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TRILITE
삼양 트리라이트
Ion Exchange Resin

Introduction to Samyang Corporation & TRILITE

Samyang Corporation Ion exchange resin
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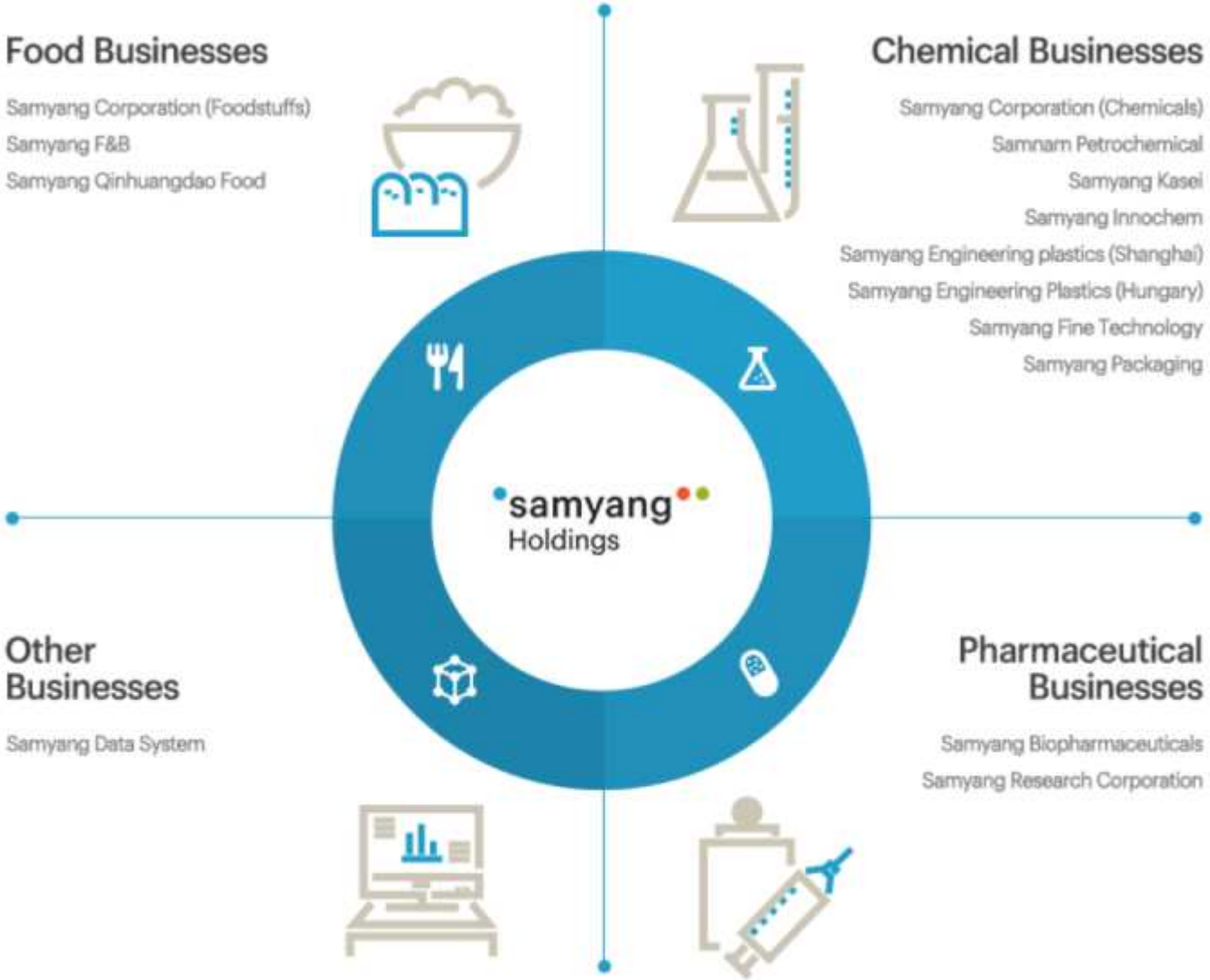
http://samyangtrilite.com

1. Samyang Group Overview

- **Established in 1924 / Employees : 3,200 / Sales : USD 3.8 billion (2018)**



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2. Product Line of Samyang Group

(Business Domain)	(Subsidiaries)		(Product line)						
Chemical Business	Samyang Corporation ✓	Engineering Plastics	Ion Exchange Resin(Non-UPS) ✓	IT Appliance Materials					
	Samnam Petro-Chemicals	Terephthalic acid							
	Samyang Kasei	Poly Carbonate							
	Samyang Eng'g Plastics (Shanghai)	Engineering Plastics							
	Samyang Innochem	Bisphenol-A							
	Samyang Eng'g Plastics (Hungary)	Engineering Plastics							
	Samyang Fine Technology ✓	Ion Exchange Resin(UPS※) ✓							
	Samyang Packaging	PET Bottle	PET Preform	Aseptic Bottling					
Food Business	Samyang Corporation	Sugar	Sweetener	Cooking Oil	Homemade Mix	Hangover Cure	Home Baking Products	Margarine & Shortening	Olive & Grape Seed Oil
		Starch	Starch Sugar	Sugar Alcohol	Health Functional Food	Cosmetics			
	Samyang F&B	Salad & Grill Restaurant	Salad & Brunch Cafe						
	Samyang Qinhuangdao Food	Starch Sugar							
Pharmaceutical Business	Samyang Biopharm	Medical Device	Carcinostatic Agent	Patch					
Other Business	Samyang Data Systems	IT Service							

Samyang Corporation | Samyang Petro-Chemicals | Samyang Kasei | Samyang Innochem | Samyang Fine Technology

※ UPS : Uniform particle sized

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3. Locations (HQ, Plant, Technical Center of TRILITE)

- **Technical sales force by 3 fields**
  - Demineralization/Ultrapure water/ Condensate polishing/Catalyst
  - Food/Amino acid/Pharmaceuticals
  - Wastewater/Chelating/purification
- **One stop service**
  - Analysis of IER
  - Equipment Diagnosis
  - Design support
  - Technical seminar
  - Trouble shooting guide

TRILITE
삼양 트리라이트
Ion Exchange Resin

- **Analysis of IER**
- **Recipe improvement of IER**
- **New product development**
  - Tailored / Specialty Resins
- **Application process development**
  - Pilot test
  - Engineering data gathering
  - Process proposal

samyang fine technology

- **Since 2016**
- **Joint venture with Mitsubishi Chemicals**
- **Production Capacity : 20,000㎘/yr**
  (Cation 13,000㎘/yr , Anion 7,000㎘/yr)
- **Product line**
  - Uniform particle sized resins
  - Ultrapure water grade(for OLED, LCD)
  - Chromatography resins

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- **Since 1976**
- **Technology licensed by Mitsubishi Chemicals & Self-development**
- **Production Capacity : 7,000㎘/yr**
  (Cation 4,000㎘/yr , Anion 3,000㎘/yr)
- **Product line**
  - Ultrapure water grade(for semiconductor)
  - Tailored resins(food, catalyst, pharmaceuticals)
  - Specialty resins(chelating, synthetic adsorbents)

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4. Overview of Samyang Fine Technology Corp.

Samyang Fine Technology Corporation is a joint venture founded by Samyang Corporation and Mitsubishi Chemical Corporation, which is leading IER(ion exchange resin) maker in Korea and Japan.

Samyang Fine Technology Corporation is Asia's largest specialized UPS(uniform particle sized) IER plant.

We fulfill customer satisfaction with innovative technologies and strict quality control.

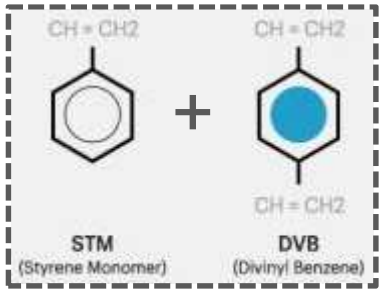
History)

2016.04 Completion ceremony
2015.12 Commercial operation initiation
2014.01 Samyang Fine Technology established
2013.07 Samyang Corporation and Mitsubishi Chemical Corporation signed a joint venture agreement

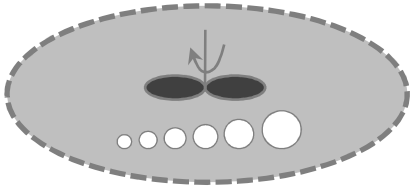
5. Cutting-edge Technology Droplet Generator

Conventional Technology

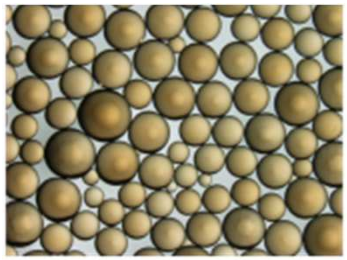
(Raw Material Adjustment)

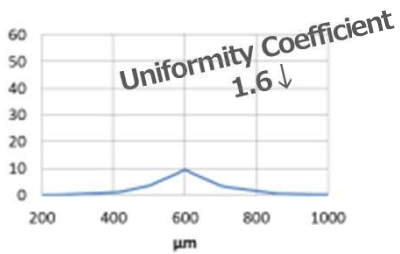


(Polymerization - Agitation)



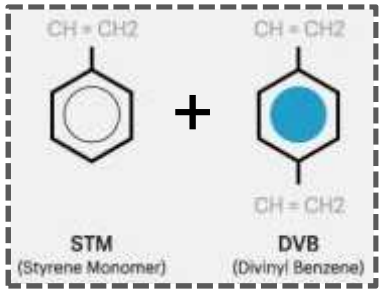
(Post-treatment – Functional Group)



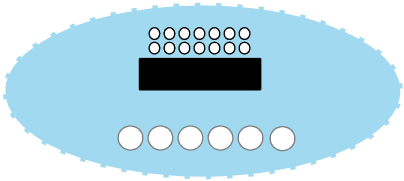


UPS(uniform particle sized) Technology

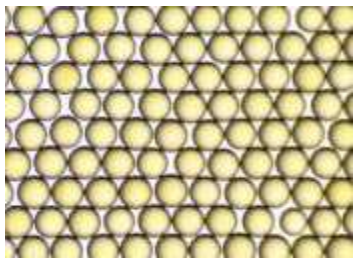
(Raw Material Adjustment)

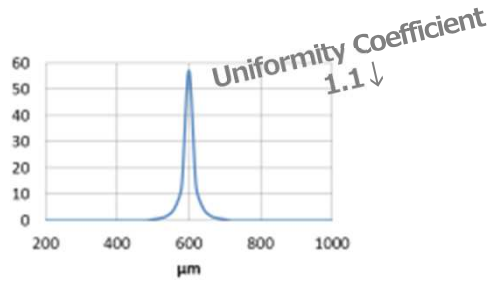


(Polymerization - Droplet Generator)



(Post-treatment – Functional Group)





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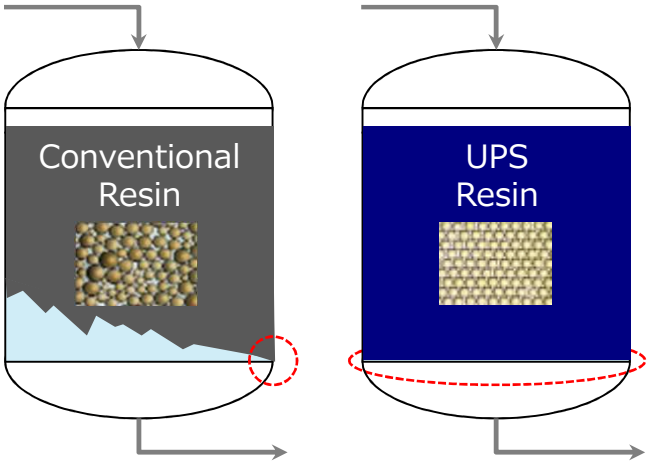
6. Next Generation IER, high performance low cost

Conventional resin gives diffused exhaustion front

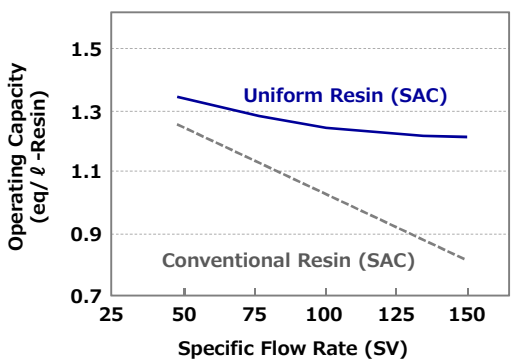


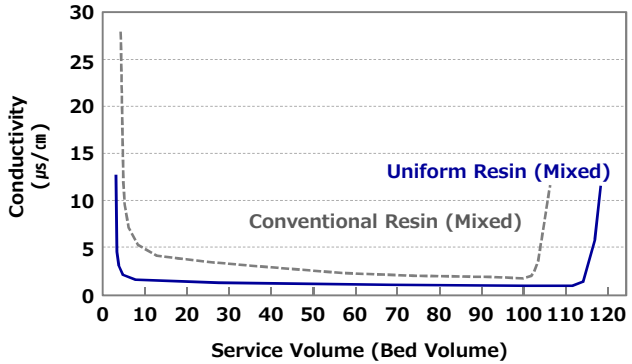
UPS resin gives an extremely even exhaustion front

Improved kinetics, Fast Reaction Speed + **Excellent Physical & Chemical Strength**

Higher Operating Capacity, Reduction of Rinse Volume
Longer Life Time of IER

"Lower Running Cost and Capital Expenditure"





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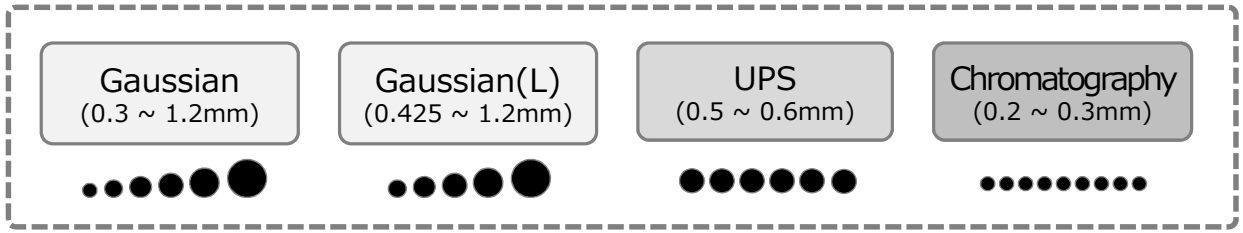
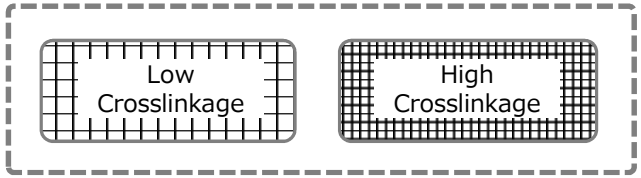
7. Product line of TRILITE

(Particle Distribution, Size)

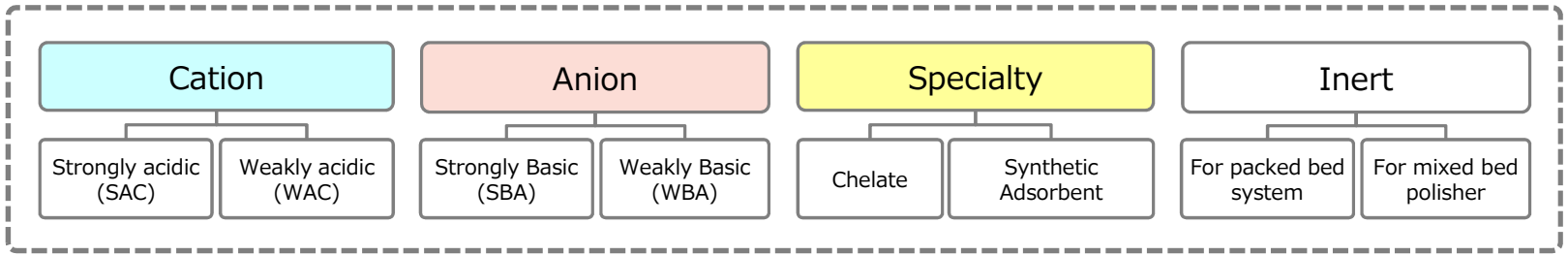


(Crosslinkage)

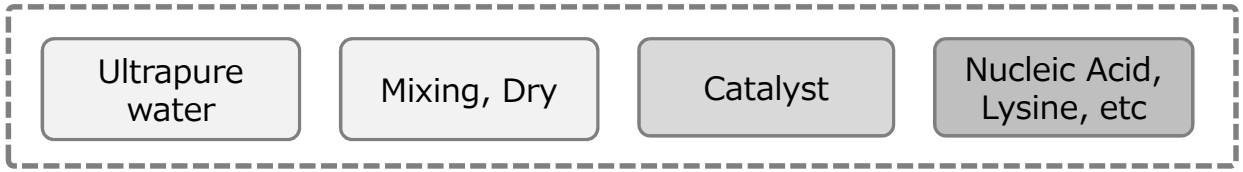


(Porosity)

(Functional Group)



(Post-treatment / Tailored Resin)



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7. Product line of TRILITE

Water treatment
- Softening
- Demineralization
- Condensate polishing
- Nuclear power

Catalyst

Ultrapure water

Chromatography
- Fructose/glucose separation
- Amino acid separation
- Acid purification

Food
- Starch sugar refining
- Sugar refining
- Nucleic acid, lysine separation

Chelating resins
- Secondary brine purification
- Wastewater treatment

Synthetic adsorbents

Ready to use mixed resins

Layered bed anion resins

Inert resins

EO/EG cycle water treatment

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7. Product line of TRILITE

(Particle Distribution, Size)

Gaussian
- Particle Size : 0.3 ~ 1.2mm
- Uniformity Coefficient : 1.6↓

Gaussian L-type
- Particle Size : 0.425 ~ 1.2mm
- Uniformity Coefficient : 1.4↓

UPS
- Particle Size : 0.5 ~ 0.7mm
- Uniformity Coefficient : 1.1↓

(Classification by IER layer)

Single Bed	SAC / WAC / SBA / WBA
Layered Bed	WAC + SAC / WBA + SBA
Mixed Bed	SBA + SAC

(Classification by regeneration system)

Co-current Regeneration System	Counter-current Regeneration System	
	Water Blocking System	Packed Bed: Upflow System / Downflow System
Service / Rege-neration: Freeboard, IER	Middle Distributor: Freeboard, IER	IER, Freeboard / Freeboard, IER
Gaussian	Gaussian or L-type	UPS IER

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7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin

		Uniformity Coefficient (U.C)	Strongly acidic cation resins (SAC)		Strongly basic anion resins (SBA)		
			Grade name	TEC (eq/ℓ)	Type	Grade name	TEC (eq/ℓ)
Performance Product Line	UPS (Samyang Fine Technology)	1.1↓	MC-08	2.0↑	Type1	MA-12	1.3↑
			MC-10	2.2↑		MA-10	1.35↑
			MC-14	2.5↑		MA-15	1.4↑
					Type2	MA-20	1.3↑
Basic Product Line	Gaussian (Samyang Ulsan Plant)	1.4~1.6↓	SCR-B	2.0↑	Type1	SAR10	1.3↑
						SAR12	1.3↑
					Type2	SAR20	1.3↑
Economy Product Line	UPS (OEM)	1.1~1.2↓	UKC-08	2.0↑	Type1	UKA-12	1.3↑
			UKC-10	2.2↑	WBA	AW80	1.5↑
			UKC-12	2.3↑			
	Gaussian (OEM)	1.4~1.6↓	KC-07	1.9↑	Type1	KA-10	1.3↑
			KH-70	1.9↑		KA-12	1.3↑
			KC-08	2.0↑	Type2	KA-20	1.3↑
			KH-80	2.0↑			

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7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Type	Strongly acidic cation resins (SAC)			Strongly basic anion resins (SBA)			
		Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
Performance	UPS Gel	**MC-08**	2.0↑	0.55~0.65㎜	Type1	**MA-12**	1.3↑	0.53~0.63㎜
		MC-08H	1.8↑	0.57~0.67㎜		MA-12OH	1.0↑	0.57~0.67㎜
		MC-10	2.2↑	0.60~0.70㎜		MA-10	1.35↑	0.50~0.60㎜
		MC-10H	1.9↑	0.61~0.71㎜		**MA-10OH**	1.0↑	0.54~0.64㎜
		MC-14	2.5↑	0.60~0.70㎜		MA-15	1.4↑	0.55~0.65㎜
		MC-14H	2.4↑			**MA-15OH**	1.2↑	0.58~0.68㎜
					Type2	**MA-20**	1.3↑	0.53~0.63㎜
Basic	Gaussian Gel	**SCR-B**	2.0↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜	Type1	**SAR10(MB)**	1.3↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜
						SAR12	1.3↑	
					Type2	**SAR20(MB)**	1.3↑	
Economy	UPS Gel	**UKC-08**	2.0↑	0.60~0.70㎜	Type1	UKA-12	1.2↑	0.55~0.65㎜
		UKC-10	2.2↑	0.60~0.70㎜				
		UKC-12	2.3↑	0.60~0.70㎜				
	Gaussian Gel	KC-07	1.9↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜	Type1	KA-10	1.3↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜
		KH-70	1.9↑			KA-12	1.3↑	
		KC-08	2.0↑		Type2	**KA-20**	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)			
Performance	Gaussian, UPS Porous	**WCA10L**	4.2↑	0.425~1.2㎜	WBA	AW90	1.6↑	0.50~0.60㎜
Basic	UPS Porous					**AW80**	1.5↑	0.50~0.60㎜
Economy	Gaussian Porous					**AW30L**	1.5↑	0.425~1.2㎜
	Functional group	(Polystyrene+DVB) + Carboxylate			(Polystyrene+DVB) + Tertiary Amine			

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7. Product line of TRILITE

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

Sodium hypochlorite(NaClO), Free chlorine(Cl_2), Ozone(O_3)

When softeners are used with oxidizing agents such as sodium hypochlorite or free chlorine, it is recommended to use highly crosslinked strongly acidic cation ion exchange resin with high resistance to oxidation.

IER Selection		ClO_2 Concentration	Cl_2 or O_3 Concentration
Performance	MC-08	0.1ppm↓	0.2ppm↓
Basic	SCR-B		
Economy	KC-07, KC-08		
Performance	MC-10	0.15ppm↓	0.3ppm↓
Economy	UKC-10		
Economy	UKC-12	0.2ppm↓	0.4ppm↓

Food grade softening

When food grade softening is required, it is needed to select a suitable food grade ion exchange resin. Examples are as follows.

KH-80 SCR-B SCR-BL

NSF

(NSF Test method)
100 ㎖ of ion exchange resin is put into 100 ㎖ of water at 70℃, and APHA(unit of chromaticity) is measured with a visible spectrophotometer.

IER	Grade	Spec.	Day 1	Day 2	Day 3	Day 4	Day 7
KH-80	**Food**	**< 25**	**12**	**13**	**13**	**13**	**14**
SCR-B	Tech	-	145	149	153	160	183
SCR-BL	Tech	-	53	55	191	257	347

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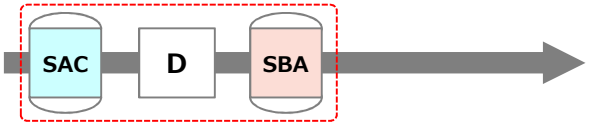
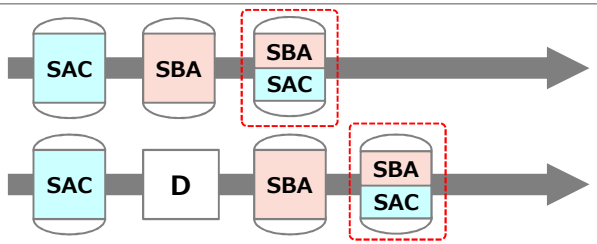
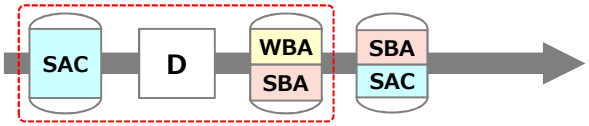
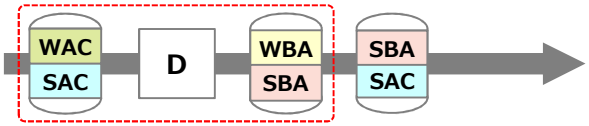
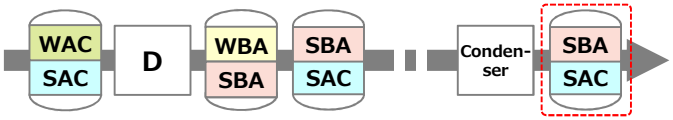
7. Product line of TRILITE

Demineralization system		Line	SAC	SBA	WAC	WBA
2B2T (2Bed 2Tower) Cation Exchanger + Anion Exchanger		Performance	MC-08 MC-10	MA-12 MA-20		
		Basic	SCR-B	SAR10 SAR20		
2B3T Cation Exchanger + Degasifier + Anion Exchanger		Economy	UKC-08 UKC-10 KC-08	UKA-12 KA-12 KA-20		
Working MB (Mixed Bed)		Performance	MC-08	MA-20P		
		Basic	SCR-B	SAR20MB		
2B2T or 2B3T + **MBP** (Mixed Bed Polisher)		Performance	MC-08 MC-10	MA-10P		
		Basic	SCR-B	SAR10MB		
3B3T+MBP		Performance	MC-08 MC-10	KA18LB		AW90
		Basic	SCR-B	KA18LB		AW80
		Economy	UKC-08 UKC-10	KA18LB		AW30L
4B3T+MBP		Performance	MC-08 MC-10	KA18LB	WCA10L	AW90
		Basic	SCR-B	KA18LB	WCA10L	AW80
		Economy	UKC-08 UKC-10	KA18LB	WCA10L	AW30L
4B3T+MBP+ **CPP**(Condensate Polisher)		Performance	MC-10H MC-14H	MA-10OH MA-15OH		

※ Anion grade name + (P) means anti-clumping treatment. Anion resin used for MB or MBP requires anti-clumping treatment that helps separation of cation and anion.

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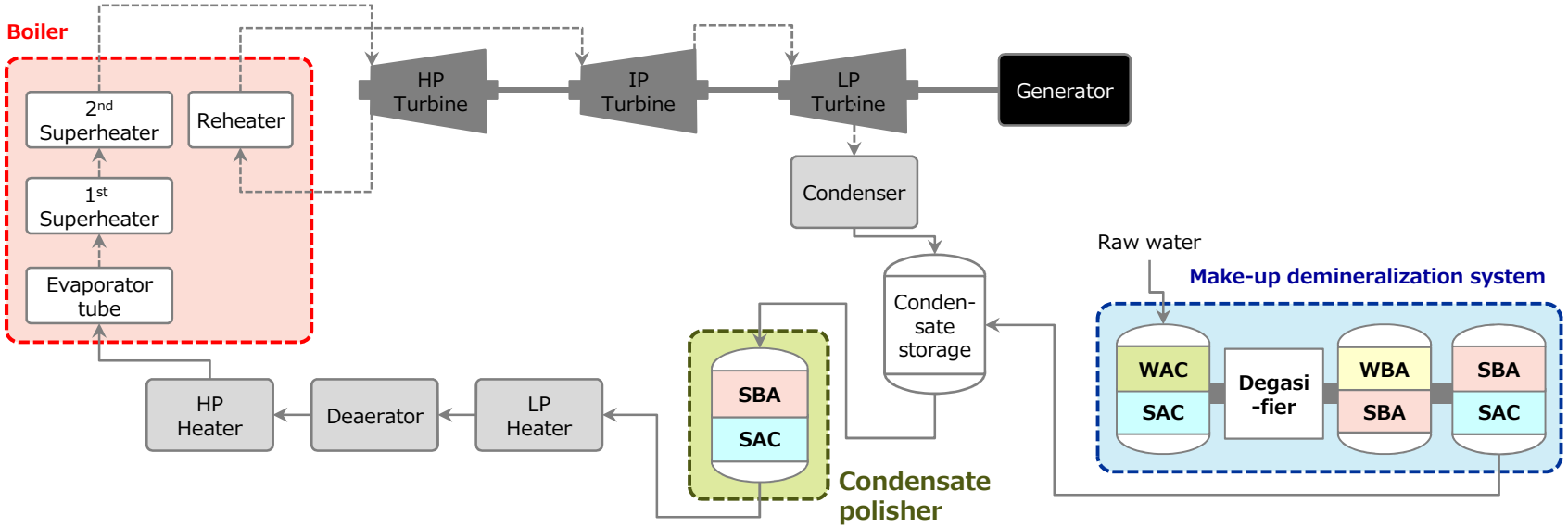
7. Product line of TRILITE

(Typical power plant steam turbine loop and IER selection)



Fast kinetics according to high uniformity, higher separation rate between Cation & Anion, high physical & chemical strength

TRILITE 삼양 트리라이트 Ion Exchange Resin	Condensate polishing resins							
	Strongly acidic cation resins (SAC)				Strongly basic anion resins (SBA)			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
Gaussian	Porous	CMP28L	2.05↑	0.425~1.2㎜	Porous type1	AMP18L	1.3↑	0.425~1.2㎜
		CMP28LH	1.8↑			AMP18LOH	1.0↑	
UPS	Gel	MC-10	2.2↑	0.60~0.70㎜	Gel type1	MA-10	1.35↑	0.50~0.60㎜
		MC-10H	1.9↑	0.61~0.71㎜		**MA-10OH**	1.0↑	0.54~0.64㎜
		MC-14	2.5↑	0.60~0.70㎜		MA-15	1.4↑	0.55~0.65㎜
		MC-14H	2.4↑			MA-15OH	1.2↑	0.58~0.68㎜

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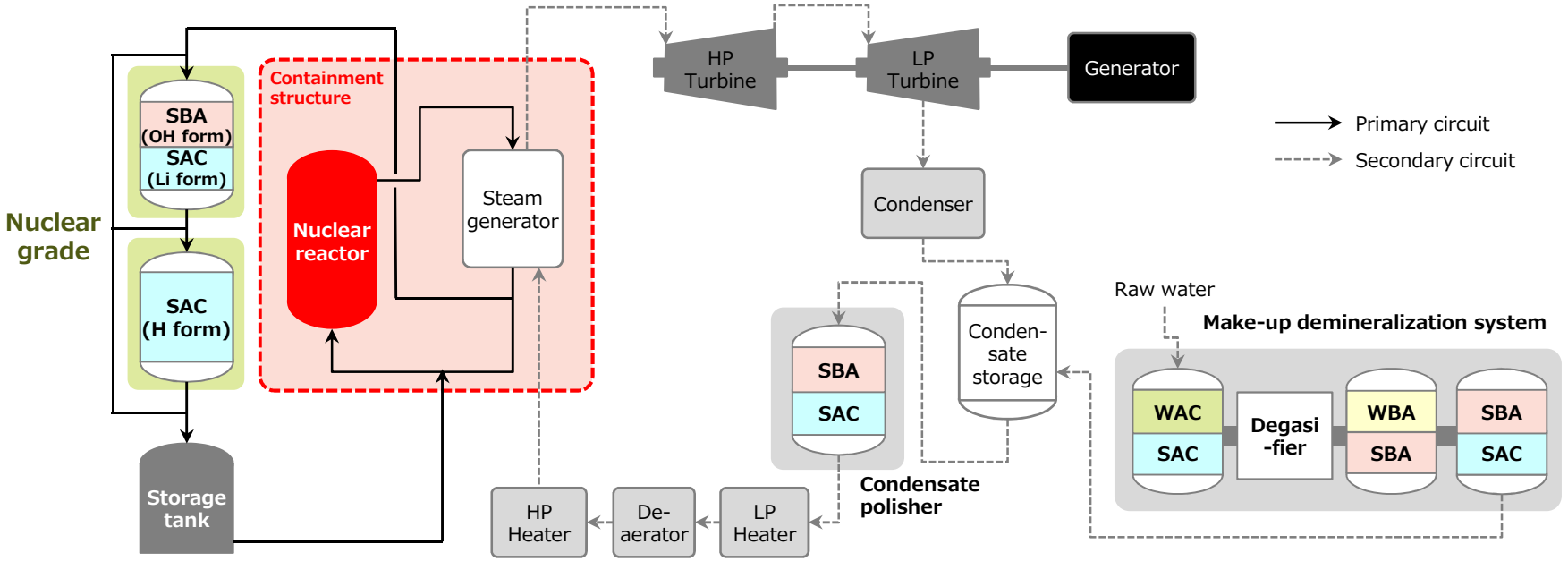
7. Product line of TRILITE

(Pressure water reactor type nuclear power plant steam turbine loop and IER selection)



High ion exchange capacity with high crosslinkage, low TOC leakage with less rinse water consumption
High conversion rate to ensure maximum ionic load & minimum kinetic leakage, very low level of heavy metal ion impurities

	Nuclear Grade resins (for primary circuit)							
TRILITE 삼양 트리라이트 Ion Exchange Resin	Strongly acidic cation resins (SAC)				Strongly basic anion resins (SBA)			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
UPS	Gel	**MCN116K**	2.4↑	0.60~0.70㎜	Gel type1	**MAN210K**	1.1↑	0.58~0.65㎜
	MMN316K / Mixed Resin ratio = 1 : 1 as same equivalent (MCN116K : MAN210K)							

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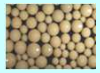
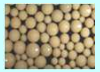
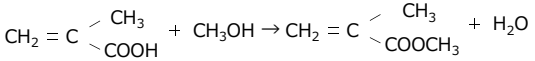
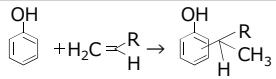
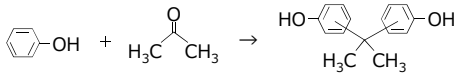
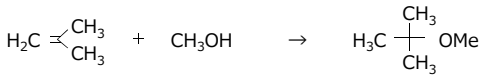
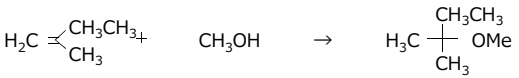
7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Strongly acidic cation resins for catalyst (SAC for catalyst)								
	Type	Grade name	TEC (eq/ℓ)	Particle distribution		Type	Grade name	TEC (eq/ℓ)	Particle distribution
Gaussian	Gel catalyst	**PCC30H**	1.1↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜ (XL-type) 0.7~1.2㎜	UPS	Gel catalyst	MC-04H	1.2↑	0.47~0.57㎜
		PCC40H	1.2↑						
	Porous Catalyst 	**CMP08H**	1.0↑		Gaussian	Porous Catalyst 	SPC400H	1.0↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜
		CMP28H	2.0↑				**SPC160H**	1.5↑	
		SPC260H	1.7↑				**SPC180H**	1.5↑	
		SPC280H	2.0↑				SPC320H	1.9↑	

(Typical catalysis application and selection of catalytic resins)

Application	Reaction	Catalytic resins	Equivalent
Hydrolysis of methyl acetate	$CH_3COOCH_3 + H_2O \rightarrow CH_3COOH + CH_3OH$	CMP08LH	
Esterification reaction	$RCOOH + ROH \rightarrow RCOOR + H_2O$	PCC40H, MC-08H, CMP08LH, SPC160H, SPC180H, SPC400LH	
Synthesis of methyl methacrylate		SPC180H	
Alkylation of phenol		SPC260H, SPC320H	Amberlyst15Wet
Synthesis of Bisphenol A		PCC30H, PCC40H	
Methyl tertiary butyl ether(MTBE)		SPC280H	Amberlyst35Wet
t-amyl methyl ether(TAME)		SPC160H, SPC180H	

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7. Product line of TRILITE

TRILITE 삼양 트리라이트 Ion Exchange Resin

	Ultrapure water grade cation resins					Ultrapure water grade anion resins				
	Type	Grade name	TEC (eq/ℓ)	Outlet condition	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Outlet condition	Particle distribution
UPS	Gel	**UPRC100U**	1.8↑	Guarantee) Resistivity > 17.0 MΩ·cm (in 10min.) Actual) Resistivity > 18.0 MΩ·cm (in 10min.)	0.57~0.67㎜	Gel type1	**UPRA100U**	1.0↑	Guarantee) Resistivity > 17.0 MΩ·cm (in 10min.) Actual) Resistivity > 18.0 MΩ·cm (in 10min.)	0.57~0.67㎜
		UPRC120U	1.9↑		0.61~0.71㎜		UPRA120U	1.0↑		0.54~0.64㎜
							UPRA140U	1.2↑		0.58~0.68㎜
		UPRC200U	1.8↑	Resistivity >18.1㏁.㎝ (in 30min) △TOC<5ppb (in 120min)	0.57~0.67㎜		**UPRA200U**	1.0↑	Resistivity >18.1㏁.㎝ (in 30min) △TOC<5ppb (in 120min)	0.57~0.67㎜
		UPRC220U	1.9↑		0.61~0.71㎜		UPRA220U	1.0↑		0.54~0.64㎜
							UPRA240U	1.2↑		0.58~0.68㎜
		UPRC300U	1.8↑	Resistivity >18.2㏁.㎝ (in 30min) △TOC<1ppb (in 180min)	0.57~0.67㎜		**UPRA300U**	1.0↑	Resistivity >18.2㏁.㎝ (in 30min) △TOC<1ppb (in 180min)	0.57~0.67㎜
		UPRC320U	1.9↑		0.61~0.71㎜		UPRA320U	1.0↑		0.54~0.64㎜
							UPRA340U	1.2↑		0.58~0.68㎜

	Ultrapure water grade mixed resins									
	Type	Grade		Cation TEC		Anion TEC	H^+(%)	OH^-(%)	Cl^-(%)	Outlet condition
UPS	Gel	**UPRM100U**	=	1.8↑	+	1.0↑	99.0↑	90.0↑	1.0↓	Guarantee) Resistivity > 17.0 MΩ·cm (in 10min.) Actual) Resistivity > 18.0 MΩ·cm (in 10min.)
		UPRM120U	=	1.9↑	+	1.0↑	99.0↑	90.0↑	1.0↓	
		UPRM140U	=	1.9↑	+	1.2↑	99.0↑	90.0↑	1.0↓	
		UPRM200U	=	1.8↑	+	1.0↑	99.0↑	95.0↑	1.0↓	Resistivity >18.1㏁.㎝ (in 30min) △TOC<5ppb (in 120min)
		UPRM220U	=	1.9↑	+	1.0↑	99.0↑	95.0↑	1.0↓	
		UPRM240U	=	1.9↑	+	1.2↑	99.0↑	95.0↑	1.0↓	
		UPRM300U	=	1.8↑	+	1.0↑	99.9↑	97.0↑	0.1↓	Resistivity >18.2㏁.㎝ (in 30min) △TOC<1ppb (in 180min) Na<1, Fe<1, Ca<1, Zn<0.5, Al<0.5, Cu<0.5
		UPRM320U	=	1.9↑	+	1.0↑	99.9↑	97.0↑	0.1↓	
		UPRM340U	=	1.9↑	+	1.2↑	99.9↑	97.0↑	0.1↓	

※ Feed water(100 Series) : Conductivity 10㎲/㎝ RO outlet, SV36 Feed water(200, 300 Series) : Resistivity >17.5㏁.㎝, TOC<2ppb, SV=30

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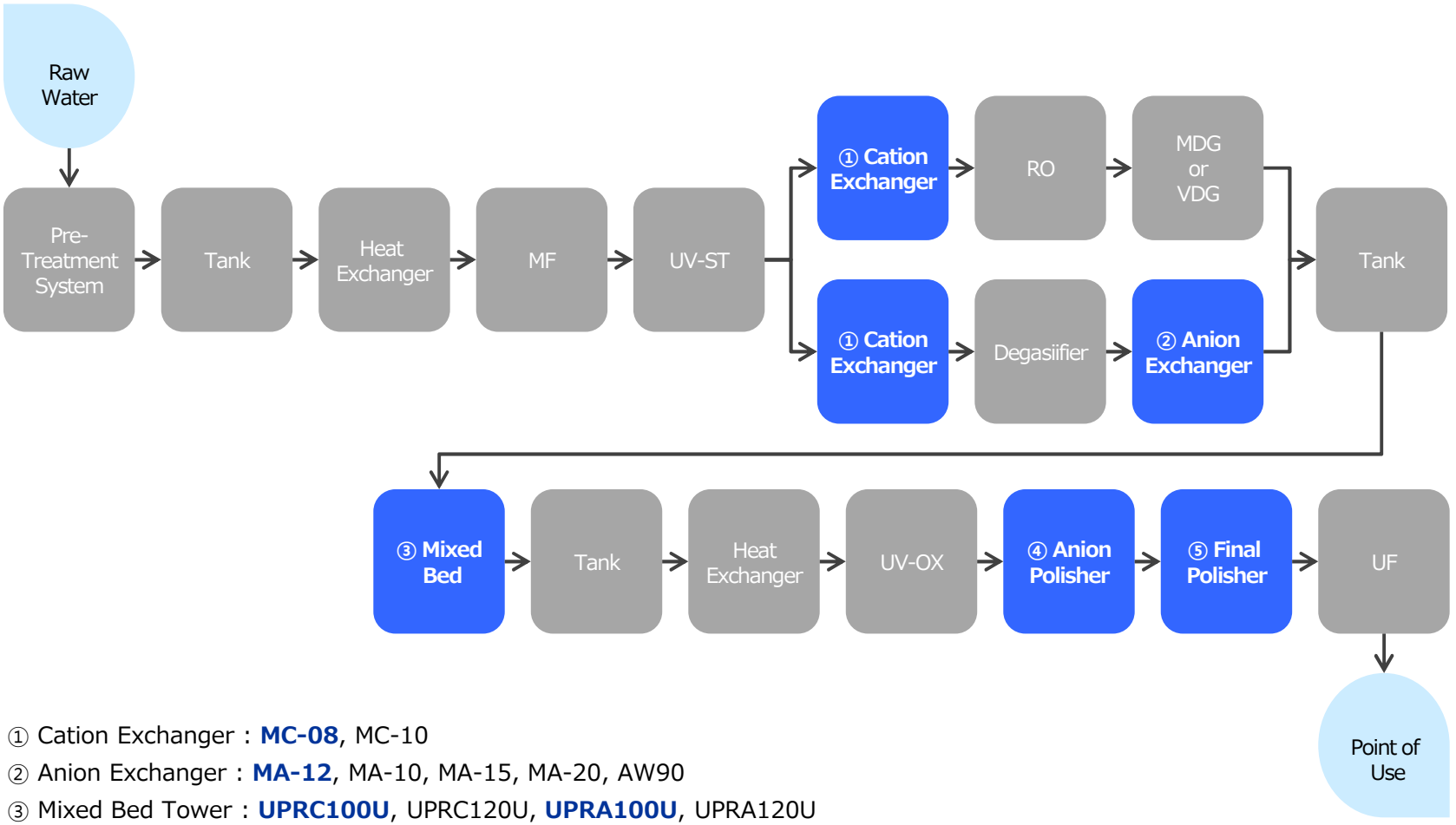
7. Product line of TRILITE

(Demineralization system for ultrapure water and IER selection)



① Cation Exchanger : **MC-08**, MC-10
② Anion Exchanger : **MA-12**, MA-10, MA-15, MA-20, AW90
③ Mixed Bed Tower : **UPRC100U**, UPRC120U, **UPRA100U**, UPRA120U
④ Anion Polisher : **UPRA200U**, UPRA220U, UPRA240U, **UPRA300U**, UPRA320U, UPRA340U
⑤ Final Polisher : **UPRM200U**, UPRM220U, UPRM240U, **UPRM300U**, UPRM320U, UPRM340U

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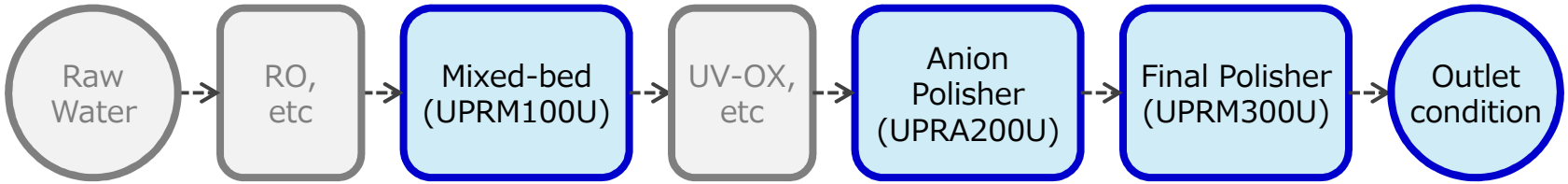
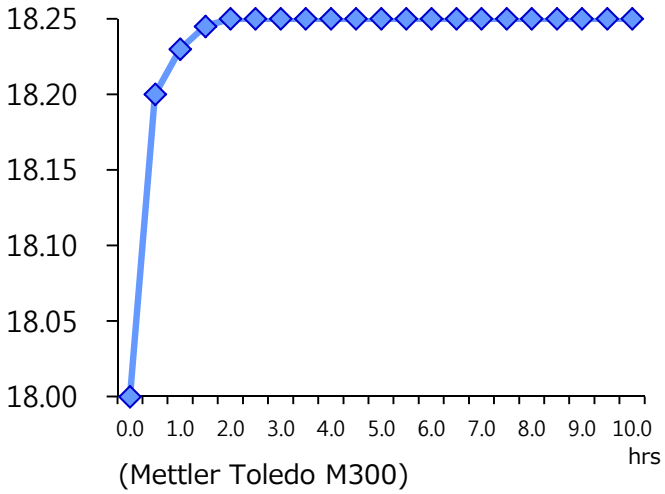
7. Product line of TRILITE

(Outlet condition of TRILITE UPW Resins)

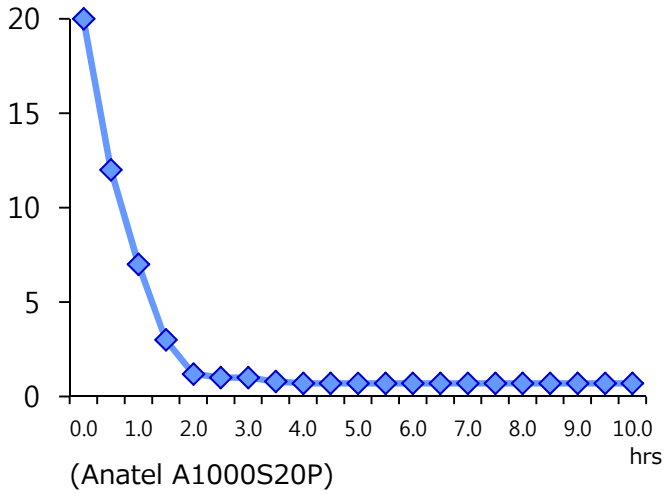


① Resistivity (MΩ·cm)



(Mettler Toledo M300)

② TOC (ppb)



(Anatel A1000S20P)

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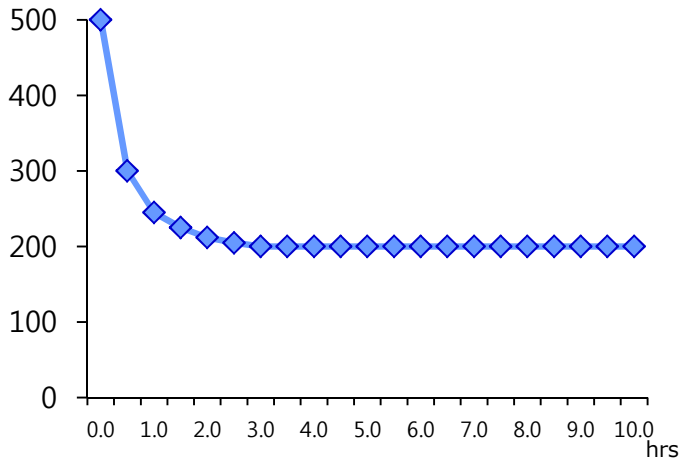
7. Product line of TRILITE

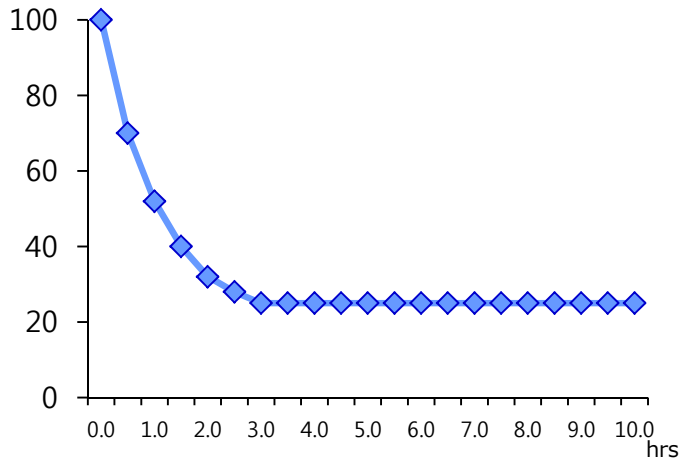
(Outlet condition of TRILITE UPW Resins)

③ Total Silica (ppt)



(HACH Series 5000 Silica Analyzer)

④ Boron (ppt)



(Sievers UPW Boron Analyzer)

⑤ Metals (ppt)

Li	Be	Na	Mg	Al	K	Ca	Ti	Cr	Mn	Fe	Co	Ni	Cu
< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Zn	Ga	As	Sr	Mo	Ag	Cd	Sn	Sb	Ba	Au	Pb	Bi	
< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	

⑥ Particle (0.05㎛/㎖): None
(RION XP-L4W)

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7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Chromatography cation resins					Chromatography anion resins				
	Type	Grade name	TEC (eq/ℓ)	Ionic form	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Ionic form	Particle distribution
UPS 	Gel	**MCK-30**	1.6↑	Na	210~230㎛	Gel type1	**MA-13J**	1.35↑	Cl	270~330㎛
		MCK-32	1.6↑	K	205~220㎛		MA-13F	1.4↑	Cl	220~240㎛
		MCK-35	1.6↑	Ca	200~220㎛	Gel type2	**MA-23F**	1.4↑	Cl	220~240㎛
		MCK-30J	1.6↑	Na	290~300㎛					
		MCK-32J	1.6↑	K	280~295㎛					
		MCK-35J	1.6↑	Ca	280~285㎛					
		MCK-30L	1.6↑	Na	310~345㎛					
		MCK-32L	1.6↑	K	320~340㎛					
		MCK-35L	1.6↑	Ca	300~330㎛					
		MCK-30K	1.6↑	Na	340~360㎛					
		MCK-32K	1.6↑	K	330~360㎛					
		MCK-35K	1.7↑	Ca	330~360㎛					
		MCK-35M	1.6↑	Ca	290~320㎛					
		MCK-22K	1.6↑	K	335~365㎛					
		MCK-22M	1.6↑	K	290~320㎛					
		MCK-50	1.9↑	Na	210~220㎛					
		MCK-52	2.0↑	K	205~225㎛					
		MCK-55	2.0↑	Ca	200~220㎛					
Functional group	Sulfonate					Type1 : TMA, trimethylamine Type2 : DMEA, dimethylethanolamine				

		Ionic form	Grade Example	Application Example
UPS SAC Gel Type		Na	MCK-30	Glucose/Oligosaccharide
		K	MCK-22M	Sucrose from molasses
		Ca	MCK-55	Fructose/Glucose
UPS SBA Gel Type	Type1	Cl	MA-13J	Biodiesel refining
	Type2		MA-23F	Acid purification

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7. Product line of TRILITE

(MCK series are the best choice as resins for chromatographic separation)

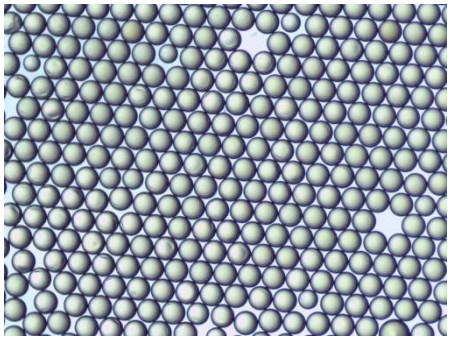
TRILITE MCK series are high quality uniform particle sized strongly acidic cation exchange resins used for chromatographic separation.

TRILITE MCK series are developed and manufactured by state-of-the-art technology, providing excellent characteristics and resin performance.

Lower uniformity coefficient (1.05~1.10) than other resins for chromatographic separation
→ Excellent separation efficiency

+

Higher physical & chemical strength
→ Longer life time



Crosslinkage	Ionic form	Average particle size: 210~220㎛ ●	283~295㎛ ●	305~328㎛ ●	340~350㎛ ●
5%	K			**MCK-22M(305㎛)**	MCK-22K(346㎛)
6%	Na	**MCK-30(220㎛)**	MCK-30J(295㎛)	MCK-30L(328㎛)	MCK-30K(350㎛)
	K	MCK-32(213㎛)	MCK-32J(288㎛)	MCK-32L(320㎛)	MCK-32K(345㎛)
	Ca	MCK-35(210㎛)	MCK-35J(283㎛)	MCK-35M(305㎛) MCK-35L(315㎛)	MCK-35K(340㎛)
8%	Na	MCK-50(215㎛)			
	K	MCK-52(215㎛)			
	Ca	**MCK-55(210㎛)**			

※ The data of crosslinkage and average particle size is reference

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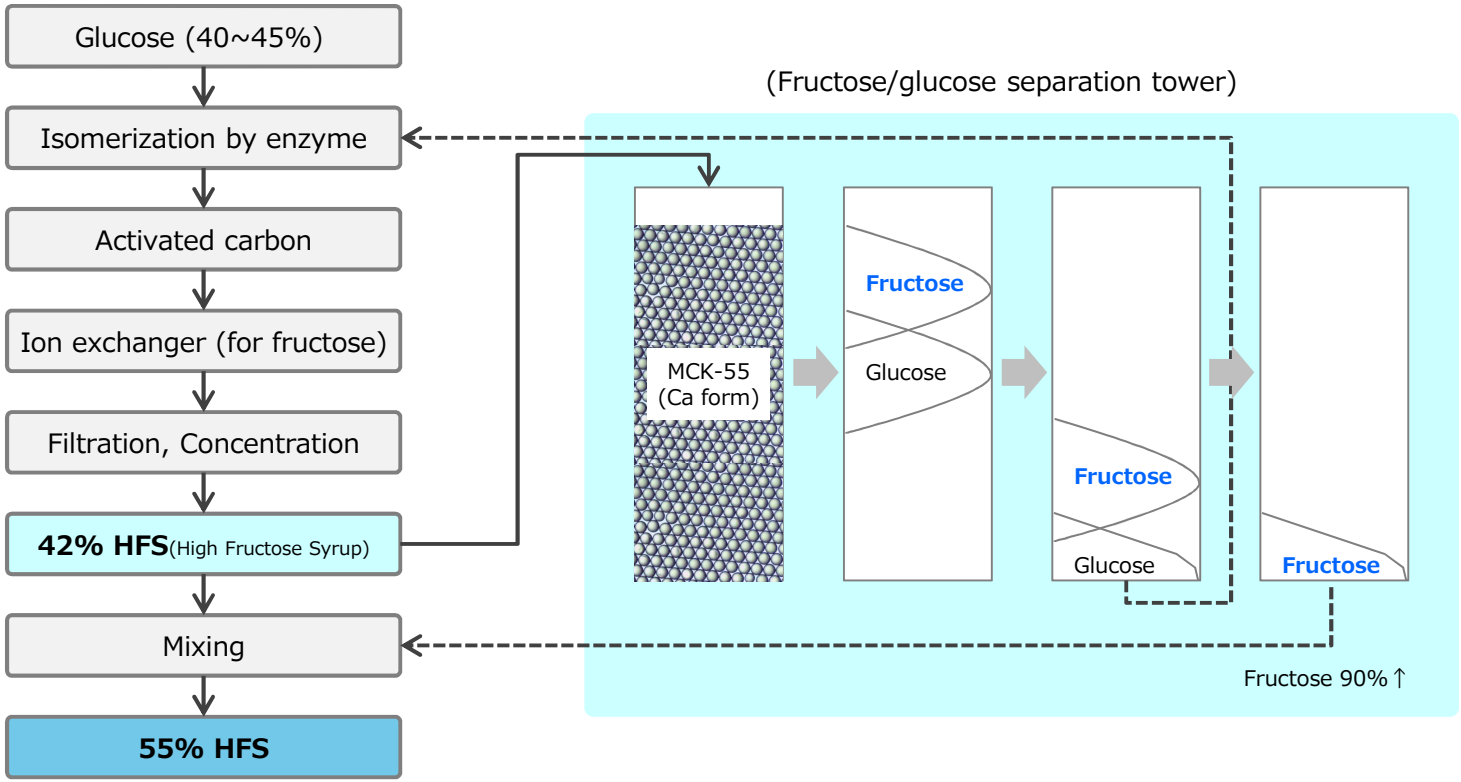
7. Product line of TRILITE

(Fructose/glucose separation by MCK-55)

Isomerization of fructose by the use of enzyme produces glucose which features a higher sweetness (1.7 times of sugar). The starch sugar is proved to be economically efficient and is substitutable to the use of sugar. However, the enzyme reaction is a reversible reaction. The isomerization is limited up to 42% (equal to 90% of sugar sweetness) due to reaction equilibrium. Hence, it is required to increase the glucose percentage up to 55%, with the IER technology.

A typical process to treat the fructose/glucose mixture with the Ca type ion exchange resin tower is described as below. As the mixture passes through the IER layers, glucose moves slower than fructose as it has a higher affinity with Ca ion. In this principal, fructose elutes in before the glucose. The collection of glucose is sold as a finished product, and the fructose is put to the previous process to react with isomerization enzyme.



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7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Strongly acidic cation resins (SAC)				Strongly basic anion resins (SBA)			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
Gaussian	Gel	SCRB	2.0↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜	Porous type2	AMP24	1.0↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜
	Porous	CMP18	1.8↑					
UPS	Gel	MC-08	2.0↑	0.55~0.65㎜				
Functional group	Sulfonate				Type2 : DMEA, dimethylethanolamine			

TRILITE 삼양 트리라이트 Ion Exchange Resin	Weakly basic anion resins (WBA)					
	Type	Grade name	TEC (eq/ℓ)	SBA/WBA Ratio	Particle distribution	Application
Gaussian	Porous	AW30L	1.5↑	25/75	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜	It can be used economically for the decolorization process and it is widely used in the starch sugar refining process. However, SBA ratio is a little bit high, so it should be used with caution in processes where isomerization reaction is concerned.
UPS		AW30C	1.6↑	5/95		High WBA ratio and excellent resistance to high temperature (100℃↓). It can be used in a process that the temperature of the process liquid is high or isomerization reaction is concerned(Fructose refining).
		AW90	1.6↑	17/83	0.50~0.60㎜	Low uniformity coefficient, it is recommended to be used in upflow process.
Functional group	Tertiary Amine					

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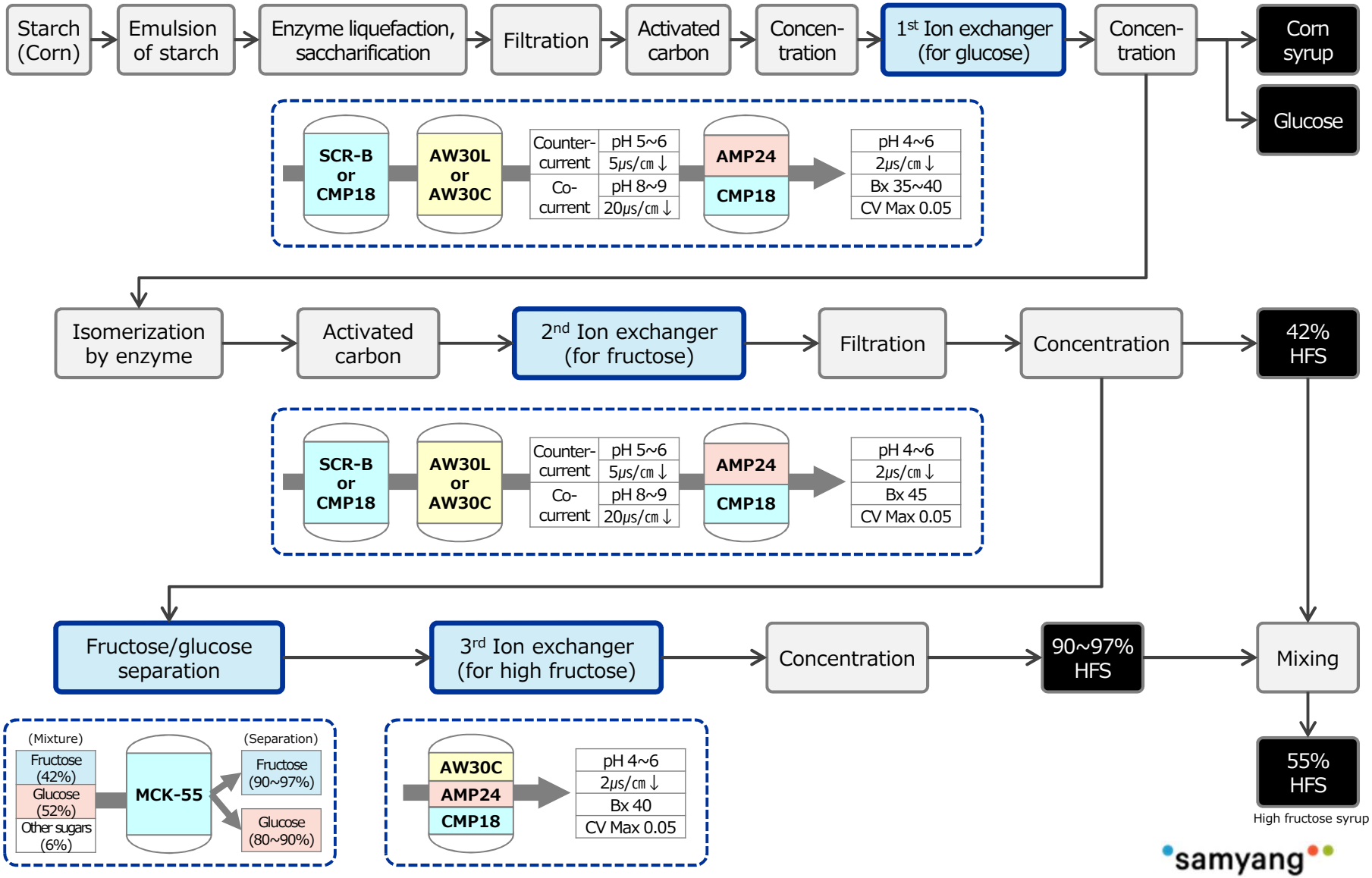
7. Product line of TRILITE

(Typical process of starch sugar refining and fructose/glucose separation)

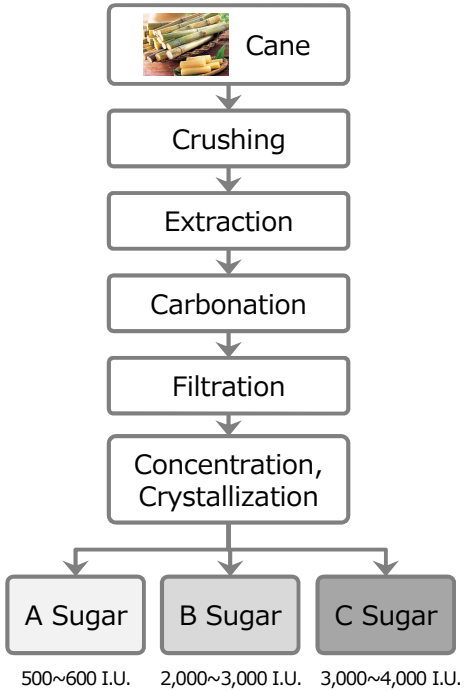


7. Product line of TRILITE

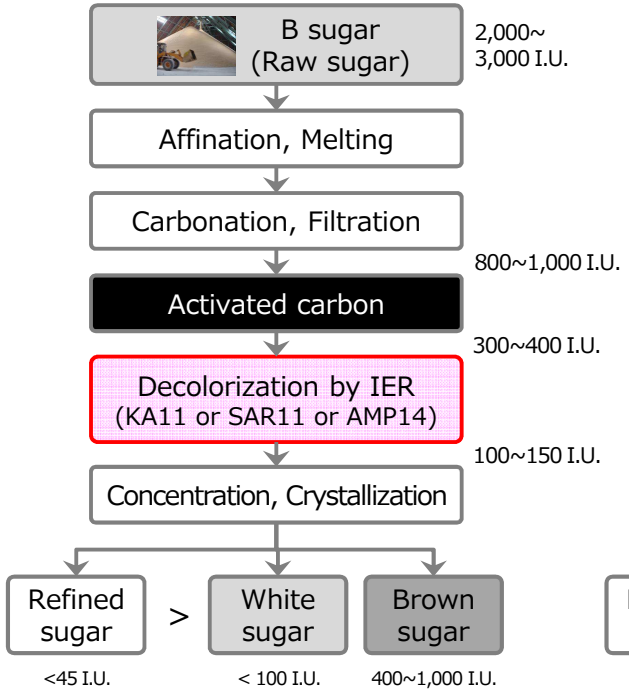
※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Sugar refining resins (With activated carbon)				Sugar refining resins (Without activated carbon)			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
Gaussian	Gel type1	KA-11 SAR11	0.9↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜	Porous (Polyacrylate +DVB)	ASP10	0.9↑	0.425~1.2㎜
	Porous type1 (Polystyrene +DVB)	AMP14	1.0↑					
Functional group	TMA, trimethylamine				Quaternary ammonium			

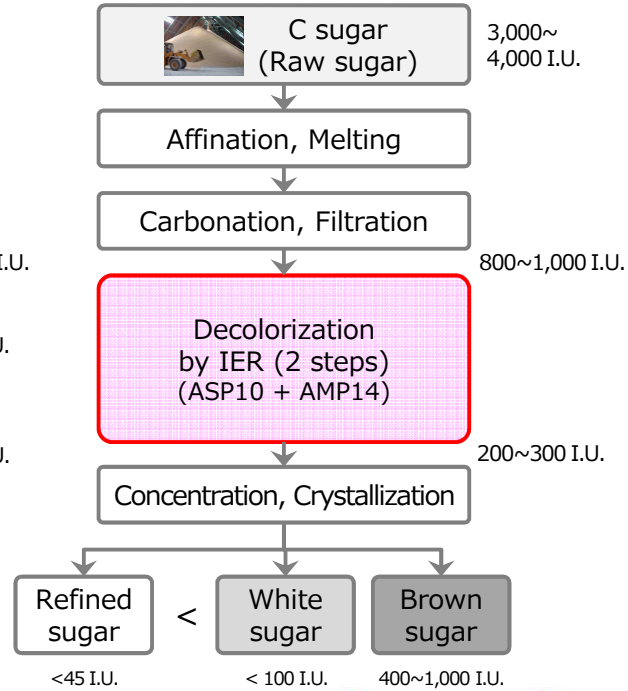
(Cane raw sugar refining process)



(Sugar refining process with A/C)



(Sugar refining process without A/C)



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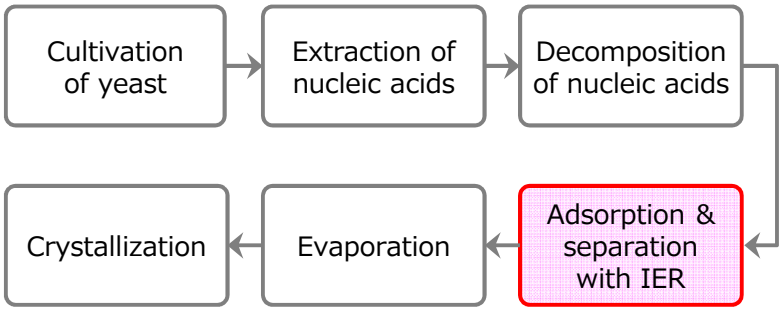
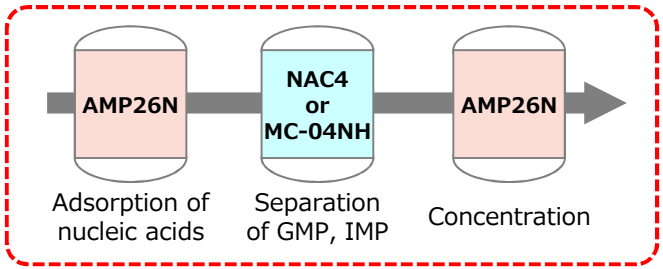
7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Nucleic acids adsorption resins				Lysine adsorption resins			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
Gaussian	Gel tailored SAC	NAC4	1.2↑	(General type) 0.3~1.2㎜ (L-type) 0.425~1.2㎜				
	Porous tailored SBA	AMP26N	1.2↑					
UPS	Gel	MC-04NH	1.2↑	0.47~0.57㎜	Gel tailored SAC	MC-08LS	2.0↑	0.55~0.65㎜

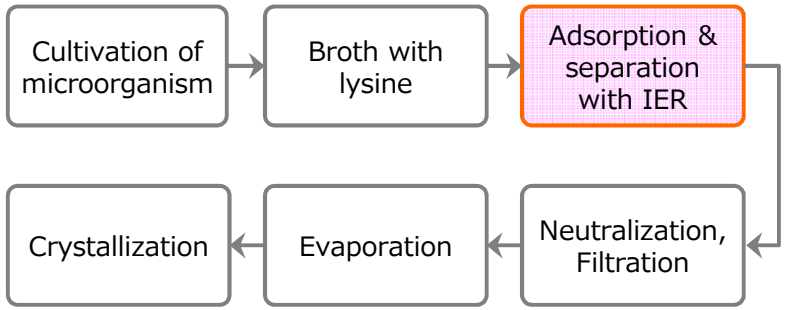
(Typical process of nucleic acid adsorption/separation process)

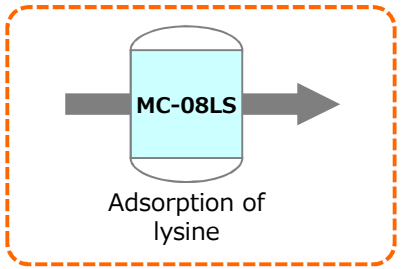




※ GMP : Guanosine monophosphate
IMP : Inosine monophosphate

(Typical process of lysine adsorption/separation process)





※ Lysine : essential amino acid

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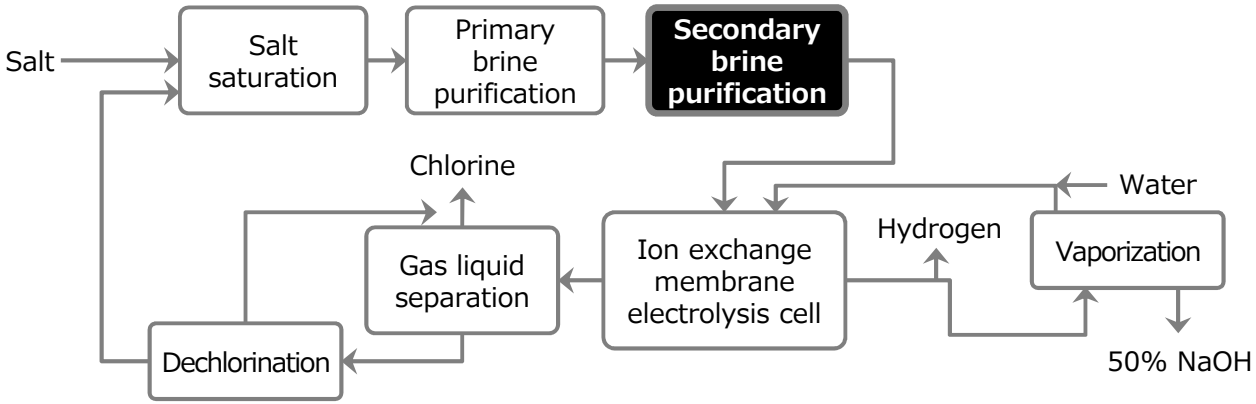
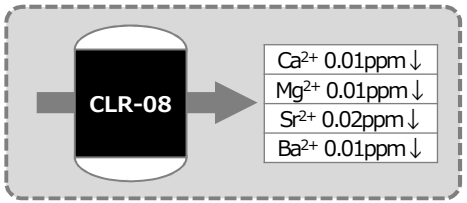
7. Product line of TRILITE

TRILITE 삼양 트리라이트 Ion Exchange Resin	Chelating resins						
	Grade name	Functional group	Ionic form	TEC (eq/ℓ)	Particle distribution	Application	Equivalent
Gaussian	CLR-08	Iminodiacetate	Na	Cu^{2+} 0.5↑ Ca^{2+} 0.4↑	0.4~1.0㎜	Brine purification	Lewatit TP208 Amberlite IRC748 Diaion CR11 Purolite S930
	CLR-09	Aminomethyl phosphonate	Na	Ca^{2+} 0.6↑	0.4~1.0㎜	Brine purification	Lewatit TP260 Amberlite IRC747 Purolite S940
	CLR-10	Thiouronium	H	1.1↑	0.3~1.25㎜	Mercury removal	Eporous-Z7 Purolite S924
	CLR-20	Polyamine	OH	4mol as copper↑	0.4~1.25㎜	Heavy metal removal	Diaion CR20 Eporous MX-8C
	CLR-B3	Glucamine	Free base	0.6eq/ℓ as boron↑	0.3~1.25㎜	Boron removal	Diaion CRB03 Amberlite IRA743 Purolite S108
	CLR-B3UP	Glucamine	Free base	0.6eq/ℓ as boron↑	0.3~1.25㎜	Boron polisher (TOC 5ppb↓)	Diaion CRBT03
	CLR-F	Aminophosphonate	Al	11g as fluorine↑	0.3~1.0㎜	Fluoride removal	Eporous-K1
	CLR-N	Triethylamine	Cl	1.0↑	0.3~1.25㎜	Nitrate removal	Amberlite IRA996 Purolite A520E

(Typical process of chloro-alkali process)



(Secondary brine purification)



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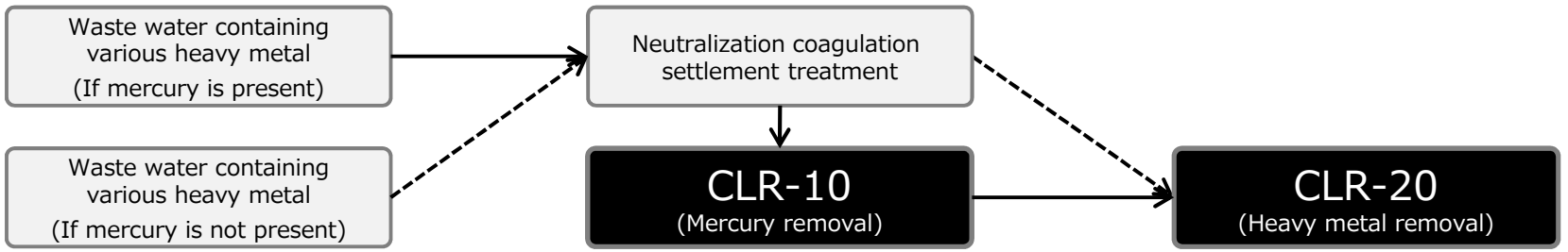
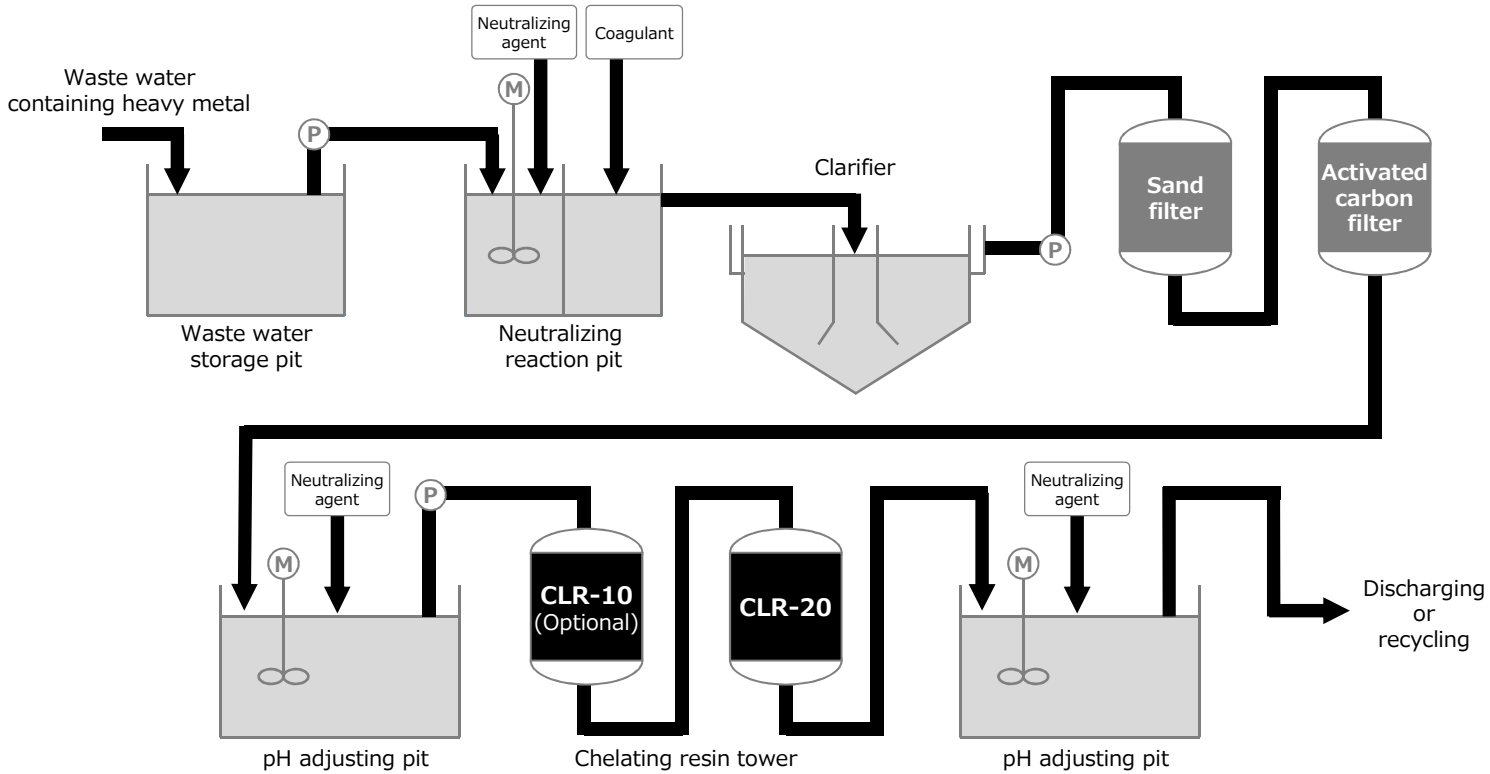
7. Product line of TRILITE

(Typical process of removing heavy metal from waste water)





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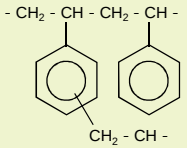
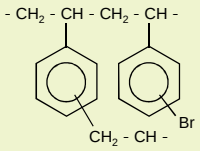
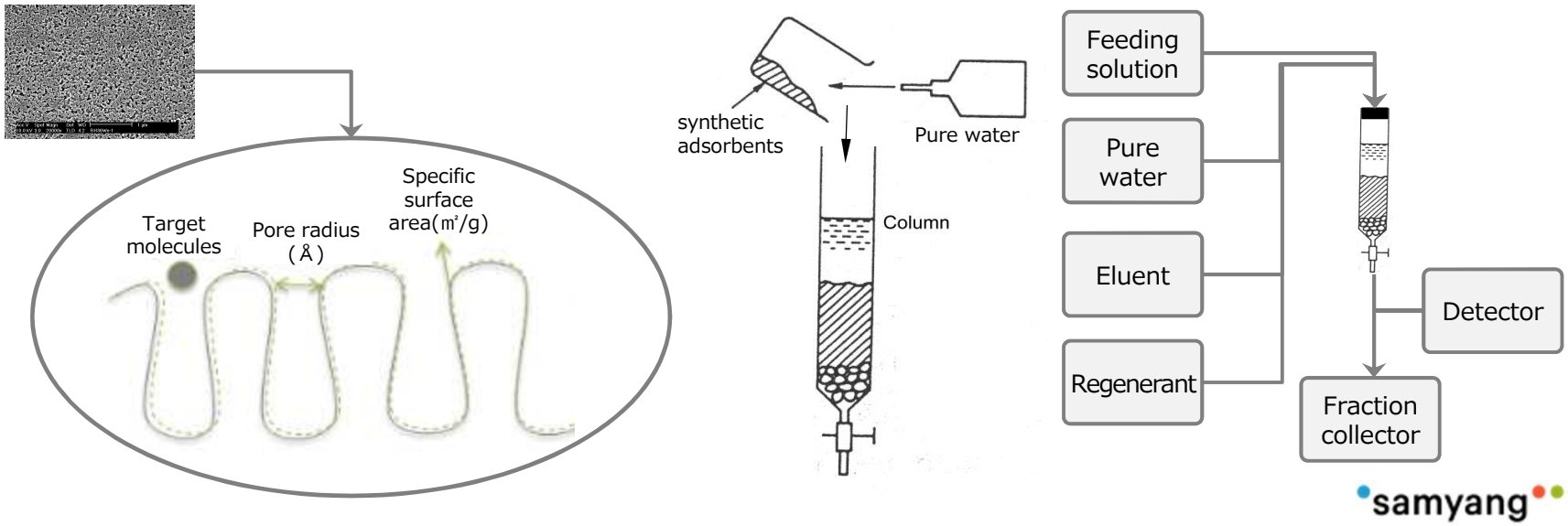
7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Synthetic adsorbents							
	Grade name	Chemical structure	Specific surface area(㎡/g)	Pore volume (㎖/g)	Pore radius (Å)	Particle distribution	Application	Equivalent
Styrene type	GSH-20		750↑	1.0~1.5	50~80	0.31~1.25㎜	Purification and decolorization of protein, antibiotics and food	Diaion HP20
	GSP-25		1,100↑	1.2~1.6	45~55	0.25~0.7㎜		Diaion SP825
	GSP-50		1,000↑	0.9~1.1	30~50	0.25~0.7㎜		Diaion SP850
Chemically modified styrene type	GSP-07		600↑	0.8~1.0	50~70	0.25~0.7㎜		Diaion SP207

(The reaction mechanism of synthetic adsorbents and experimental apparatuses)



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7. Product line of TRILITE

(Selection of Synthetic adsorbents)

Aromatic standard type GSH-20	Bigger pore radius **Suitable for absorbing large molecules (> 1,000mw)** Easy elution of absorbed materials
Aromatic special type GSP-25, GSP-50	Larger specific surface area, smaller pore radius than GSH20 **Suitable for selectively absorbing small molecules (< 1,000mw)** Easy elution of absorbed materials
Aromatic chemically modified GSP-07	Highly hydrophobic and **strong adsorption ability** May require a large amount of regenerant Shipping density is high, so can be used in high density solutions

(How to use synthetic adsorbents)

	Procedure	Flow rate (SV)	Flow volume (BV)	Remarks
Conditioning	Backwash	-	-	Removal of small and broken particles
	Pretreatment	1~5	5~10	Alcohol or aqueous alcoholic solution
	Washing	1~5	3~4	Water of buffer solution (same pH as feed solution)
Adsorption, Elution	Adsorption	0.5~3	Loading amount should be lower than maximum adsorption capacity	
	Washing	1~5	0.5~1	Removal of feed solution
	Elution	0.5~3	2~10	Separating absorbed target materials from adsorbent. If the elution is difficult, use organic solvents such as alcohol and acetone as eluent. In case of electrolyte, use acid and alkali as eluent.
	Washing	1~5	3~4	Water of buffer solution (same pH as feed solution)
Regeneration	Regeneration	0.5~3	3~4	Operate with organic solvents such as alcohol, acetone, IPA and acid, alkali once in a few cycles
	Washing	1~5	3~4	Rinse of adsorbent

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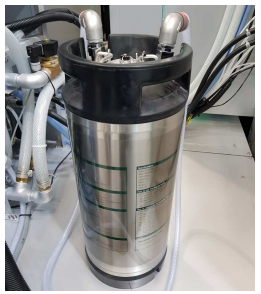
7. Product line of TRILITE

(Selection of Ready to use mixed resins)

Grade name	Feature & Application	Components	Treated Water Quality	
SM200	Simple production of pure water from tab water For Laboratories, Wire-cutting(EDM)	KC-08H(H^+ 99.0%↑) KA-12OH(OH^- 90.0%↑) Mixed ratio(Volume) : 45:55	Out	**Guarantee) Resistivity > 10.0 MΩ·cm (in 10min.)** **Actual) Resistivity > 15.0 MΩ·cm (in 10min.)**
			Feed	Conductivity 150㎲/㎝ Potable water, SV36
SM210	Simple production of pure water from tab water For Laboratories, Wire-cutting(EDM)	SCR-BH(H^+ 99.0%↑) SAR12OH(OH^- 95.0%↑) Mixed ratio(Volume) : 45:55	Out	**Guarantee) Resistivity > 10.0 MΩ·cm (in 10min.)** **Actual) Resistivity > 15.0 MΩ·cm (in 10min.)**
			Feed	Conductivity 150㎲/㎝ Potable water, SV36
SM300	High Resistivity and superb SiO_2 removal ability MB for Post-RO and EDI	SCR-BH(H^+ 99.0%↑) SAR12OH(OH^- 95.0%↑) Mixed ratio(Volume) : 40:60	Out	**Guarantee) Resistivity > 15.0 MΩ·cm (in 10min.)** **Actual) Resistivity > 17.0 MΩ·cm (in 10min.)**
			Feed	Conductivity 10㎲/㎝ RO outlet, SV36
UPRM100U (UPS grade)	Very high resistivity Electronics Grade Ultrapure water	UPRC100U(H^+ 99.0%↑) UPRA100U(OH^- 95.0%↑) Mixed ratio(Capacity) : 50:50	Out	**Guarantee) Resistivity > 17.0 MΩ·cm (in 10min.)** **Actual) Resistivity > 18.0 MΩ·cm (in 10min.)**
			Feed	Conductivity 10㎲/㎝ RO outlet, SV36
UPRM200U (UPS grade)	Very high resistivity, Low ΔTOC level LCD, OLED Ultrapure water final polisher	UPRC200U(H^+ 99.0%↑) UPRA200U(OH^- 95.0%↑) Mixed ratio(Capacity) : 50:50	Out	**Resistivity >18.1㏁·㎝ (in 30min.)** **△TOC<5ppb (in 120min.)**
			Feed	Resistivity >17.5㏁·㎝, TOC<2ppb, SV30
UPRM300U (UPS grade)	Extremely high resistivity Extremely low ΔTOC level Metal ion < 0.1ppt Semiconductor Ultrapure water final polisher	UPRC300U(H^+ 99.9%↑) UPRA300U(OH^- 97.0%↑) Mixed ratio(Capacity) : 50:50	Out	**Resistivity >18.2㏁·㎝ (in 30min.)** **△TOC<1ppb (in 180min.)** **Metal ion < 0.1ppt**
			Feed	Resistivity >17.5㏁·㎝, TOC<2ppb, SV30

(Pressure vessel for RO unit)

(Cartridge polisher for wire-cutting)



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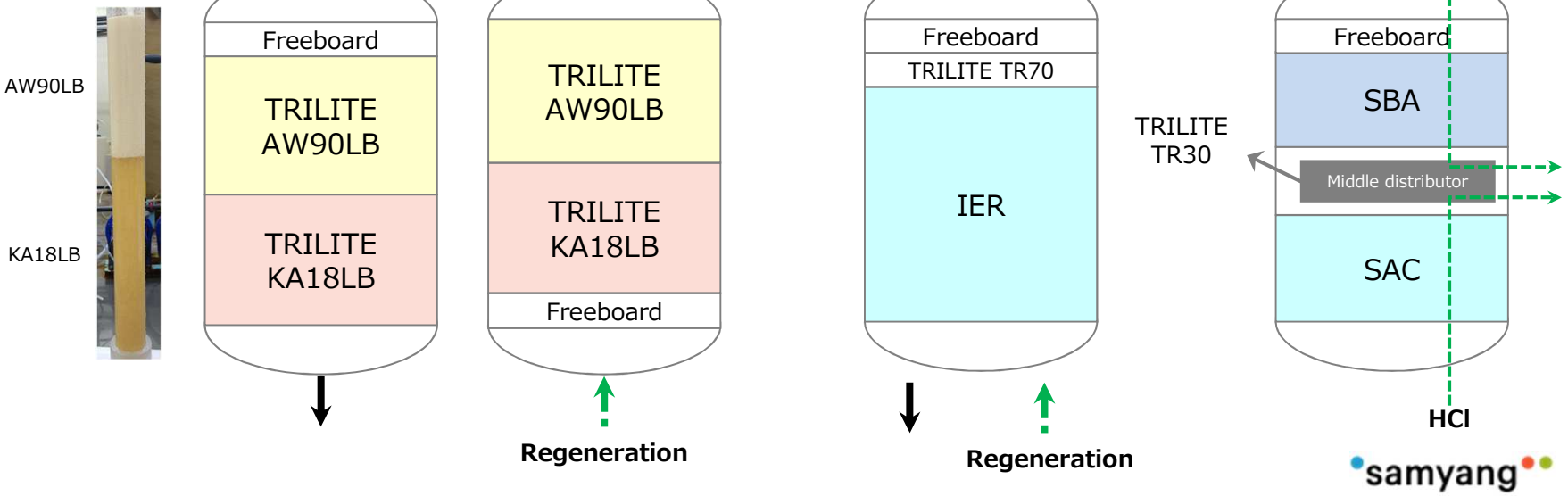
7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Layered bed anion resins				Inert resins				
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Grade name	Matrix	Shipping density(g/ℓ)	Particle distribution	Application
UPS	Porous WBA	AW90LB	1.6↑	0.5~0.6㎜	TR70	Poly-ethylene	500	1.2~1.8㎜	Inert resin for packed bed
Gaussian	Gel type1	KA18LB	1.3↑	0.6~1.2㎜	TR30	Polystyrene +DVB	725	0.7~0.9㎜	Inert resin for triobed



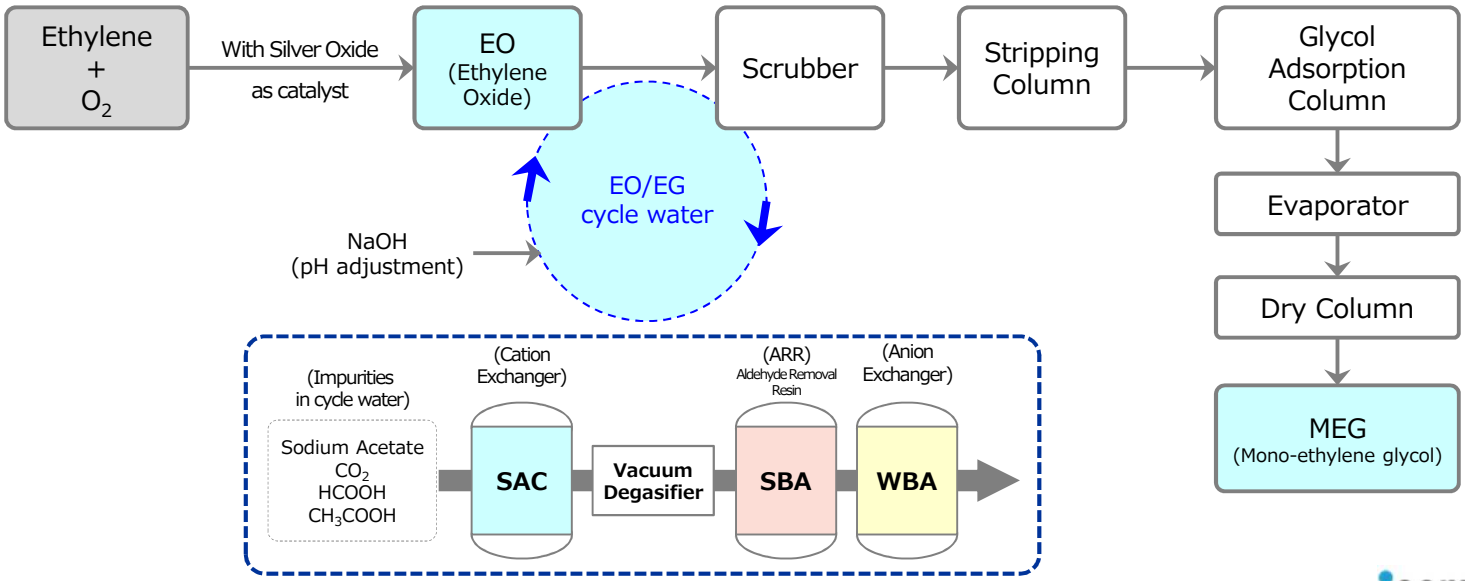
7. Product line of TRILITE

※ TEC: Total Exchange Capacity

TRILITE 삼양 트리라이트 Ion Exchange Resin	Strongly acidic cation resins (SAC)				Strongly basic anion resins (SBA)			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution	Type	Grade name	TEC (eq/ℓ)	Particle distribution
Gaussian	Cation Exchanger	SPC260EGH	1.7↑	0.3~1.2㎜	ARR	AMP16EG	1.2↑	0.3~1.2㎜

TRILITE 삼양 트리라이트 Ion Exchange Resin	Weakly basic anion resins (WBA)			
	Type	Grade name	TEC (eq/ℓ)	Particle distribution
UPS	Anion Exchanger	AW90EG	1.6↑	0.50~0.60㎜

(Typical MEG production process)



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8. Product analysis / Quality control

Basic | Performance

samyang Corporation (Ulsan Plant)

samyang fine technology (Gunsan Plant)

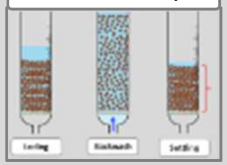
Product hopper

Sampling

ISO9001 Lloyd's Register LRQA

(Basic product analysis)

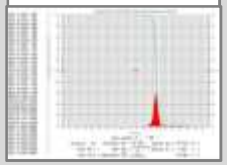
Bulk density



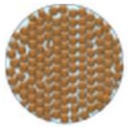
Moisture retention

Exchange capacity

Particle distribution



Whole bead count

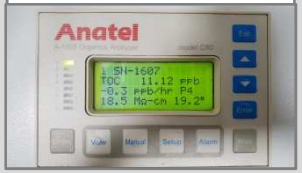


(Optional product analysis for H/OH type resin, catalyst, ultrapure water resin)

H/OH Conversion rate

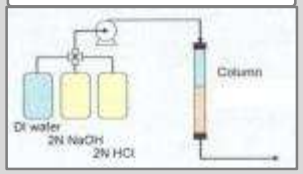
Resistivity

ΔTOC

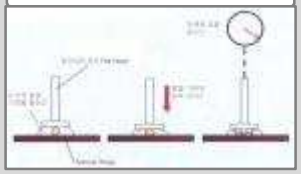


(Periodical product analysis)

osmotic shock stability



Friability



Keeping samples (for 4years)

DB

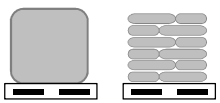
Quality test

N

Y

Process analysis

Packing



COA (From DB)

Shipping

Customer

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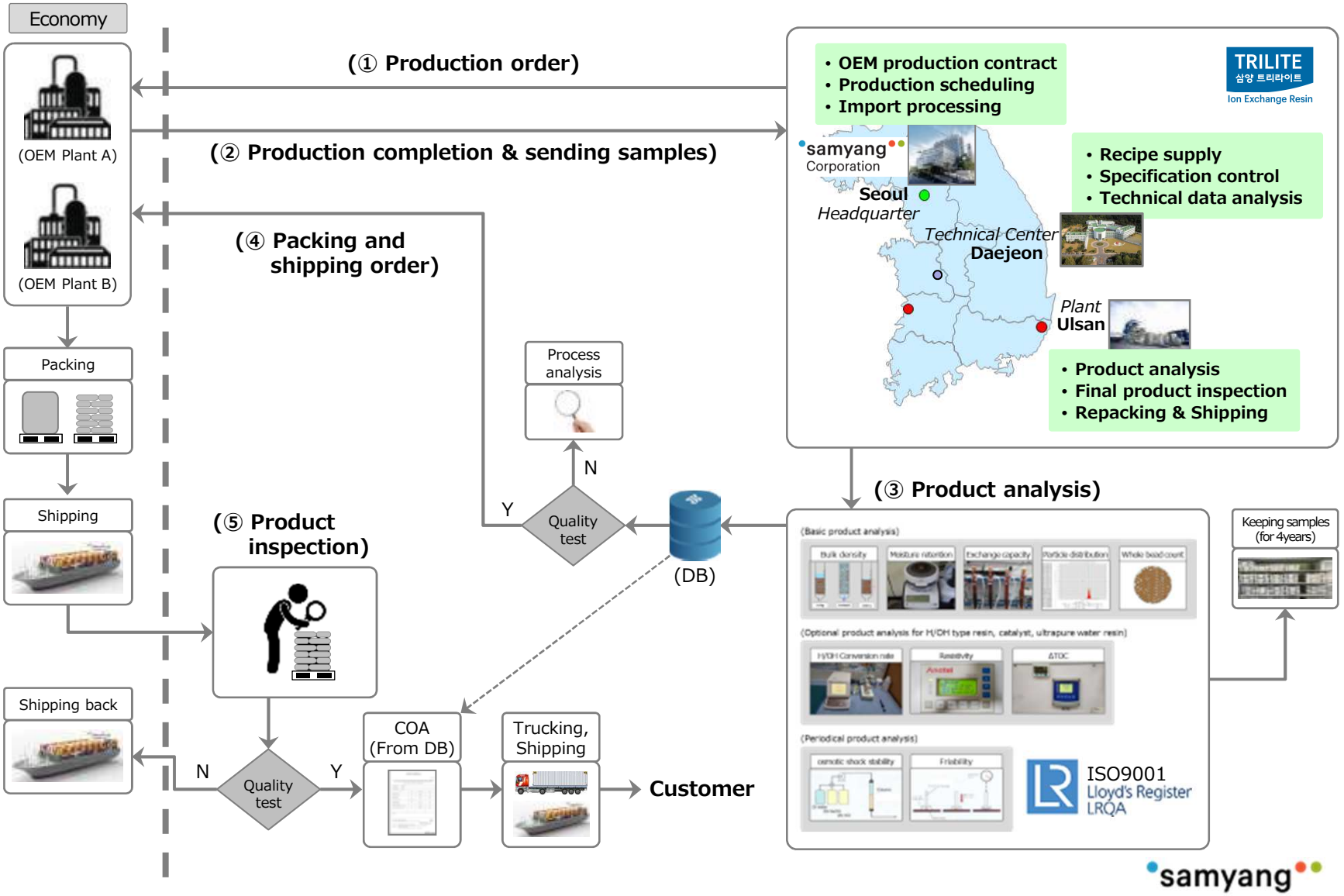
9. Product analysis / Quality control (OEM)

TRILITE OEM products are manufactured under the strict quality control; the recipe and the technical guidance. Our quality management system assures the credible quality of final products.



10. Quality assurance system

Quality standard and total quality management
are both necessary for any organization to become world class.
The commitment to total quality operations is a way of life in Samyang.

ISO9001 Certificate

Lloyd's Register LRQA

Lloyd's Register LRQA

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Samyang Fine Technology Corporation
63, Jayumuyeok 1-gil
Gunsan-si, Jeonbuk, Korea

has been approved by Lloyd's Register Quality Assurance to the following Quality Management System Standards:

ISO 9001: 2015

The Quality Management System is applicable to:

Manufacture of ion exchange resin.

Approval Certificate No: SEO 6040809

Original Approval: 29 August 2016
Current Certificate: 29 August 2016
Certificate Expiry: 28 August 2019

Issued by: LRQA(Korea) Ltd. for and on behalf of Lloyd's Register Quality Assurance Limited

HALAL Certificate

MUI
JAKIM
KMF

KOREA MUSLIM FEDERATION

HALAL CERTIFICATION

KMFHC17-182 Date: 08. Jan. 2017

TO WHOM IT MAY CONCERN

Halal Committee of Korea Muslim Federation hereby certifies that the products listed below mentioned have met the Halal requirements in accordance with the Islamic law.

1. Cation Exchange Resin
2. Anion Exchange Resin

(Two Products Only)

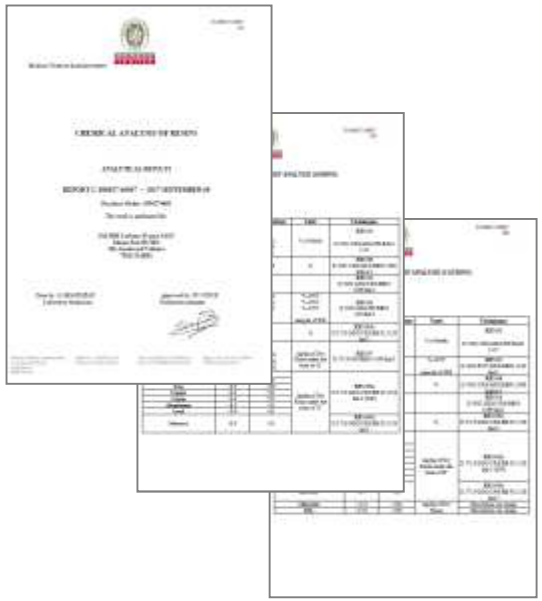
Distributor : Samyang Corporation
Manufacturer : Samyang Corporation Ulsan plant

Valid until 1-07, Jan. 2018

Yours in Islam

Muhammad Kim Dong Soo
Chairman of the Halal Committee

Veritas Certificate



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11. Packing line, packing type

(Automatic packing line : 25ℓ PE Bag)

(Manual packing line : 1,000ℓ Bag, plastic/fiber drum)

25Liters
PE bag

1,000Liters Ton bag | 50Liters Plastic drum | 5 or 7ft³ Fiber Drum | 5Liters Vacuum bag

Palletizing, container loading

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12. Technical service

1

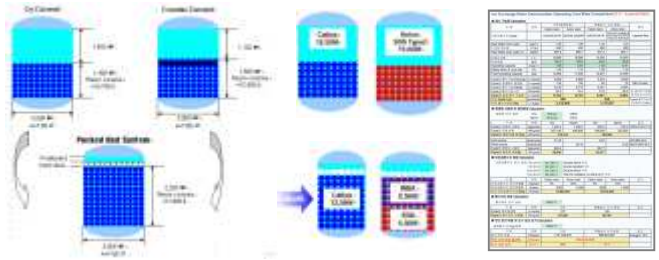
Ion exchange resin analysis report

2

Ion exchange resin calculation program

3

Facilities diagnosis, retrofit proposal



4

Application process development

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13. Major customers

Samyang has provided its TRILITE resins to practically every companies in Korea from 1970s since it is the only resin manufacturer in Korea. The below is a few of representative customers using TRILITE resins.

Oil & Petrochemical

GS Caltex
SK energy
LOTTE CHEMICAL
LG Chem
S-OIL
SK chemicals

Electronics

LG Display
SAMSUNG
SK hynix

Power

KEPCO Korea Electric Power Corp.
KHNP Korea Hydro & Nuclear Co.
KOREA DISTRICT HEATING CORP.
POSCO ENERGY

Food

CJ
DAESANG
Ingredion

Steel

posco
HYUNDAI STEEL

Engineering

SAMSUNG
DAELIM
MITSUBISHI HEAVY INDUSTRIES, LTD.

14. Major References – Power & UPW

Customer Name	Location	Application	Resin Type	Web Site
KOREA ELECTRIC POWER	Seoul, Korea Indonesia South Afreeca	Demineralization Condensate Polishing	SCR-B / SAR10 /SAR20 / CMP / AMP / AW90 / UPRM / TR70	http://cyber.kepco.co.kr/kepco/main.do
KOREA HYBRID & NUCLEAR POWER	Seoul, Korea	Demineralization Condensate Polishing	SCR-B / SAR10 / SAR20 / MC08 / MA12 / MA20 / UPRM	http://cms.khnp.co.kr
SAMSUNG ELECTRONICS	Hwasung, Korea	Demineralization Chemical Purification	MC / MA / UPR Series	www.samsungsvc.co.kr
SAMSUNG DISPLAY	Asan, Korea Suzhou, China	Demineralization UPW	MC / MA / UPR Series	http://www.samsungdisplay.com
SAMSUNG ELECTRO-MECHANICS	Ulsan, Korea	Demineralization	SCR / SAR Series	http://www.samsungsem.co.kr
SK HYNIX	Incheon, Korea	Demineralization Ultra Pure Water	MC / MA / UPR Series	http://skhynix.com
LG DISPLAY	Gumi, Korea Paju, Korea China	Demineralization UPW	MC / MA / UPR Series	http://www.lgdisplay.com

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14. Major References – Power (China & Taiwan)

Region	Customer Name (for Condensate polishing)		Products	
			Cation	Anion
China (16.6~)	JIANGSU SHAZHOU Power Plant		TRILITE MC-10H	TRILITE MA-10OH
	NEIMENGGU TUOKETUO Power Plant			
	SHILIQUAN Power Plant			
Taiwan (17.01~)	Maanshan Nuclear Power plant		TRILITE MC-10HUP	TRILITE MA-10OHUP

电力工业热力发电设备及材料质量检验测试中心

检 验 报 告

(Test result passed)

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14. Major References – Power (Overseas, 2016~)

Company	Type	Capacity(MW)	Start Year	Resin Types	Delivery Date
MAANSHAN NUCLEAR POWER PLANT (Taiwan)	Nuclear CPP (PWR)	951 X 2	1985	MC-10HUP, MA-10OHUP	2017.02
Thermal Power Station-9 (Russia Angarsk)	Thermal Make-up	475	1958	MA-12 AW-90	2017.05
TUKETUO POWER PLANT (China Inner Mongol)	Thermal CPP	600 X 8 300 X 2	1995	MC-10H MA-15OH	2016.11
SHAZHOU POWER PLANT (China Zhangjiagang)	Thermal CPP	1.000 X 2 630 X 2	2006	MC-10H MA-10OH	2017.03
ZAOZHUANG POWER PLANT (China Shandong)	Thermal CPP	300 X 2	2015	MC-10H MA-10OH	2017.02
FUSHUN POWER PLANT (China Liaoning)	Thermal CPP	50 X 2	2016	MC-10H MA-10OH	2017.01
WUJIANFANG POWER PLANT (China Inner Mongol)	Thermal CPP	660 X 2	2017	MC-10H MA-10OH	2017.04
Tanjung Jati Power Plant - Unit 3&4 (PT. KPJB)	Thermal Make-up	660 MW x 2	2017	MC-08, MA-20, MA-12	2017.04
Tanjung Power Indonesia KALSEL-1 Coal Fired Power Plant	Demi. Make-up	1,000MW x 2	2017	MC-08H, MA-12	2017.05

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14. Major References – Oil & Petrochemicals

Customer Name	Location	Application	Resin Type	Web Site
GS CALTEX	Yeosu, Korea	Demineralization	MC / MA Series / TR70	http://www.gscaltex.com
SK	Ulsan, Korea	Demineralization, Methanol Purification	MC Series / MA Series / TR70 SPC Series	http://eng.skinnovation. com
S-OIL	Ulsan, Korea	Demineralization	MC Series / MA Series / TR70 AW Series	http://www.s-oil.com
HYUNDAI OILBANK	Daesan, Korea	Demineralization	MC Series / MA Series/ TR70	http://www.oilbank.co.kr
HANWHA CHEMICAL	Yeosu, Korea	Demineralization	MC / MA / SCR / SAR Series	http://hcc.hanwha.co.kr
KUMHO P&B	Yeosu, Korea	BPA Catalyst	PCC Series	http://www.kpb.co.kr
HYOSUNG	Jiaxing, China Ulsan, Korea	Catalyst (PTMEG / PTMA) / Demineralization	SPC / SCR / SAR Series	http://www.hyosung.co.kr

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14. Major References – Chemicals, Steel/Fertilizer

Customer Name	Location	Application	Resin Type	Web Site
LG CHEM	Seoul, Korea	Demineralization	MC Series / MA Series/ TR70 /SCR Series / SAR Series	http://www.lgchem.com
LG MMA	Yeosu, Korea	MMA Catalyst	PCC / SPC Series	https://www.lgmma.com
LOTTE CHEMICAL	Malaysia, Ulsan/ Yeosu/ Seosan, Korea	Demineralization EO/EG, Catalyst	SPC /MC / MA Series	http://www.lottechem. com
POSCO	Pohang, Korea Jakarta, Indonesia	Ultra Pure Water Demineralization	MC Series / MA Series/ TR70 /SCR Series / SAR Series /UPRM Series	www.posco.co.kr
HYUNDAI STEEL	Dangjin, Korea	Demineralization	SCR Series / SAR Series	https://www.hyundai-steel.com
WUHAN Engineering	Wuhuan, CHINA	Catalyst (PTMEG / PTMA)	SPC / CMP / AMP Series	
PT. Petrokimia Indonesia	Gresik, Indonesia	Demineralization	MC-08, AMP16	www.petrokimia-gresik.com

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14. Major References – Food & Bio

Customer Name	Location	Application	Resin Type	Web Site
Cheil Jaedang	Liaocheng, China Shenyang, China Jombang, Indonesia Incheon, Korea	Nucleic Acid / Lysine Sugar / Sweetener Demineralization	NAC4 / AMP / MC / MA Series / SCR-B / SAR10 / SAR11 / SAR20	http://cj.net
Daesasng (Miwon)	Gresik, Indonesia Gunsan, Korea	MSG / Lysine Sweetener/ DI Water	MC Series / SCR-B / SAR20 / AW90	http://www.daesang.co.kr
Ingredion Incorporated	Iecheon, Korea Bupyoung, Korea	Sweetener	CMP / AMP / SCR-B / SAR10 / MCK series	http://www.ingredion. com
LG House hold and	Ulsan, Korea	Sorbitol purification Demineralization	SCR / SAR Series	http://www.lgcare.com

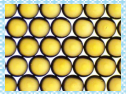
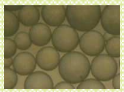
14. Major References - Eng'g Projects

Customer Name (EPC)	Location (Project Name)	Application	Capacity	Web Site
SAMSUNG **Samsung Engineering**	Saudi Arabia, (Saudi ma'aden Ammonia Project)	Demineralization / Condensate Polishing System (ACF+2B2T+MBP)	280㎥/h x 2 trains 350㎥/h x 3 trains	http://www.samsungengineering.co.kr
	Saudi Arabia, (APPC PDH/PP Project)	Demineralization (ACF+2B3T+MBP)	120㎥/h x 2 trains	
	India (IOCL MEG Project)	MEG Purification System / Cycle water treating unit	39㎥/h x 2 trains	
	Thailand	EO/EG Purification System / Cycle water treating unit	39㎥/h x 2 trains	
DAELIM **Daelim Ind.**	Saudi Arabia, (Umm Wu'al Ammonia Project)	Demineralization / Condensate Polishing System (ACF+2B2T+MBP)	280 ㎥/h x 2 train 350 ㎥/h x 3 train	https://www.daelim.co. kr/eng/main.do
MITSUBISHI HEAVY INDUSTRIES, LTD. **Mitsubishi Heavy Ind.**	Saudi Arabia, (Ar-Razi Saudi Methanol Project)	Demineralization (S/F+ACF+2B3T+MBP)	100㎥/h x 2 trains	https://www.mhi-global.com/
	Algeria (Algeria Oman Fertilizerp Project)	Demineralization / Condensate Polishing System (ACF+2B3T+MBP)	325㎥/h x 4 trains 480㎥/h x 5 trains	

15. Cross reference guide

"Only 3 major companies possess UPS resin(**U**niformity **C**oefficient 1.1↓) technology in the world"

→ ①**Samyang** & Mitsubishi, ②Dow, ③Lanxess

Type		TRILITE 삼양 트리라이트 Ion Exchange Resin	Mitsubishi DIAION	DOW		Lanxess Lewatit	Purolite
				Dowex	Amberjet/lite		
		UC 1.1↓	**UC 1.1↓**	**UC 1.1↓**	**UC 1.2↓**	**UC 1.1↓**	**UC 1.2↓**
UPS Gel 	SAC	**MC-08**	UBK08	Marathon C	1200	MP S100	PFC/PPC100
		MC-08H	UBK08H	Marathon CH	1200H	MP S100H	PFC/PPC100H
		MC-10	UBK10	Mono 650 C	1500	MP S108	SGC-650C
		MC-10H	UBK10H	Mono 650 C H	1500H	MP S108H	SGC-650CH
	SAC (Chromatography)	**MCK series**	UBK500 series			MDS series	
	SBA_Type 1	**MA-12**	UBA120	Marathon A	4200 Cl	MP M500	PFA/PPA400
		MA-12OH	UBA120OH	Marathon A OH	4200 OH	MP M500 OH	PFA/PPA400 OH
		MA-10	UBA100	Mono 550A	4400 Cl	MP M800	SGC-550A
		MA-10OH	UBA100OH	Mono 550A OH	4400 OH	MP M800OH	SGC-550A OH
		MA-15	UBA150	Mono 550A	4400 Cl	MP M800	SGC-550A
		MA-15OH	UBA150OH	Mono 550A OH	4400 OH	MP M800OH	SGC-550A OH
	SBA_Type 2	**MA-20**	UBA200	Marathon A2	4600 Cl	MP M600	PFA/PPA200
	UPW_Mixed Bed	**UPRM100U**					UCW 3600
		UPRM200U		MR-450 UPW	UP6150	1292MD	UCW 3700
		UPRM300U		MR-3 UPW	UP6040	1294MD	UCW 9966
UPS Porous	WBA	**AW90**		Monosphere 66		MP64/MP68	
		UC 1.6↓	**UC 1.6↓**	**UC 1.6~1.8↓**			
Gaussian Gel 	SAC	**SCR-B(KC-08)**	SK1B	HCR-S	IR120Na	C249/C267	C100
	SAC_Food grade	**KH-70/KH-80**		HCR-S/S			C100E
	SBA	**SAR10(KA-10)**	SA10	SBRP	IRA400	ASB1	A400
		SAR11(KA-11)	SA11		IRA401S		
		SAR12(KA-12)	SA12		IRA402		A600
		SAR20(KA-20)	SA20	SAR	IRA416	ASB1	A200
	Mixed Bed	**SM200/210/300**			MB20	NM91	MB400
Gaussian Porous 	SAC	**CMP/SPC Series**	PK series			SP120	C150, C160
	SBA	**AMP Series**	PA series	MSA	IRA900 OH	MP500	A500
	WAC	**WCA10L**	WK40/WK60L	MWC-1	IRC86	CNP80	C105
	WBA	**AW30**	WA30		IRA93SP	MP62	A100
	Chelating	**CLR series**	CR series			TP207/208	S930Puls
Inert resin		**TR series**		IF-62		IN49	IP1

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