

# Samyang TriAngle™ 水处理设计软件使用指南

## 用TRILITE离子交换树脂设计水处理系统

### 1. Samyang TriAngle

TriAngle 是(株)三养社的离子交换树脂设计软件。

Samyang TriAngle表示(株)三养社的离子交换树脂品牌TRILITE®和离子交换树脂设计的主要因素：离子交换树脂，装置和设备操作/运行。



Samyang TriAngle




### 2. Samyang TriAngle 管理者

Samyang TriAngle的管理者是三养社离子交换树脂销售队。  
如有关于Samyang TriAngle的疑问请通过邮箱联系管理者。

邮箱：[triangle@samyang.com](mailto:triangle@samyang.com)

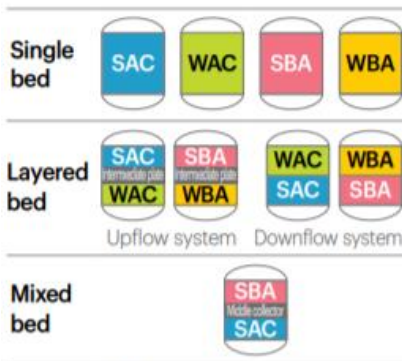
## 1. 三养社离子交换树脂

粒径，粒度范围，均一系数

<b>• Gaussian</b> - Particle Size : 0.3 ~ 1.2mm - Uniformity Coefficient : 1.6 ↓ 	<b>• Gaussian L-type (L)</b> - Particle Size : 0.425 ~ 1.2mm - Uniformity Coefficient : 1.4 ↓ 	<b>• UPS*</b> - Particle Size : 0.5 ~ 0.7mm - Uniformity Coefficient : 1.1 ↓ 
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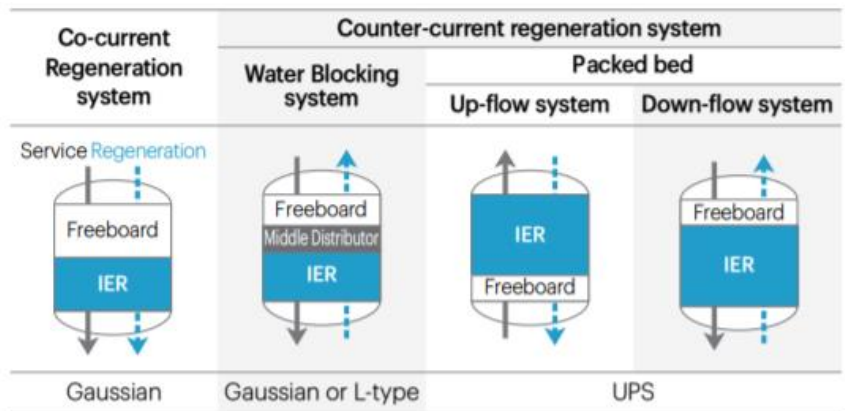
※ UPS : Uniform Particle Sized

按照树脂层



※ SAC : Strongly Acidic Cation Resin  
 WAC : Weakly Acidic Cation Resin  
 SBA : Strongly Basic Anion Resin  
 WBA : Weakly Basic Anion Resin



按照再生系统





※ IER : Ion Exchange Resin

TRILITE 水处理产品




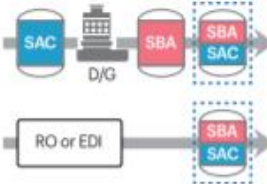

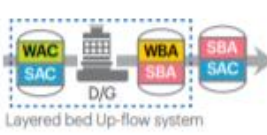
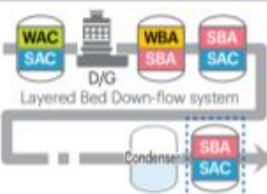
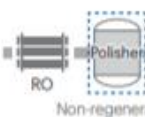
Product line	Origin	U.C (Uniformity coefficient)	Grade	Remarks
Premium	Samyang Fine Technology	1.1↓	<b>• Power plant</b> - Nuclear grade - Condensate polishing	Premium grades produced in UPS resin specialized factory, extremely even uniformity, impurities minimized resins. High performance for premium water treatment.
	Samyang Corp Ulsan plant		<b>• Ultrapure water</b> - Make-up & final polisher in semiconductor and OLED/ LCD, etc	
Performance	Samyang Fine Technology	1.1↓	<b>• Power plant</b> - Condensate polishing - Pretreatment Make-up	Produced in UPS resin specialized factory, extremely even uniformity and excellent physical, chemical strengths. High performance and long-term use
			<b>• Large-scaled industrial water treatment</b> - Petrochemicals, foods, electronics, etc	
Basic	OEM	1.1↓ ~ 1.6↓	<b>• General water treatment</b> - Softening (industrial, domestics, foods) - Demineralization	Produced under Samyang's strict quality control and technical guidance. Highly reliable quality and economical results.

	Type	Strongly acidic cation resins (SAC)			Strongly basic anion resins (SBA)			
		Grade	TEC (eq/ℓ)	Particle Distribution	Type	Grade	TEC (eq/ℓ)	Particle Distribution
Premium		MC-10S	2.2↑	0.60-0.70mm		MA-10S	1.35↑	0.50-0.60mm
		MC-10SH	2.0↑	0.61-0.71mm		MA-10SOH	1.1↑	0.54-0.64mm
Performance	UPS Gel 	MC-08	2.0↑	0.55-0.65mm	Type1	MA-12	1.3↑	0.53-0.63mm
		MC-08H	1.8↑	0.57-0.67mm		MA-12OH	1.1↑	0.57-0.67mm
		MC-10	2.2↑	0.60-0.70mm		MA-10	1.35↑	0.50-0.60mm
		MC-10H	2.0↑	0.61-0.71mm		MA-10OH	1.1↑	0.54-0.64mm
		MC-14M	2.5↑	0.50-0.60mm		MA-15	1.4↑	0.55-0.65mm
		MC-14MH	2.4↑			MA-15OH	1.2↑	0.58-0.68mm
					Type2	MA-20	1.3↑	0.53-0.63mm
Basic	Gaussian Gel 	UKC-08	2.0↑	0.55-0.65mm	Type1	UKA-12	1.3↑	0.55-0.65mm
		UKC-10	2.2↑	0.60-0.70mm				
		UKC-12	2.3↑	0.60-0.70mm				
		SCR-B(L)	2.0↑	0.3-1.2mm (L-type) 0.425-1.2mm	Type1	SAR10(MB)	1.3↑	0.3-1.2mm (L-type)
						SAR12	1.3↑	0.425-1.2mm (MB) for mixed bed
					Type2	SAR20(MB)	1.3↑	
		KC-07	1.9↑	0.3-1.2mm	Type1	KA-10(MB)	1.3↑	0.3-1.2mm (MB) for mixed bed
		KH-70	1.9↑			KA-12	1.3↑	
		KC-08	2.0↑		Type2	KA-20(MB)	1.3↑	
		KH-80	2.0↑					
Functional group		(Polystyrene+DVB) + Sulfonate			(Polystyrene+DVB) + Type1 : TMA, trimethylamine, Type2 : DMEA, dimethylethanolamine			
	Type	Weakly acidic cation resins (WAC)			Weakly basic anion resins (WBA)			
Premium					UPS Porous	AW90	1.6↑	0.50-0.60mm
Performance	Gaussian Porous	WCA10L	4.2↑	0.425-1.2mm		AW80	1.5↑	0.40-0.60mm
Basic					Gaussian Porous	AW30	1.5↑	0.425-1.2mm
Functional group		(Polystyrene+DVB) + Carboxylic Acid			(Polystyrene+DVB) + Tertiary Amine			

## 硬水软化

Softening		Product Line	SAC	SBA	WAC	WBA
Softening (Industrial grade)		Performance	MC-08 MC-10			
		Basic	UKC-08, UKC-10 UKC-12, SCR-B KC-07, KC-08			
Softening (Food grade)		Basic	KH-70 KH-80			

## 纯水生产

Demineralization system		Treated water quality	Product Line	SAC	SBA	WAC	WBA
2B2T (2Bed 2Tower) Cation Exchanger + Anion Exchanger		1-2 $\mu\text{S}/\text{cm}$ $\downarrow$ $\text{SiO}_2$ 20-100ppb $\downarrow$	Performance	MC-08 MC-10	MA-12 MA-20		
			Basic	SCR-B UKC-08 UKC-10 KC-08	SAR10 SAR20 UKA-12 KA-12 KA-20		
2B3T Cation Exchanger + Degasifier + Anion Exchanger		1 $\mu\text{S}/\text{cm}$ $\downarrow$ $\text{SiO}_2$ 100ppb $\downarrow$	Performance	MC-08	MA-20		
			Basic	SCR-B	SAR20MB		
Working MB (Mixed Bed)		0.1 $\mu\text{S}/\text{cm}$ $\downarrow$ $\text{SiO}_2$ 5-10ppb $\downarrow$	Performance	MC-10S	MA-10S		
			Performance	MC-08 MC-10	MA-10		
			Basic	SCR-B	SAR10MB KA-10MB		
2B2T or 2B3T or RO or EDI + MBP (Mixed Bed Polisher)		10-17 $\text{M}\Omega\cdot\text{cm}$ $\uparrow$ $\text{SiO}_2$ 5-10ppb $\downarrow$	Performance	MC-08 MC-10	MA-12 MA-10		AW90 AW80
			Basic	SCR-B	SAR10MB UKA-12		AW30
			Performance	MC-10SH	MA-10SOH		
3B3T +MBP		10-17 $\text{M}\Omega\cdot\text{cm}$ $\uparrow$ $\text{SiO}_2$ 5-10ppb $\downarrow$	Performance	MC-08 MC-10	KA18LB	WCA10L	AW90 AW80
			Basic	SCR-B UKC-08 UKC-10			AW30
			Performance	MC-10H	MA-10OH MA-15OH		
4B3T +MBP		15-18 $\text{M}\Omega\cdot\text{cm}$ $\uparrow$ $\text{SiO}_2$ 5-10ppb $\downarrow$	Performance	UPRM100U, UPRM200U, UPRM300U			
			Performance	SM210, SM300			
			Basic	SM200			
4B3T +MBP +CPP (Condensate Polisher)		10-17 $\text{M}\Omega\cdot\text{cm}$ $\uparrow$ $\text{SiO}_2$ 10ppb $\downarrow$	Performance	UPRM100U, UPRM200U, UPRM300U			
			Performance	SM210, SM300			
			Basic	SM200			
RO (Reverse Osmosis) + Polisher (Polishing Resin)		10-17 $\text{M}\Omega\cdot\text{cm}$ $\uparrow$ $\text{SiO}_2$ 10ppb $\downarrow$	Performance	UPRM100U, UPRM200U, UPRM300U			
			Performance	SM210, SM300			
			Basic	SM200			

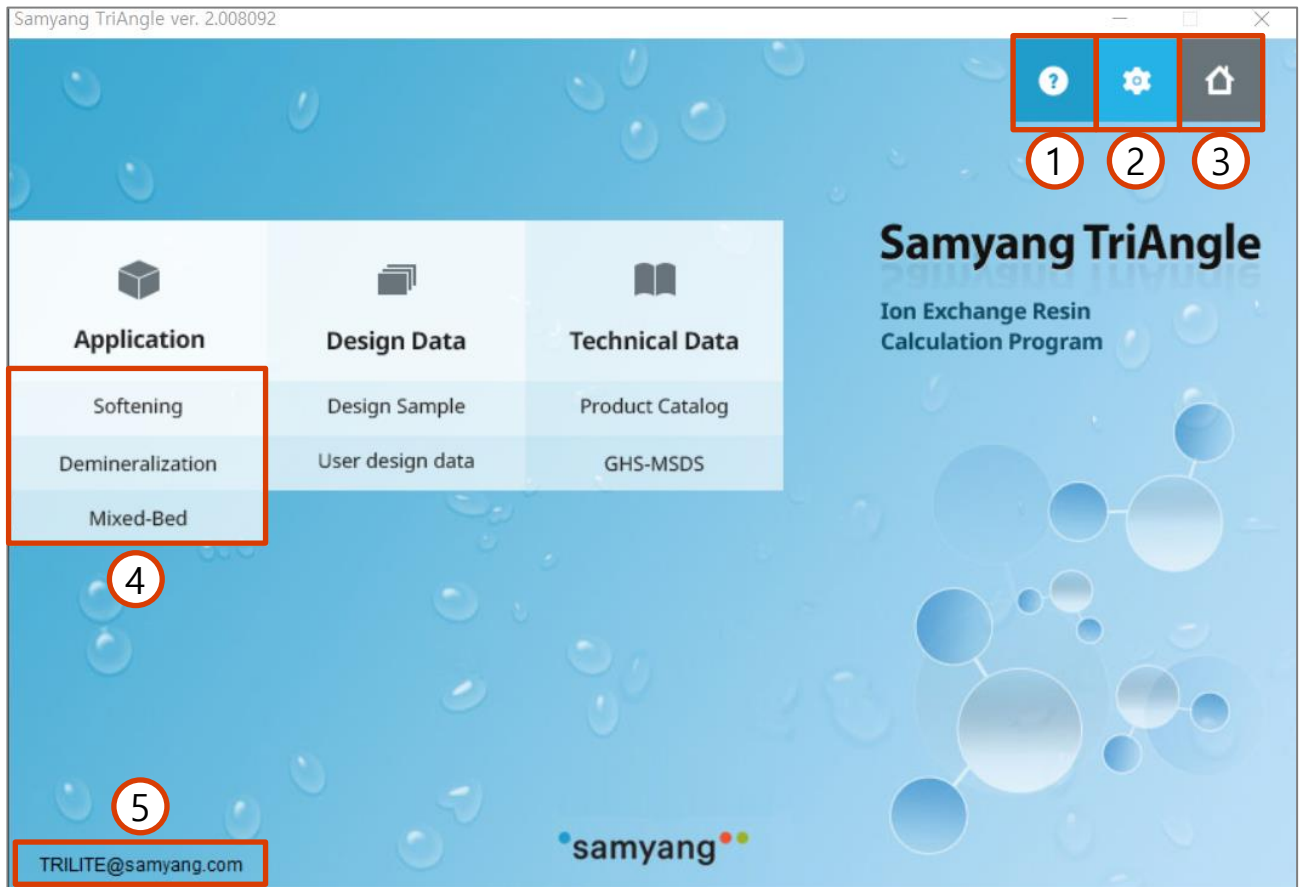
## 2. 水处理设备类型

Samyang TriAngle 包括如下设备类型

Options	Feature
Conventional(co-current)	<ul style="list-style-type: none"><li>• Poor regeneration efficiency</li><li>• Requires free board for backwashing</li><li>• Recommended for conventional resins</li></ul>
Conventional(count-current)	<ul style="list-style-type: none"><li>• Good regeneration efficiency</li><li>• More complicated operation compared to Co-current</li><li>• Recommended for conventional resins</li></ul>
Packed-bed(up-flow)	<ul style="list-style-type: none"><li>• Excellent regeneration efficiency</li><li>• Require separate backwashing tower</li><li>• Recommended for UPS resins</li></ul>
Packed-bed(down-flow)	<ul style="list-style-type: none"><li>• Excellent regeneration efficiency</li><li>• Simple operation</li><li>• Recommend for UPS resins.</li></ul>

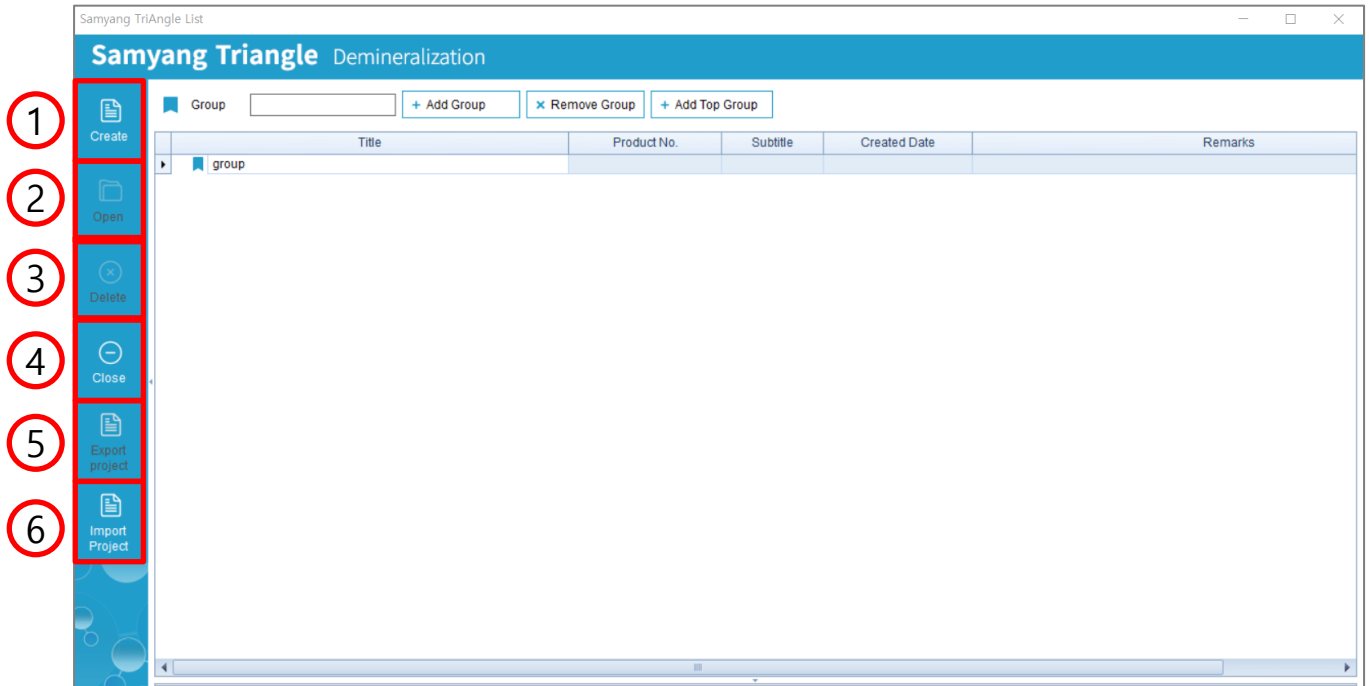
## II. 软件功能

### 1. 设计软件主界面



- ① 打开使用指南。
- ② 执行使用环境设置窗口。语言可以变换为韩/英/中文之一。
- ③ 前往三养社离子交换树脂官网。
- ④ 前往各种装置的设计页面。
- ⑤ 给TriAngle管理者发邮件。

## 2. 装置设计



- ① 开始新的设计。
- ② 打开既有项目。
- ③ 删除既有项目。
- ④ 前往软件界面。
- ⑤ 导出设计并将信息转移储存。
- ⑥ 引入从其他TriAngle软件保存下的设计。

## 3. 装置设计\_基本信息

① 移动到前/后设计阶段。

② 按照项目名保存设计资料。

③ 用其他名字保存设计资料。

④ 将设计输出成PDF文件

⑤ 关闭设计

⑥ 表示设计上的最大/最小数值

⑦ 设计基本信息

- ① 移动到前/后设计阶段。
- ② 按照项目名保存设计资料。
- ③ 用其他名字保存设计资料。
- ④ 将设计输出成PDF文件
- ⑤ 关闭设计
- ⑥ 表示设计上的最大/最小数值
- ⑦ 设计基本信息

※ 备注

Project title 

如未填入必要的信息，会显示  ，无法往下进行。



## 4. 装置设计\_原水条件

- ① 可以输入不同的原水条件。
- ② 填入流量和预计运行周期\*。
- ③ 选择水质条件和国家。
- ④ 如有困难填入详细的原水条件，可以用TDS / Conductivity values 设定。Na和Cl离子会以balance自动调整。

## ※ 备注

- 白色(□): 表示该字段需要由用户输入
- 灰色(■): 表示系统计算的字段
- 蓝色(■): 表示该字段的数据小于系统规定的最小值
- 橙色(■): 表示该字段的数据超过系统规定的最大值

[WARNING] The red value above is out of the recommended range. Please refer to the MIN and MAX range on the bottom left.

点击警告语句，会显示错误发生原因

## 4. 装置设计\_原水条件

The screenshot shows the 'Original Water Conditions' (原水条件) setup screen. It includes the following sections:

- Cations:** A table with columns for Cations, Original, Unit, and [meq/l]. It lists various ions like Na, Ca, Mg, K, Sr, Ba, NH4, Fe(II), and Mn.
- Anions:** A similar table for anions like Cl, SO4, CO3, HCO3, NO3, F, SiO2, B, and PO4.
- Others:** A section for additional parameters such as Temperature, pH, CO2, Turbidity, SDI, TSS, TOC, Fe(Total), Free Chlorine, and H2S.
- Totals:** Summary rows for Total Cation, Total Anion, and their respective adjustments (+Na, +Cl).
- Automatic balancing:** A checkbox at the bottom left.

Red annotations indicate the following steps:

- 1:** Selecting the unit for the cations (e.g., meq/l).
- 2:** Entering the original water analysis results into the Cations and Anions tables.
- 3:** Entering other water quality parameters in the 'Others' section.
- 4:** Entering TDS and Conductivity values.
- 5:** Checking the 'Automatic balancing' option to adjust the ion values.

- ① 选择分析结果的单位。点击刷新，统一其他单位。
- ② 填入分析结果。
- ③ 填入其他条件。
- ④ 如有困难填入详细的原水条件，可以按照TDS和Conductivity value填入。之后Na和Cl离子会按照balance调整。
- ⑤ 自动调整阴阳离子值平衡。

## 4. 装置设计\_离子交换树脂

## ① 选择工艺

SAC：强酸阳树脂， SBA：强碱阴树脂  
WAC：弱酸阳树脂， WBA：弱碱阴树脂  
MBP：混床

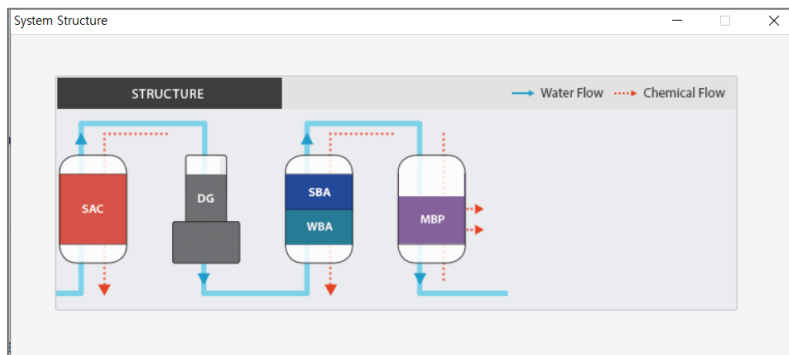
## ② 均一系和非均一系树脂中选一种。

Packed-bed上显示使用均一系树脂的设计。

## ③ 选择树脂并反应出设计上的富余率。

## ④ 确认阴树脂塔后端和混床的限值。

## ⑤ 点击START来显示设计工艺流程。



## 4. 装置设计\_选择再生剂

The screenshot shows the 'Regenerant selection' tab with the following data:

Section	Regenerant selection	Regeneration level [g/l]	Chemical concentration as supplied [%]	Concentration in WAC [%]	Chemical Injection Concentration [%]	Rate [%]	Temperature (Regenerant) [°C]	Slow rinse [BV]	Fast rinse [BV]
Cation	HCl	55.00	35.0		1st step: 3.0, 2nd step:	100.0		2.0	3.0
Anion	NaOH	85.00	50.0	3.0			35.0	3.0	3.0
MBP	HCl	100.0	35.0	5.0				3.0	3.0
	NaOH	104.0	50.0	4.0			50.0		

- ① 选择再生level和药剂浓度。
  - 按不同再生level设定需要的树脂量。
  - 不同的浓度影响再生时间
- ② 设定阳树脂的药剂注入浓度和反洗时间
  - 用 $\text{H}_2\text{SO}_4$  再生可能需要多阶段再生。
- ③ 设定阴树脂的药剂注入浓度和反洗时间
  - 再生温度有可能改变再生效率。
- ④ 设定混床的药剂注入浓度和反洗时间

## 4. 装置设计\_树脂塔设计

General data   Raw water condition   Ion exchange resin   Regenerant selection   **Tower design**   Regeneration process

4   IonExchgCalc   IonTower Design

	1 Cation	2 Anion	3 MBP
Process	Packed-bed(up-flow)	Packed-bed(up-flow)	
Component	SAC	WBA   SBA	SAC   SBA
Resin type	TRILITE MC-08	TRILITE AW90   TRILITE MA-12	TRILITE MC-10   TRILITE MA-10
Ionic load [meq/l]	2.58	3.30   1.35	0.01   0.01
Ionic load per cycle [eq]	8956.73	11597.85   4744.58	259.56   259.56
Ion exchange resin volume(as delivered) [liter]	8675.00	10150.00   5075.00	1500.00   1500.00
Operation capacity [eq/l]	1.03	1.14   0.93	0.03   0.05
Installed capacity [eq]	9421.05	12180.00   5227.25	1800.00   1800.00
Specific flow rate [l/hr]	18.19	15.55   31.09	50.00
Diameter [mm]	2190.00	2730.00   2730.00	1950.00
Thickness of rubber lining [mm]	3.00	3.00   3.00	3.00
Area [m <sup>2</sup> ]	3.75	5.83   5.83	2.97
Linear velocity [m/hr]	42.08	27.07   27.07	53.13
Bed depth(as delivered) [mm]	2313.33	1740.99   870.50	505.05   505.05
Inert Resin Volume [liter]	750.00	600.00   1175.00	
Cycle time [hr]	22	22   22	168

- ① 根据已输入的信息软件自动计算阳树脂塔设计
  - 可以根据运行交换容量/SV/LV调整阳树脂补充量。
  - 可以调整树脂塔直径和橡胶内衬。
- ② 根据已输入的信息软件自动计算阴树脂塔设计
  - 可以根据运行交换容量/SV/LV调整阳树脂补充量。
  - 可以调整树脂塔直径和橡胶内衬。
- ③ 根据已输入的信息软件自动计算混床设计
  - 可以调整混床运行周期(Cycle time)。
- ④ 可以设定离子交换树脂量和树脂塔设计。


## 4. 装置设计\_树脂塔设计

General data | Raw water condition | Ion exchange resin | Regenerant selection | **Tower design** | Regeneration process

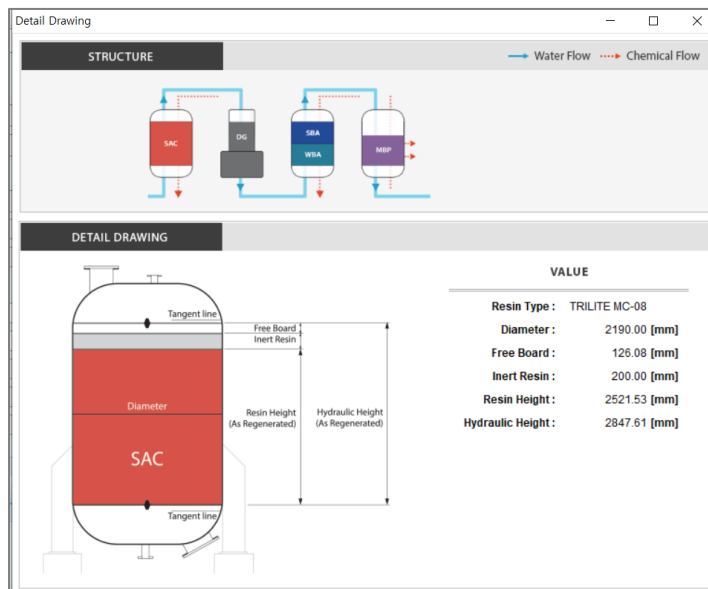
IonExchgCalc | IonTower Design

**1**

	Cation	Anion		MBP	
Process	Packed-bed(up-flow)	Packed-bed(up-flow)			
Component	SAC	WBA	SBA	SAC	SBA
<b>Process selection</b>					
Resin type	TRILITE MC-08	TRILITE AW90	TRILITE MA-12	TRILITE MC-10	TRILITE MA-10
Swelling rate [%]	9.0	20.0	24.0	8.0	23.0
Resin bed depth as regenerated [mm]	2521.53	2089.19	1079.42	545.45	621.21
<b>Filter compartment</b>					
Bed depth(Blocking resin) [mm]	200.00	200.00	200.00		
Freeboard ratio [%]	5	5	5	100	
Hydraulic height as delivered [mm]	2639.41	2045.45	1124.47		
Hydraulic height as regenerated [mm]	2847.61	2393.65	1333.39	2333.32	
Total pressure loss [kPa]	64	46	46	42	

**2** 

- ① 设定阳床、阴床、混床的树脂塔条件
  - 指定适当的惰性树脂床深。
  - 设定剩余空间(free board)和每个树脂型号的膨胀率。
  - 如需要反洗空间，设定剩余空间(free board)。
- ② 点击START查看每个工艺流程和塔的设计图。



General data

Raw water condition

Ion exchange resin

Regenerant selection

Tower design

Regeneration process\*

Regeneration data

Cation regeneration

Anion regeneration

MBP regeneration

Waste water

1

Gross flowrate [m<sup>3</sup>/h]

157.80

	Cation	Anion	MBP	
Process	Packed-bed(up-flow)	Packed-bed(up-flow)		
Component	SAC	WBA SBA	SAC	SBA
Resin type	TRLITE MC-08	TRLITE AW90 TRLITE MA-12	TRLITE MC-10	TRLITE MA-10
Total resin volume [lit]	8675.00	10150.00 5075.00	1500.00	1500.00
Regenerant	HCl	NaOH	HCl	NaOH
Regeneration level [g/l]	55.00	85.00	100.00	104.00
Chemical concentration as supplied [%]	35.0	50.0	35.0	50.0
1. Dilution				
Chemical injection concentration [%]	3.0	3.0	5.0	4.0
Multi-stage regeneration Ratio [%]	100.0			
Chemical consumption as 100% [kg]	477.13	431.38	150.00	156.00
Chemical consumption as supplied (weight) [kg]	1363.23	862.79	428.57	312.00
Chemical consumption as supplied (volume) [lit]	1157.47	561.40	363.88	203.02
Volume as supplied [lit]	14541.12	13516.57	2571.42	3588.00

2

- ### ※ 阳离子交换树脂再生条件

### ※ 阴离子交换树脂再生条件

SBA		Injection percent [%]	LV [m/hr]	Rate [m3/hr]	Time [min]	Volume [m3]	Volume [BV]
Caustic injection	3.0	7.00	40.81	21	14.08		
Caustic displacement		6.62	38.62	71	45.70	3.0	
Fast rinse			157.80	17	44.71	3.0	

WBA		Injection percent [%]	LV [m/hr]	Rate [m3/hr]	Time [min]	Volume [m3]	Volume [BV]
Caustic injection	3.0	7.00	40.81	21	14.08		
Caustic displacement		6.62	38.62	71	45.70	4.5	
Fast rinse			157.80	17	44.71	4.4	
Cycle rinse		27.07	157.80	10	26.30	1.7	
Total service water					122	109.76	
Total waste water						110.32	

## 4. 装置设计\_再生流程

### ※ 混床离子交换树脂再生条件

SAC	TRILITE MC-10	LV	Rate	Time	Volume	Volume
SBA	TRILITE MA-10	[m/hr]	[m3/hr]	[min]	[m3]	[BV]
Backwash		10.00	29.70	20	9.90	
Settling				10		
Caustic injection		4.0	2.55	7.58	30	3.79
Caustic displacement		2.42	7.18	45	5.39	3.6
Acid injection		5.0	1.98	5.87	30	2.94
Acid displacement		1.73	5.14	45	3.86	2.6
Slow rinse(caustic)		6.06	18.00	30	9.00	6.0
Slow rinse(acid)		6.06	18.00	30	9.00	6.0
Blow-down				10	7.35	
Mixing		90.00	267.3	[Nm3/hr as Air]	20	
Fast rinse			59.40	15	14.85	5.0
Total service water				180	58.16	
Total waste water					66.08	

### ※ 再生废液信息

Net production					
	Cation / Anion	MBP			
Net capacity [m3]	3300.00	25200.00			
Net flow rate [m3/hr]	150.00	150.00			
Total waste water [m3]					
159.60					
Waste water and neutralisation					
Cations			Anions		
	[eq]	[meq/l]		[eq]	[meq/l]
Total hardness	6930.00	43.42	Cl	6477.90	40.59
Na, K, NH4	1544.40	9.68	SO4	3808.20	23.86
Other cations	29.70	0.19	HCO3	7609.80	47.68
			SiO2	105.60	0.66
			Other anions	277.20	1.74
Regenerants					
Regenerant selection	Excess chemical load [eq]	Total [kg as 100%]	Expected pH of waste water	Required chemical for neutralization [kg as 100%]	
HCl	13062.73	477.1		58.7	
NaOH	14669.66	587.4	12.0	0.0	



## 5. 保存 &amp; 输出流程

**Samyang Triangle Demineralization**

General data | Raw water condition | Ion exchange resin | Regenerant selection | Tower design | **Regeneration process\***

Regeneration data | Cation regeneration | Anion regeneration | MBP regeneration | **Waste water**

**1** Save

**2** Export

**3**

**Selection**

	Cation / Anion	MBP
Net capacity [m3]	4400.00	33600.00
Net flow rate [m3/hr]	200.00	200.00

Total waste water [m3] 207.58

**Waste water and neutralisation**

Cations		Anions	
[mg]	[meq/l]	[mg]	[meq/l]
Total hardness	9240.00	44.51	
Na, K, NH4	2059.20	9.92	
Other cations	39.60	0.19	
		Cl	8637.20
		SO4	5077.60
		HCO3	10146.40
		SiO2	140.80
		Other anions	369.60

**Regenerants**

Regenerant selection	Excess chemical load [mg]	Total [kg as 100%]	Expected pH of waste water	Required chemical for neutralization [kg as 100%]
HCl	17394.14	635.3		0.0
NaOH	17377.04	695.9	4.1	0.7

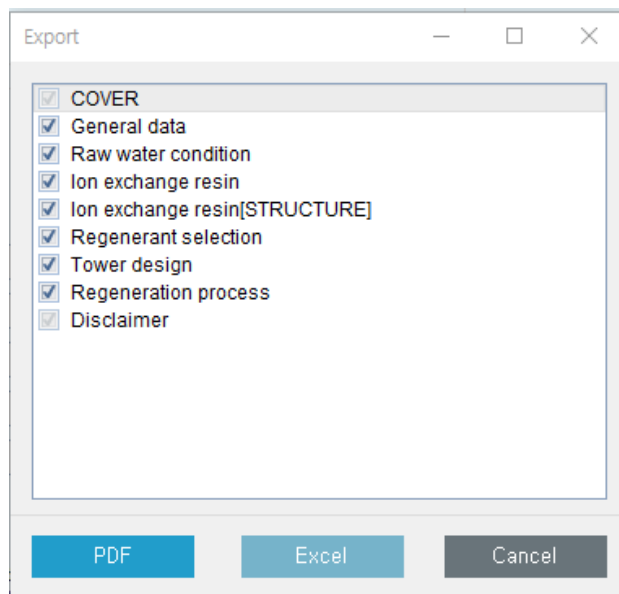
MIN  
MAX

[WARNING] The red value above is out of the recommended range. Please refer to the MIN and MAX range on the bottom left.  
[WARNING] The red value above is out of the recommended range. Please refer to the MIN and MAX range on the bottom left.

- ① 关闭前保存设计文件。
- ② 将设计输出成PDF文件。
- ③ 请在Waste water阶段保存设计，  
否则会保存在最后点击过的阶段，反应不出后面的添加/修改内容。

Regeneration data	Cation regeneration	Anion regeneration	MBP regeneration	<b>Waste water</b>
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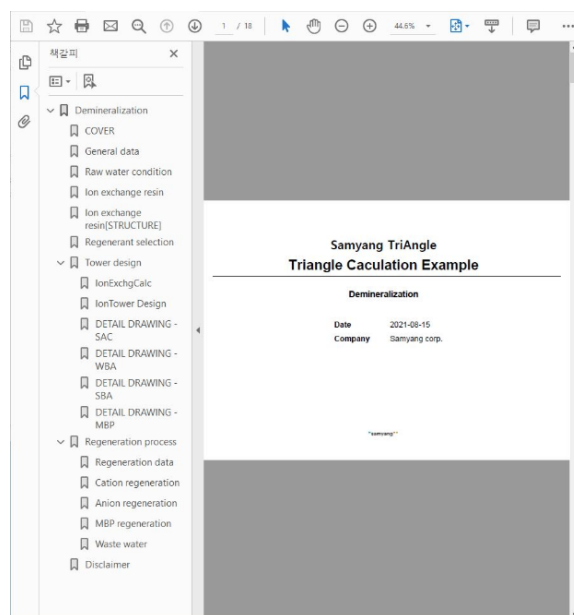
## 5. 保存 & 输出流程



除了COVER和Disclaimer, 其他资料能随意选择输出需要的部分。

输出文件时可以排除不需要的资料。

输出的文件可以保存为PDF或Excel形式。



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Ion Exchange Resin

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