%)	4.0	Dilution Water	7.4 m3	Bed Depth	1439 mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None	
Total (100%)	320 kg	Slow Rinse	3.000 BV	Vessel Diameter	2400 mm	Round	<input type="checkbox"/> <input type="checkbox"/> None
% of Theory (calc.)	197	Fast Rinse	0.000 BV	Cross-section Area	4.45 m2	Linear Velocity	18.0 m/h
Excess	3941 eq	Pressure Drop	35.7 kPa				

Leakages
Conductivity 0.50 µS/cm Sodium 15.5 ppb Na Silica 4.2 ppb SiO2

SAC SBA

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help
Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	12.0 h	Flow Rate	80.0 m3/h	Net Run	960.0 m3		
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	12.2 BV/h	Ionic Load	6684 eq
Regeneration Mode	Puropack	Theoret. Capacity	1.07 eq/l	Gross Load	1013.9 m3		
Regenerant	HCl	Design Factor	0.90	Capacity	0.96 eq/l		
Level (R 100%)	55.0 gal	Temperature	25 °C	Resin volume	6950 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Concentration (%)	5.0	Dilution Water	6.5 m3	Bed Depth	1702 mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None	
Total (100%)	382 kg	Slow Rinse	3.000 BV	Vessel Diameter	2300 mm	Round	<input type="checkbox"/> <input type="checkbox"/> None
% of Theory (calc.)	157	Fast Rinse	0.000 BV	Cross-section Area	4.08 m2	Linear Velocity	19.6 m/h
Excess	3797 eq	Pressure Drop	38.6 kPa				

Leakages
Conductivity 0.50 µS/cm Sodium 15.5 ppb Na Silica 4.2 ppb SiO2

SAC SBA


The Design – Flow Rate and Cycle Time

PuroLite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help




Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0	h	Flow Rate	80.0	m3/h	Net Run	640.0	m3	
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	19.4	BV/h	Ionic Load	2738	eq
Regeneration Mode	Puropack	Theoret. Capacity	0.73	eq/l	Gross Load	685.7	m3		
Regenerant	NaOH	Design Factor	0.85	Capacity	0.64	eq/l	Organic Load	0.194	g/l
Level (R 100%)	50.0	g/l	Temperature	25	°C	Resin volume	4425	l	Round <input checked="" type="checkbox"/> On <input type="checkbox"/> Off
		Dilution Water	5.1	m3					
Concentration (%)	4.0								<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None
Total (100%)	221								
% of Theory (calc.)	202								
Excess	2792								
Leakages									
Conductivity	0.50								

Design Calculation : SBA

 Bed depth 995 < 1200 mm not recommended
Use the closest recommended value ?

Don't show warnings during calculation

SAC   SBA 

Calculation in progress. Please wait ...

The Design – Flow Rate and Cycle Time

The screenshot shows the 'Puro-lite Ion Exchange Design' software interface. The main window title is 'Puro-lite Ion Exchange Design <NONAME>'. The menu bar includes 'Project', 'Reference Data', 'Printout', 'Options', and 'Help'. The main title bar reads 'Design Calculation : Demineralisation : SAC -> DEG -> SBA'. The interface is filled with various input fields and dropdown menus for design parameters. A red oval highlights a warning message box that appears over the 'Design Calculation : SBA' section. The warning message, preceded by a yellow triangle icon, states: 'Bed depth 995 < 1200 mm not recommended. Use the closest recommended value?'. Below the message are three buttons: 'Yes', 'No', and 'Change limit'. A red arrow points from the warning box to a text box at the bottom right of the slide. At the bottom of the software window, there are icons for 'SAC' (a red liquid in a beaker) and 'SBA' (a blue liquid in a beaker), and a status bar that says 'Calculation in progress. Please wait ...'.

Parameter	Value	Unit
Cycle Time	8.0	h
Flow Rate	80.0	m ³ /h
Net Run	640.0	m ³
SBA Resin	A-200	
Grade	PP	
Rel. Flow Rate	19.4	BV/h
Ionic Load	2738	eq
Regeneration Mode	Puropack	
Theoret. Capacity	0.73	eq/l
Gross Load	685.7	m ³
Regenerant	NaOH	
Design Factor	0.85	
Capacity	0.64	eq/l
Organic Load	0.194	g/l
Level (R 100%)	50.0	g/l
Temperature	25	°C
Resin volume	4425	l
Dilution Water	5.1	m ³
Concentration (%)	4.0	
Total (100%)	221	
% of Theory (calc.)	202	
Excess	2792	
Leakages Conductivity	0.50	

A warning ! There are various 'hard' and 'soft' limits built into the program. We would suggest increasing design margin if these warnings are overridden, as the program assumes operation within defined parameters

The Design – Flow Rate and Cycle Time

Purilite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	19.8 BV/h
Regeneration Mode	Puropack	Theoret. Capacity	0.75 eq/l	Ionic Load	2736 eq
Regenerant	NaOH	Design Factor	0.85	Gross Load	685.2 m3
Level (R 100%)	50.0 g/l	Capacity	0.64 eq/l	Organic Load	0.198 g/l
Temperature	25 °C	Resin volume	4325 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Dilution Water	5.0 m3	Bed Depth	1405 mm		
Concentration (%)	4.0	Slow Rinse	3.000 BV		<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None
Total (100%)	216 kg	Fast Rinse	0.000 BV	Vessel Diameter	2000 mm
% of Theory (calc.)	198	Cross-section Area	3.08 m2	Round	<input type="checkbox"/> On <input type="checkbox"/> Off
Excess	2668 eq	Linear Velocity	26.0 m/h		
		Pressure Drop	51.7 kPa		

Leakages

Conductivity	0.50 μS/cm	Sodium	15.5 ppb Na
		Silica	4.2 ppb SiO2

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Purilite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	17.8 BV/h
Regeneration Mode	Puropack	Theoret. Capacity	1.05 eq/l	Ionic Load	4460 eq
Regenerant	HCl	Design Factor	0.90	Gross Load	676.6 m3
Level (R 100%)	55.0 g/l	Capacity	0.94 eq/l	Organic Load	
Temperature		Resin volume	4750 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Dilution Water	4.4 m3	Bed Depth	1543 mm		
Concentration (%)	5.0	Slow Rinse	3.000 BV		<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None
Total (100%)	261 kg	Fast Rinse	0.000 BV	Vessel Diameter	2000 mm
% of Theory (calc.)	161	Cross-section Area	3.08 m2	Round	<input type="checkbox"/> On <input type="checkbox"/> Off
Excess	2703 eq	Linear Velocity	26.0 m/h		
		Pressure Drop	48.8 kPa		

Leakages

Conductivity	0.50 μS/cm	Sodium	15.5 ppb Na
		Silica	4.2 ppb SiO2

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The Design – Optimising Rinse Volumes and Regeneration Levels

Purolite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time: 8.0 h | Flow Rate: 80.0 m3/h | Net Run: 640.0 m3

SAC Resin: A-200 | Grade: PP | Rel. Flow Rate: 19.8 BV/h | Ionic Load: 2732 eq

Regeneration Mode: Puropack | Theoret. Capacity: 0.75 eq/l | Gross Load: 684.9 m3

Regenerant: NaOH | Design Factor: 0.85 | Capacity: 0.63 eq/l | Organic Load: 0.198 gal

Level (R 100%): 50.0 gal | Temperature: 25 °C | Resin volume: 4325 l | Round: On Off

Dilution Water: 5.0 m3 | Slow Rinse: 2.000 BV | Bed Depth: 1405 mm | Metric Imperial

Concentration (%): 4.0 | Fast Rinse: 4.000 BV | Vessel Diameter: 2000 mm | Round: Imperial None

Total (100%): 216 kg | % of Theory (calc.): 198 | Cross-section Area: 3.08 m2 | Linear Velocity: 26.0 m/h

Excess: 2673 eq | Pressure Drop: 51.7 kPa

Leakages

Conductivity: 0.50 µS/cm | Sodium: 15.5 ppb Na | Silica: 4.2 ppb SiO2

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Purolite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time: 8.0 h | Flow Rate: 80.0 m3/h | Net Run: 640.0 m3

SAC Resin: C-100H | Grade: PP | Rel. Flow Rate: 17.9 BV/h | Ionic Load: 4574 eq

Regeneration Mode: Puropack | Theoret. Capacity: 1.05 eq/l | Gross Load: 694.8 m3

Regenerant: HCl | Design Factor: 0.90 | Capacity: 0.95 eq/l

Level (R 100%): 55.0 gal | Temperature: 25 °C | Resin volume: 4850 l | Round: On Off

Dilution Water: 4.5 m3 | Slow Rinse: 2.000 BV | Bed Depth: 1575 mm | Metric Imperial

Concentration (%): 5.0 | Fast Rinse: 2.000 BV | Vessel Diameter: 2000 mm | Round: Imperial None

Total (100%): 267 kg | % of Theory (calc.): 160 | Cross-section Area: 3.08 m2 | Linear Velocity: 26.0 m/h

Excess: 2740 eq | Pressure Drop: 49.8 kPa

Leakages

Conductivity: 0.50 µS/cm | Sodium: 15.5 ppb Na | Silica: 4.2 ppb SiO2

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The Design – Optimising Rinse Volumes and Regeneration Levels

Purilite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
Resin	A-200	Grade	PP	Rel. Flow Rate	19.8 BV/h	Ionic Load	2732 eq
Regeneration Mode	Puropack	Theoret. Capacity	0.75 eq/l	Gross Load	684.9 m3		
Regenerant	NaOH	Design Factor	0.85	Capacity	0.63 eq/l	Organic Load	0.198 gal
Level (R 100%)	50.0 gal	Temperature	25 °C	Resin volume	4325 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Dilution Water	5.0 m3	Slow Rinse	2.000 BV	Bed Depth	1405 mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None	
Concentration (%)	4.0	Fast Rinse	4.000 BV	Vessel Diameter	2000 mm	Round	<input type="checkbox"/> Imperial <input type="checkbox"/> None
Total (100%)	216 kg			Cross-section Area	3.08 m2		
% of Theory (calc.)	198			Linear Velocity	26.0 m/h		
Excess	2673 eq			Pressure Drop	51.7 kPa		

Leakages
Conductivity 0.50 µS/cm Sodium 15.5 ppb Na Silica 4.2 ppb SiO2

SAC SBA

Purilite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
Resin	C-100H	Grade	PP	Rel. Flow Rate	17.9 BV/h	Ionic Load	4574 eq
Regeneration Mode	Puropack	Theoret. Capacity	1.05 eq/l	Gross Load	694.8 m3		
Regenerant	HCl	Design Factor	0.90	Capacity	0.95 eq/l		
Level (R 100%)	55.0 gal	Temperature	25 °C	Resin volume	4850 l	Round	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Dilution Water	4.5 m3	Slow Rinse	2.000 BV	Bed Depth	1575 mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None	
Concentration (%)	5.0	Fast Rinse	2.000 BV	Vessel Diameter	2000 mm	Round	<input type="checkbox"/> Imperial <input type="checkbox"/> None
Total (100%)	267 kg			Cross-section Area	3.08 m2		
% of Theory (calc.)	160			Linear Velocity	26.0 m/h		
Excess	2740 eq			Pressure Drop	49.8 kPa		

Leakages
Conductivity 0.50 µS/cm Sodium 15.5 ppb Na Silica 4.2 ppb SiO2

SAC SBA

Typical rinse volumes for counter-flow systems

The Design – Optimising Rinse Volumes and Regeneration Levels

PuroLite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time 8.0 h | Elow Rate 80.0 m3/h | Net Run 640.0 m3

SBA Resin A-200 | Grade PP | Rel. Flow Rate 21.8 BV/h | Ionic Load 2761 eq

Regeneration Mode Puropack | Theoret. Capacity 0.82 eq/l | Gross Load 692.4 m3

Regenerant NaOH | Design Factor 0.85 | Capacity 0.70 eq/l | Organic Load 0.218 g/l

Level (R 100%) 65.0 g/l | Temperature 5 °C | Resin volume 3975 l | Round On Off

Dilution Water 5.9 m3

Concentration (%) 4.0 | Slow Rinse 2.000 BV | Bed Depth 1291 mm

Total (100%) 258 kg | Fast Rinse 4.000 BV | Vessel Diameter 2000 mm | Round Imperial Metric

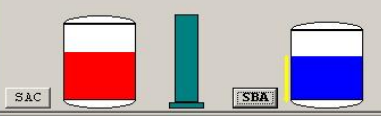
% of Theory (calc.) 234 | Cross-section Area 3.08 m2

Excess 3697 eq | Linear Velocity 26.0 m/h

Pressure Drop 47.5 kPa

Leakages

Conductivity 0.50 µS/cm | Sodium 12.2 ppb Na | Silica 4.4 ppb SiO2



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PuroLite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time 8.0 h | Elow Rate 80.0 m3/h | Net Run 640.0 m3

SAC Resin C-100H | Grade PP | Rel. Flow Rate 19.8 BV/h | Ionic Load 4560 eq

Regeneration Mode Puropack | Theoret. Capacity 1.16 eq/l | Gross Load 692.4 m3

Regenerant HCl | Design Factor 0.90 | Capacity 1.04 eq/l

Level (R 100%) 69.0 g/l | Resin volume 4375 l | Round On Off

Dilution Water 5.1 m3

Concentration (%) 5.0 | Slow Rinse 2.000 BV | Bed Depth 1421 mm

Total (100%) 302 kg | Fast Rinse 2.000 BV | Vessel Diameter 2000 mm | Round Imperial Metric


% of Theory (calc.) 182 | Cross-section Area 3.08 m2

Excess 3717 eq | Linear Velocity 26.0 m/h

Pressure Drop 44.9 kPa

Leakages

Conductivity 0.50 µS/cm | Sodium 12.2 ppb Na | Silica 4.4 ppb SiO2



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The Design – Optimising Rinse Volumes and Regeneration Levels

Puroilite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	21.8 BV/h	Ionic Load	2761 eq
Regeneration Mode	Puropack	Theoret. Capacity	0.82 eq/l	Gross Load	692.4 m3		
Regenerant	NaOH	Design Factor	0.85	Capacity	0.70 eq/l	Organic Load	0.218 g/l
Level (R 100%)	65.0 g/l	Temperature	5 °C	Resin volume	3975 l	Round	<input type="checkbox"/> On <input type="checkbox"/> Off
Concentration (%)	4.0	Dilution Water	5.9 m3	Bed Depth	1291 mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None	
Total (100%)	258 kg	Slow Rinse	2.000 BV	Vessel Diameter	2000 mm	Round	<input type="checkbox"/> <input type="checkbox"/> None
% of Theory (calc.)	234	Fast Rinse	4.000 BV	Cross-section Area	3.08 m2	Linear Velocity	26.0 m/h
Excess	3697 eq	Pressure Drop	47.5 kPa				

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

SAC SBA

Puroilite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	19.8 BV/h	Ionic Load	4560 eq
Regeneration Mode	Puropack	Theoret. Capacity	1.16 eq/l	Gross Load	692.4 m3		
Regenerant	HCl	Design Factor	0.90	Capacity	1.04 eq/l	Organic Load	0.218 g/l
Level (R 100%)	69.0 g/l	Temperature	5 °C	Resin volume	4375 l	Round	<input type="checkbox"/> On <input type="checkbox"/> Off
Concentration (%)	5.0	Dilution Water	5.1 m3	Bed Depth	1421 mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None	
Total (100%)	202 kg	Slow Rinse	2.000 BV	Vessel Diameter	2000 mm	Round	<input type="checkbox"/> <input type="checkbox"/> None
% of Theory (calc.)	182	Fast Rinse	2.000 BV	Cross-section Area	3.08 m2	Linear Velocity	26.0 m/h
Excess	3717 eq	Pressure Drop	44.9 kPa				

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

SAC SBA

Regen. levels set to give approximately neutral effluent and manage the small quantity of organics in the influent water

The Design – Optimising Rinse Volumes and Regeneration Levels

Note temperature adjustment on anion – default is 25 °C – not likely from deep borehole in UK

PuroLite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0	h	Flow Rate	80.0	m3/h	Net Run	640.0	m3		
SAC Resin	A-200	Grade	PP	Rel. Flow Rate	21.8	BV/h	Ionic Load	2761	eq	
Regeneration Mode	Puropack	Theoret. Capacity	0.82	eq/l	Gross Load	692.4	m3			
Regenerant	NaOH	Design Factor	0.85	Capacity	0.70	eq/l	Organic Load	0.218	g/l	
Level (R 100%)	65.0	g/l	Temperature	5	°C	Resin volume	3975	l	Round <input type="checkbox"/> On <input type="checkbox"/> Off	
Concentration (%)	4.0	Dilution Water	5.0	m3	Bed Depth	1291	mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None		
Total (100%)	258	kg	Slow Rinse	2.000	BV	Vessel Diameter	2000	mm	Round <input type="checkbox"/> Imperial <input type="checkbox"/> None	
% of Theory (calc.)	234	Fast Rinse	4.000	BV	Cross-section Area	3.08	m2	Linear Velocity	26.0	m/h
Excess	3697	eq	Pressure Drop	47.5	kPa					

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

SAC SBA

PuroLite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0	h	Flow Rate	80.0	m3/h	Net Run	640.0	m3		
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	19.8	BV/h	Ionic Load	4560	eq	
Regeneration Mode	Puropack	Theoret. Capacity	1.16	eq/l	Gross Load	692.4	m3			
Regenerant	HCl	Design Factor	0.90	Capacity	1.04	eq/l	Organic Load	0.218	g/l	
Level (R 100%)	69.0	g/l	Dilution Water	5.1	m3	Resin volume	4375	l	Round <input type="checkbox"/> On <input type="checkbox"/> Off	
Concentration (%)	5.0	Slow Rinse	2.000	BV	Bed Depth	1421	mm	<input checked="" type="checkbox"/> Metric <input type="checkbox"/> Imperial <input type="checkbox"/> None		
Total (100%)	302	kg	Fast Rinse	2.000	BV	Vessel Diameter	2000	mm	Round <input type="checkbox"/> Imperial <input type="checkbox"/> None	
% of Theory (calc.)	182	Excess	3717	eq	Cross-section Area	3.08	m2	Linear Velocity	26.0	m/h
					Pressure Drop	44.9	kPa			

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

SAC SBA

Regen. levels set to give approximately neutral effluent and manage the small quantity of organics in the influent water

The Design – Vessel Sizing

- Plant currently modeled assuming metric measurements
- In practice, vessels often sized on imperial measurements
- To minimise CAPEX, there is often merit in reducing vessel diameter, whilst factoring effect on bed depth and pressure drop
- Vessel dimensions influence distribution/flow and thus performance
- Watch out for changes to effluent levels if attempting to achieve neutral effluent !

The Design – Vessel Sizing

PuroLite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time: 8.0 h | Flow Rate: 80.0 m3/h | Net Run: 640.0 m3

SBA Resin: A-200 | Grade: PP | Rel. Flow Rate: 21.9 BV/h | Ionic Load: 2761 eq

Regeneration Mode: Puropack | Theoret. Capacity: 0.82 eq/l | Gross Load: 692.2 m3

Regenerant: NaOH | Design Factor: 0.85 | Capacity: 0.70 eq/l | Organic Load: 0.219 g/l

Level (R 100%): 65.0 gal | Temperature: 5 °C | Resin volume: 3950 l | Round: On Off

Dilution Water: 5.9 m3

Concentration (%): 4.0 | Slow Rinse: 2.000 BV | Bed Depth: 1537 mm

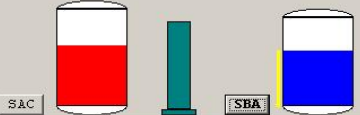
Total (100%): 257 kg | Fast Rinse: 4.000 BV | Vessel Diameter: 1829 mm | Round: Metric Imperial None

% of Theory (calc.): 232 | Cross-section Area: 2.57 m2

Excess: 3657 eq | Linear Velocity: 31.1 m/h | Pressure Drop: 68.7 kPa

Leakages

Conductivity: 0.50 µS/cm | Sodium: 12.2 ppb Na | Silica: 4.4 ppb SiO2



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PuroLite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time: 8.0 h | Flow Rate: 80.0 m3/h | Net Run: 640.0 m3

SAC Resin: C-100H | Grade: PP | Rel. Flow Rate: 20.0 BV/h | Ionic Load: 4556 eq

Regeneration Mode: Puropack | Theoret. Capacity: 1.18 eq/l | Gross Load: 691.9 m3

Regenerant: HCl | Design Factor: 0.90 | Capacity: 1.06 eq/l

Level (R 100%): 69.0 gal | Temperature: 5 °C | Resin volume: 4325 l | Round: On Off

Dilution Water: 5.0 m3

Concentration (%): 5.0 | Slow Rinse: 2.000 BV | Bed Depth: 1683 mm

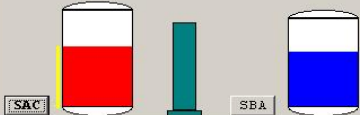
Total (100%): 298 kg | Fast Rinse: 2.000 BV | Vessel Diameter: 1829 mm | Round: Metric Imperial None

% of Theory (calc.): 180 | Cross-section Area: 2.57 m2

Excess: 3626 eq | Linear Velocity: 31.1 m/h | Pressure Drop: 65.8 kPa

Leakages

Conductivity: 0.50 µS/cm | Sodium: 12.2 ppb Na | Silica: 4.4 ppb SiO2



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The Design – Vessel Sizing

Switching vessel rounding to 'none' enables metric or imperial values

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	21.9 BV/h	Ionic Load	2761 eq
Regeneration Mode	Puropack	Theoret. Capacity	0.82 eq/l	Gross Load	692.2 m3		
Regenerant	NaOH	Design Factor	0.85	Capacity	0.70 eq/l	Organic Load	0.219 g/l
Level (R 100%)	65.0 g/l	Temperature	5 °C	Resin volume	3950 l	Round	<input type="checkbox"/> On <input checked="" type="checkbox"/> Off
Concentration (%)	4.0	Dilution Water	5.9 m3	Bed Depth	1537 mm	Round	<input type="checkbox"/> Metric <input type="checkbox"/> Imperial <input checked="" type="checkbox"/> None
Total (100%)	257 kg	Slow Rinse	2.000 BV	Vessel Diameter	1829 mm		
% of Theory (calc.)	232	Fast Rinse	4.000 BV	Cross-section Area	2.57 m2		
Excess	3657 eq	Linear Velocity	31.1 m/h	Pressure Drop	68.7 kPa		

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

SAC SBA

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Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	20.0 BV/h	Ionic Load	4556 eq
Regeneration Mode	Puropack	Theoret. Capacity	1.18 eq/l	Gross Load	691.9 m3		
Regenerant	HCl	Design Factor	0.90	Capacity	1.06 eq/l		
Level (R 100%)	69.0 g/l	Temperature	5 °C	Resin volume	4325 l	Round	<input type="checkbox"/> On <input checked="" type="checkbox"/> Off
Concentration (%)	5.0	Dilution Water	5.0 m3	Bed Depth	1683 mm	Round	<input type="checkbox"/> Metric <input type="checkbox"/> Imperial <input checked="" type="checkbox"/> None
Total (100%)	298 kg	Slow Rinse	2.000 BV	Vessel Diameter	1829 mm		
% of Theory (calc.)	180	Fast Rinse	2.000 BV	Cross-section Area	2.57 m2		
Excess	3626 eq	Linear Velocity	31.1 m/h	Pressure Drop	65.8 kPa		

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

SAC SBA

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The Design – Vessel Sizing

Switching vessel rounding to 'none' enables metric or imperial values

Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
SBA Resin	A-200	Grade	PP	Rel. Flow Rate	21.9 BV/h	Ionic Load	2761 eq
Regeneration Mode	Puropack	Theoret. Capacity	0.82 eq/l	Gross Load	692.2 m3		
Regenerant	NaOH	Design Factor	0.85	Capacity	0.70 eq/l	Organic Load	0.219 g/l
Level (R 100%)	65.0 gal	Temperature	5 °C	Resin volume	3950 l	Round	<input type="checkbox"/> On <input checked="" type="checkbox"/> Off
Concentration (%)	4.0	Dilution Water	5.9 m3	Bed Depth	1537 mm	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial
Total (100%)	257 kg	Slow Rinse	2.000 BV	Vessel Diameter	1829 mm	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial
% of Theory (calc.)	232	Fast Rinse	4.000 BV	Cross-section Area	2.57 m2	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial
Excess	3657 eq	Linear Velocity	31.1 mm	Pressure Drop	68.7 kPa	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

S&C SBA

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Purolite Ion Exchange Design <NONAME>
Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3		
SAC Resin	C-100H	Grade	PP	Rel. Flow Rate	20.0 BV/h	Ionic Load	4556 eq
Regeneration Mode	Puropack	Theoret. Capacity	1.18 eq/l	Gross Load	691.9 m3		
Regenerant	HCl	Design Factor	0.90	Capacity	1.06 eq/l		
Level (R 100%)	69.0 gal	Dilution Water	5.0 m3	Resin volume	4325 l	Round	<input type="checkbox"/> On <input checked="" type="checkbox"/> Off
Concentration (%)	5.0	Slow Rinse	2.000 BV	Bed Depth	1683 mm	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial
Total (100%)	298 kg	Fast Rinse	2.000 BV	Vessel Diameter	1829 mm	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial
% of Theory (calc.)	180	Cross-section Area	2.57 m2	Cross-section Area	2.57 m2	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial
Excess	3626 eq	Linear Velocity	31.1 mm	Pressure Drop	65.8 kPa	Round	<input type="checkbox"/> Metric <input checked="" type="checkbox"/> Imperial

Leakages
Conductivity 0.50 µS/cm Sodium 12.2 ppb Na Silica 4.4 ppb SiO2

S&C SBA

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Adjusting vessel diameter to 6' increases bed depth, velocity and pressure drop

The Design – Vessel Sizing

Switching vessel rounding to 'none' enables metric or imperial values

Purolite Ion Exchange Design - SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3
Resin	A-200	Grade	PP	Rel. Flow Rate	21.9 BV/h
Regeneration Mode	Puropack	Theoret. Capacity	0.82 eq/l	Ionic Load	2761 eq
Regenerant	NaOH	Design Factor	0.85	Gross Load	692.2 m3
Level (R 100%)	65.0 gal	Capacity	0.70 eq/l	Organic Load	0.219 gal
Concentration (%)	4.0	Temperature	5 °C	Resin volume	3950 l
Total (100%)	257 kg	Dilution Water	5.9 m3	Bed Depth	1537 mm
% of Theory (calc.)	232	Slow Rinse	2.000 BV	Vessel Diameter	1829 mm
Excess	3657 eq	Fast Rinse	4.000 BV	Cross-section Area	2.57 m2
Leakages		Linear Velocity	31.1 mm	Pressure Drop	68.7 kPa
Conductivity	0.50 µS/cm	Round	None		

Resin volumes and consequently excess regenerant to drain also affected

Purolite Ion Exchange Design - SBA

Cycle Time	8.0 h	Flow Rate	80.0 m3/h	Net Run	640.0 m3
Resin	C-100H	Grade	PP	Rel. Flow Rate	20.0 BV/h
Regeneration Mode	Puropack	Theoret. Capacity	1.18 eq/l	Ionic Load	4556 eq
Regenerant	HCl	Design Factor	0.90	Gross Load	91.9 m3
Level (R 100%)	69.0 gal	Capacity	1.06 eq/l	Resin volume	4325 l
Concentration (%)	5.0	Temperature	5 °C	Bed Depth	1683 mm
Total (100%)	298 kg	Dilution Water	5.0 m3	Vessel Diameter	1829 mm
% of Theory (calc.)	180	Slow Rinse	2.000 BV	Cross-section Area	2.57 m2
Excess	3626 eq	Fast Rinse	2.000 BV	Linear Velocity	31.1 mm
Leakages		Pressure Drop	65.8 kPa	Round	None
Conductivity	0.50 µS/cm	Round	None		

Adjusting vessel diameter to 6' increases bed depth, velocity and pressure drop

The Design – Adjusting for Neutral Effluent

Purelite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time 8.0 h Elow Rate 80.0 m3/h Net Run 640.0 m3

SAC Resin A-200 Grade PP Rel. Flow Rate 22.0 BV/h Ionic Load 2759 eq

Regeneration Mode Puropack Theoret. Capacity 0.83 eq/l Gross Load 691.7 m3

Regenerant NaOH Design Factor 0.85 Capacity 0.70 eq/l Organic Load 0.220 g/l

Level (R 100%) 66.0 g/l Temperature 5 °C Resin volume 3925 l Round On Off

Dilution Water 6.0 m3

Concentration (%) 4.0 Slow Rinse 2.000 BV Bed Depth 1527 mm Metric Imperial

Total (100%) 259 kg Fast Rinse 4.000 BV Vessel Diameter 1829 mm Round Metric Imperial

% of Theory (calc.) 235 Cross-section Area 2.57 m2

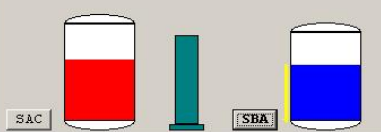
Excess 3716 eq Linear Velocity 31.1 m/h

Pressure Drop 68.2 kPa

Leakages

Conductivity 0.50 µS/cm Sodium 12.0 ppb Na

Silica 4.3 ppb SiO2



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Purelite Ion Exchange Design <NONAME>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time 8.0 h Elow Rate 80.0 m3/h Net Run 640.0 m3

SAC Resin C-100H Grade PP Rel. Flow Rate 20.1 BV/h Ionic Load 4555 eq

Regeneration Mode Puropack Theoret. Capacity 1.18 eq/l Gross Load 691.8 m3

Regenerant HCl Design Factor 0.90 Capacity 1.06 eq/l

Level (R 100%) 70.0 g/l Resin volume 4300 l Round On Off

Dilution Water 5.1 m3

Concentration (%) 5.0 Slow Rinse 2.000 BV Bed Depth 1673 mm Metric Imperial

Total (100%) 301 kg Fast Rinse 2.000 BV Vessel Diameter 1829 mm Round Metric Imperial

% of Theory (calc.) 181 Cross-section Area 2.57 m2

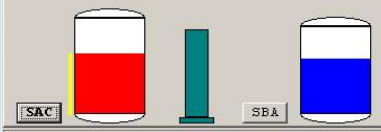
Excess 3698 eq Linear Velocity 31.1 m/h

Pressure Drop 65.4 kPa

Leakages

Conductivity 0.50 µS/cm Sodium 12.0 ppb Na

Silica 4.3 ppb SiO2



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Outputs

Puro-lite Ion Exchange Design <Model Design v1 - imperial>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : SAC -> DEG -> SBA

Cycle Time: 8.0 h | Flow Rate: 80.0 m3/h | Net Run: 640.0 m3

Resin: SBA | Resin: A-200 | Grade: PP | Rel. Flow Rate: 22.0 BV/h | Ionic Load: 2750 eq

Regeneration Mode: Puropack | Theoret. Capacity: 0.82 eq/l | Gross Load: 689.2 m3

Project Reference Data

Level (R 100%): Customer: SCI

Concentration (%): Address: Address

Total (100%): Sales Person: DH

% of Theory (calc.): Engineering Company (OEM): OEM

Excess: Agent: Agent

Leakages

Conductivity: Operator: Operator

Design Calculation No.: No 1 | Code: NONAME | Current Date: 16-07-2012

Language: English

OK Cancel

SAC SBA

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Outputs

Design generated in MS Word, e.g. [here](#)



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Other Design Options – Stratified Bed

Purotite Ion Exchange Design <Model Design v2 - Stratified Beds>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : WAC -> SAC -> DEG -> WBA -> SBA

Cycle Time 20.0 h | Flow Rate 80.0 m3/h | Net Run 1600.0 m3

WAC Resin C-104 | Grade PP | Rel. Flow Rate 30.8 BV/h | Ionic Load 4101 eq | Theoret. Capacity 1.65 eq/l | Gross Load 1708.1 m3 | Design Factor 0.90 | Capacity 1.49 eq/l

Resin volume 2775 l | Round On Off

% of Theory (reqd.) 110 | Slow Rinse 2.000 BV | Bed Depth 1080 mm | Metric Imperial None
 % of Theory (calc.) 172 | Fast Rinse 2.000 BV | Vessel Diameter 1829 mm | Round Metric Imperial None
 Overrun Weak->Strong (%) 20 | Cross-section Area 2.57 m2 | Linear Velocity 31.1 m/h | Pressure Drop 54.6 kPa

Leakages
 Conductivity 0.50 µS/cm | Sodium 9.5 ppb Na | Silica 28.0 ppb SiO2

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Purotite Ion Exchange Design <Model Design v2 - Stratified Beds>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : WAC -> SAC -> DEG -> WBA -> SBA

Cycle Time 20.0 h | Flow Rate 80.0 m3/h | Net Run 1600.0 m3

WBA Resin A-100 | Grade PP | Rel. Flow Rate 14.3 BV/h | Ionic Load 4920 eq | Theoret. Capacity 0.97 eq/l | Gross Load 1711.0 m3 | Design Factor 0.85 | Capacity 0.83 eq/l | Organic Load 0.358 gal

Temperature 5 °C | Resin volume 5975 l | Round On Off

% of Theory (reqd.) 130 | Slow Rinse 2.000 BV | Bed Depth 2325 mm | Metric Imperial None
 % of Theory (calc.) 160 | Fast Rinse 4.000 BV | Vessel Diameter 1829 mm | Round Metric Imperial None
 Overrun Weak->Strong (%) 20 | Cross-section Area 2.57 m2 | Linear Velocity 31.1 m/h | Pressure Drop 103.9 kPa

Leakages
 Conductivity 0.50 µS/cm | Sodium 9.5 ppb Na | Silica 28.0 ppb SiO2

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Purotite Ion Exchange Design <Model Design v2 - Stratified Beds>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : WAC -> SAC -> DEG -> WBA -> SBA

Cycle Time 20.0 h | Flow Rate 80.0 m3/h | Net Run 1600.0 m3

SAC Resin C-100H | Grade PP | Rel. Flow Rate 14.0 BV/h | Ionic Load 7153 eq | Theoret. Capacity 1.31 eq/l | Gross Load 1705.2 m3 | Regeneration Mode Pureopack | Design Factor 0.90 | Capacity 1.18 eq/l

Regenerant HCl | Level (R 100%) 85.0 gal | Resin volume 6100 l | Round On Off

Dilution Water 8.7 m3 | Concentration (%) 5.0 | Slow Rinse 2.000 BV | Bed Depth 2373 mm | Metric Imperial None
 Total (100%) 519 kg | Fast Rinse 2.000 BV | Vessel Diameter 1829 mm | Round Metric Imperial None
 % of Theory (calc.) 199 | Overrun Weak->Strong (%) 20 | Cross-section Area 2.57 m2 | Linear Velocity 31.1 m/h | Pressure Drop 92.8 kPa
 Excess 2971 eq

Leakages
 Conductivity 0.50 µS/cm | Sodium 9.5 ppb Na | Silica 28.0 ppb SiO2

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Purotite Ion Exchange Design <Model Design v2 - Stratified Beds>

Project Reference Data Printout Options Help

Design Calculation : Demineralisation : WAC -> SAC -> DEG -> WBA -> SBA

Cycle Time 20.0 h | Flow Rate 80.0 m3/h | Net Run 1600.0 m3

SBA Resin A-200 | Grade PP | Rel. Flow Rate 31.6 BV/h | Ionic Load 1908 eq | Theoret. Capacity 0.83 eq/l | Gross Load 1705.1 m3 | Regeneration Mode Pureopack | Design Factor 0.85 | Capacity 0.71 eq/l | Organic Load 0.158 gal

Regenerant NaOH | Level (R 100%) 145.0 gal | Temperature 5 °C | Resin volume 2700 l | Round On Off

Dilution Water 9.0 m3 | Concentration (%) 4.0 | Slow Rinse 2.000 BV | Bed Depth 1051 mm | Metric Imperial None
 Total (100%) 392 kg | Fast Rinse 4.000 BV | Vessel Diameter 1829 mm | Round Metric Imperial None
 % of Theory (calc.) 513 | Overrun Weak->Strong (%) 20 | Cross-section Area 2.57 m2 | Linear Velocity 31.1 m/h | Pressure Drop 46.9 kPa
 Excess 2965 eq

Leakages
 Conductivity 0.50 µS/cm | Sodium 9.5 ppb Na | Silica 28.0 ppb SiO2

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SCI


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OPEX Comparison – Packed Bed vs Stratified Bed

Operating costs per m³ treated water produced:

- Counter current packed bed SAC – DG – SBA - £0.38
- Stratified WAC - SAC – DG – WBA – SBA - £0.24
- **Approximate 37 % reduction in cost**

Costs based on chemical cost of £105/T of 32% HCl and £260/T of 46% NaOH

Information for costing kindly provided by  Watercare
International

Questions ?



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