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TRILITE
삼양 트리라이트
Ion Exchange Resin

TRILITE ion exchange resins for Water treatment & Power plant



Samyang Corporation Ion exchange resin
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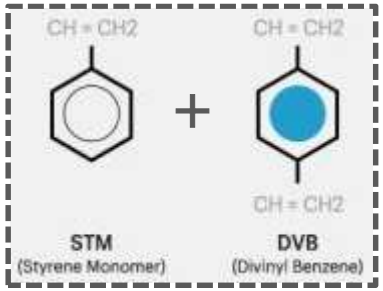
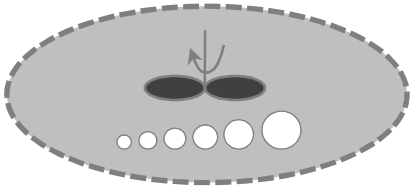
5. Cutting-edge Technology Droplet Generator

Conventional Technology

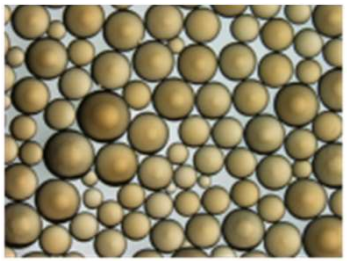
(Raw Material Adjustment)

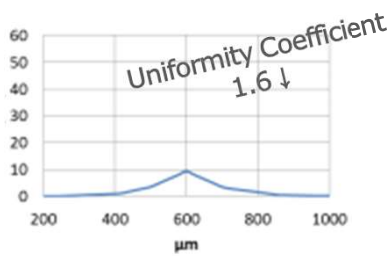


(Polymerization - Agitation)



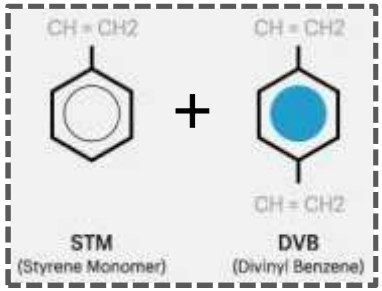
(Post-treatment – Functional Group)



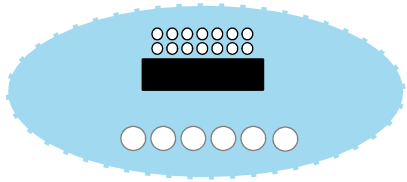


UPS(uniform particle sized) Technology

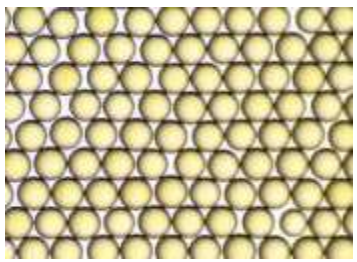
(Raw Material Adjustment)

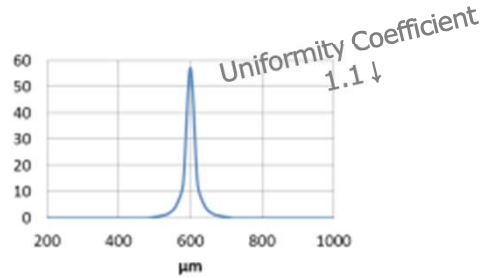


(Polymerization - Droplet Generator)



(Post-treatment – Functional Group)





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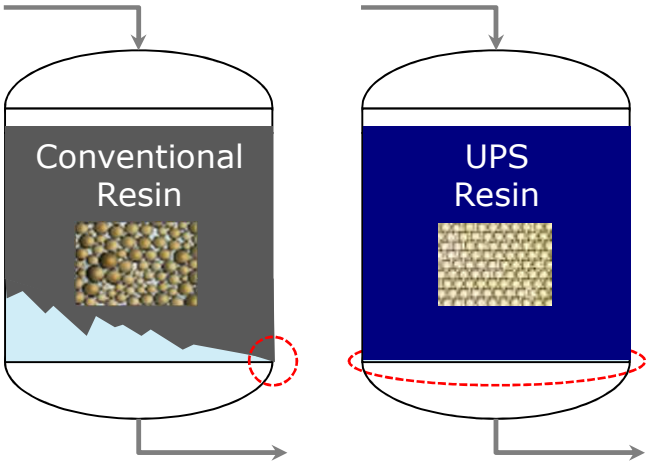
6. Next Generation IER, high performance low cost

Conventional resin gives diffused exhaustion front

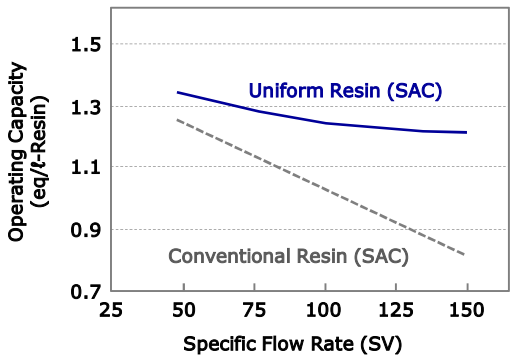


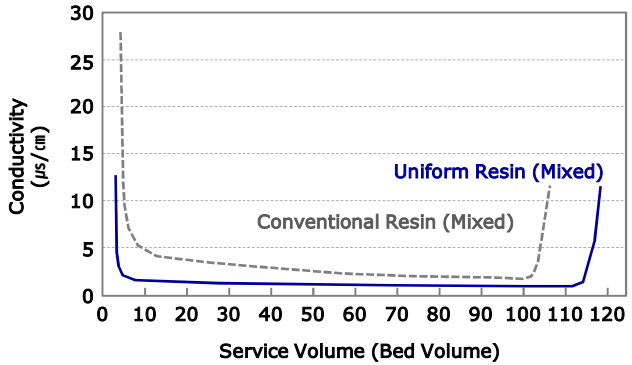
UPS resin gives an extremely even exhaustion front

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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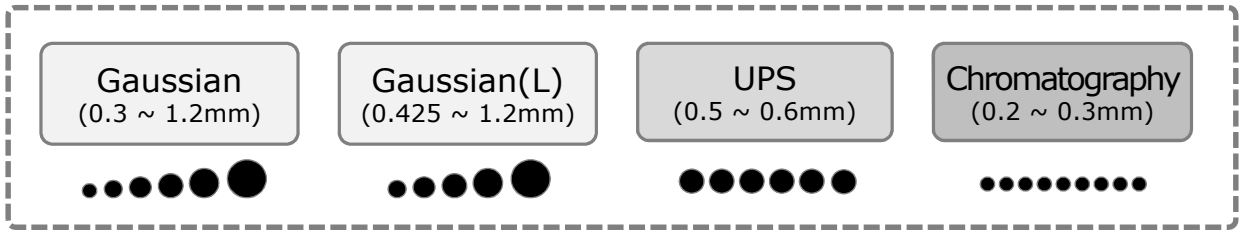
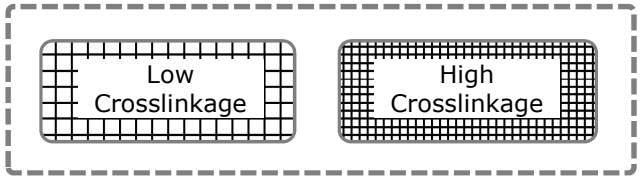
7. Product line of TRILITE

(Particle Distribution, Size)

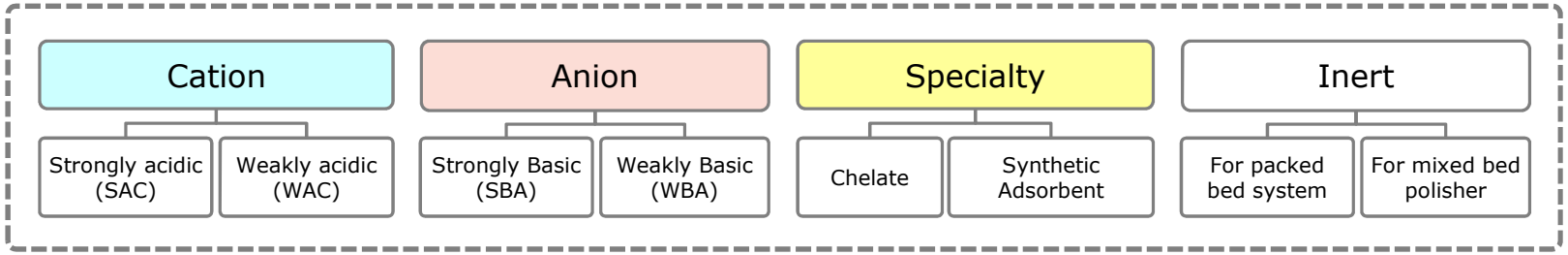


(Crosslinkage)

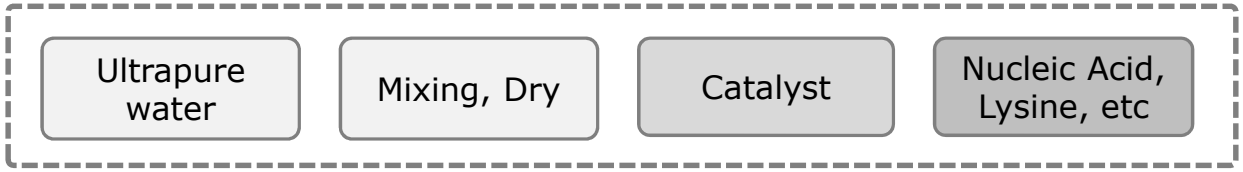


(Porosity)

(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 / Regeneration; Freeboard; IER	Middle Distributor; Freeboard; IER	IER; Freeboard (Upflow) / Freeboard; IER (Downflow)
Gaussian	Gaussian or L-type	UPS IER

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7. Product line of TRILITE

※ TEC: Total Exchange Capacity

	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↑	0.55~0.65㎜	Type1	UKA-12	1.3↑	0.55~0.65㎜
		UKC-10	2.2↑	0.55~0.65㎜				
		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**	1.6↑	0.40~0.60㎜
Economy	Gaussian Porous					**AW30L**	1.5↑	0.425~1.2㎜
	Functional group	(Polystyrene+DVB) + Carboxylate			(Polystyrene+DVB) + Tertiary Amine			

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	UKC-08, 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 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

Power Plant

• Cation grade for Demineralization

Grade	TRILITE MC-08	Dowex Marathon C Amberjet 1200 Amberlite HPR1100/1200	Lewatit Monoplus S100
Type	Strongly Acidic Cation Gel type	Strongly Acidic Cation Gel type	Strongly Acidic Cation Gel type
Matrix	Polystyrene + DVB	Polystyrene + DVB	Polystyrene + DVB
Functional group	$-SO_3 \cdot Na^+$ (Sulfonate)	$-SO_3 \cdot Na^+$ (Sulfonate)	$-SO_3 \cdot Na^+$ (Sulfonate)
Shipping weight	Approx. 845 g/l	Approx. 820g/l	Approx. 830 g/l
Moisture content	43 ~ 49 %	43 ~ 50 %	42 ~ 48 %
Exchange capacity	2.0 eq/L↑	2.0 eq/L↑	2.0 eq/L↑
Operating temp.	120℃	120℃	120℃
Operating pH range	0 ~ 14	0 ~ 14	0 ~ 14
Maximum swelling	8~9 %	8 %	8 %
Uniformity coefficient	1.1↓	1.1~1.2↓	1.1↓
Mean Particle Size	600±50 ㎛	585±50 ㎛	600±50 ㎛

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7. Product line of TRILITE

Power Plant

• Anion grade for Demineralization

Grade	TRILITE MA-12	Dowex Marathon A Amberjet 4200 Amberlite HPR4200/4800	Lewatit M500
Type	Strongly Basic Anion Resin (Type I) Gel type	Strongly Basic Anion Resin (Type I) Gel type	Strongly Basic Anion Resin (Type I) Gel type
Matrix	Polystyrene + DVB	Polystyrene + DVB	Polystyrene + DVB
Functional group	$-N(CH_3)_3 \cdot Cl^-$ (Trimethylammonium)	$-N(CH_3)_3 \cdot Cl^-$ (Trimethylammonium)	$-N(CH_3)_3 \cdot Cl^-$ (Trimethylammonium)
Shipping weight	Approx. 670 g/l	Approx. 670 g/l	Approx. 690 g/l
Moisture content	49 ~ 55 %	49 ~ 55 %	48 ~ 55 %
Exchange capacity	1.3 eq/L↑	1.3 eq/L↑	1.3 eq/L↑
Operating temp.	60 ℃ (OH^-)	60 ℃ (OH^-)	70 ℃ (OH^-)
Operating pH	0 ~ 14	0 ~ 14	0 ~ 14
Maximum swelling	24%	20%	20%
Uniformity coefficient	1.1↓	1.1↓(Marathon A, 4800) 1.25↓(4200)	1.1↓
Mean Particle Size	580±50 ㎛	575±50 ㎛ (Marathon A, 4800) 650±50 ㎛ (4200)	620±50 ㎛

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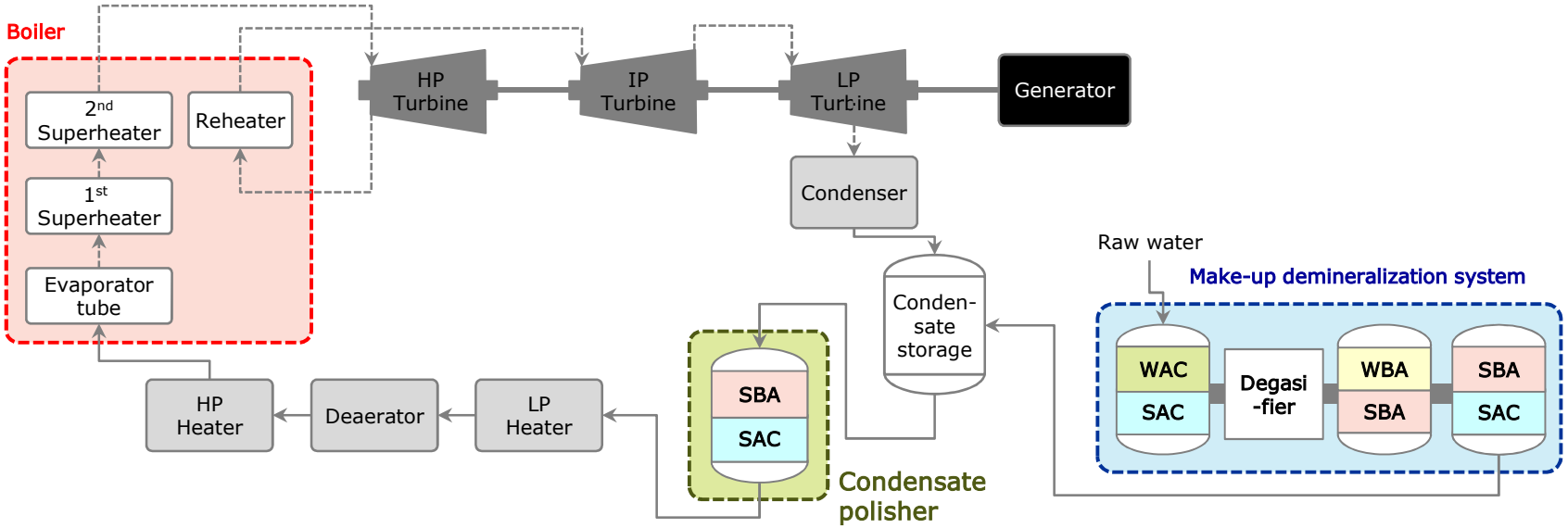
7. Product line of TRILITE

Power Plant

(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 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	1.1↑	
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**	1.1↑	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

Power Plant

Ion exchange resins for power plants are being applied to demineralization of make-up water for boiler and also to condensate polishing plant(CPP) to get rid of various impurities in condensate water.

The condensate water directly passing through generator turbine features high temp.(60~70℃) and high pressure, so ion exchange resins especially specialized in CPP application are required with the following reasons.




- Even small amount of element and impurities can be cumulated in the boiler system
- Condensate water tends to be high in solubility of ionic substances, so easy to acc elerate the corrosion of pipes and plumbing and high in Ca^{2+}, Mg^{2+}, Fe^{3+}, etc.
- Condenser leaks represent a significant risk to power plant operation

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7. Product line of TRILITE

Power Plant

• Physical Stability

Physical stability is a key characteristic of a good condensate polishing resin. TRILITE resins demonstrate exceptional physical and osmotic strength under condensate polishing conditions.

● Uniformity

TRILITE condensate polishing resins are ideally suited to the high flow rate demands with more than 100m^3/hr.

• Separability

Cross contamination during resin separation and regeneration can result in ionic contamination in condensate polishing systems. the particle size and density control offered by TRILITE condensate polishing resin result in the best possible resin separatio

(Mixing) (After Seperation)

[Cation : MC-10H, Anion : MA-10OH]

• Capacity

Most fossil fueled power plants operate at feed water pH of 9.0-9.6 using ammonia (NH3) as the primary base to reduce corrosion. With ammonia concentrations between 1-2 ppm, ammonia capacity is the primary driver of cost containment in condensate polishing systems. TRILITE condensate polishing resins offer the highest capacity resins available on the market.

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7. Product line of TRILITE

Power Plant

• Cation grade for CPP

Grade	TRILITE MC-10H	Amberlite HPR650 H (Dowex Monosphere 650C H) (Amberjet 1500H)
Type	Strongly Acidic Cation Gel type	Strongly Acidic Cation Gel type
Matrix	Polystyrene + DVB	Polystyrene + DVB
Functional group	$-SO_3 \cdot H^+$ (Sulfonate)	$-SO_3 \cdot H^+$ (Sulfonate)
Shipping weight	Approx. 800 g/l	Approx. 785g/l
Moisture content	45 ~ 51 %	46 ~ 52 %
Exchange capacity	2.0 eq/L↑	2.0 eq/L↑
Operating pH range	0 ~ 14	0 ~ 14
Maximum swelling	8 %	7 %
Uniformity coefficient	1.1↓	1.1↓
Mean Particle Size	660±50 ㎛	650±50 ㎛
Ionic Conversion(H^+)	99%↑	99%↑

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7. Product line of TRILITE

Power Plant

• Anion grade for CPP

Grade		TRILITE MA-10OH	Amberlite HPR550A OH (Dowex Monosphere 550A OH) (Amberjet 4500 OH)
Type		Strongly Basic Anion Resin (Type I) Gel type	Strongly Basic Anion Resin (Type I) Gel type
Matrix		Polystyrene + DVB	Polystyrene + DVB
Functional group		$-N(CH_3)_3 \cdot OH^-$ (Trimethylammonium)	$-N(CH_3)_3 \cdot OH^-$ (Trimethylammonium)
Shipping weight		Approx. 660 g/l	Approx. 660 g/l
Moisture content		59 ~ 65 %	55 ~ 65 %
Exchange capacity		1.1 eq/L↑	1.1 eq/L↑
Operating temp.		60 ℃ (OH^-)	60 ℃ (OH^-)
Operating pH		0 ~ 14	0 ~ 14
Maximum swelling		23%	25%
Uniformity coefficient		1.1↓	1.1↓
Mean Particle Size		590±50 ㎛	590±50 ㎛
Ionic Conversion	(OH^-)	95%↑	95%↑
	(CO_3^{2-})	5%↓	5%↓
	(Cl^-)	0.5%↓	0.5%↓

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7. Product line of TRILITE

Power Plant

• Veritas Analysis Data

SAMPLE: cationic resin 400888;

Product name: cationic resin Trilite MC-10H
Batch: 8HB07

Déterminations	Results	Spécifications
Percentage of H^+ active sites	> 99.9	> 99.9
Total exchange Capacity	2.21 ±1.9%	> 2.0.

Granulometry				
SIZE (µm)	Vol (%)	Average height	Spécification	Technique
0.010 at 316.228	0.00	676.8µm	660±50µm	Laser granulometry
316.228 at 363.078	0.12			
363.078 at 416.869	1.07			
416.869 at 478.630	5.72			
478.630 at 549.541	11.35			
549.541 at 630.957	20.14			
630.957 at 724.436	22.76			
724.436 at 831.764	19.79			
831.764 at 954.993	11.85			
954.993 at 1096.478	5.59			
1096.478 at 1258.925	1.54			
1258.925 at 1445.440	0.08			
1445.440 at 10000	0.00			

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7. Product line of TRILITE

Power Plant

• Veritas Analysis Data

SAMPLE: anionic resin 400889;

Product name: anionic resin Trilite MA-10OH
Batch: 8LD02

Déterminations	Results	Spécifications
Ionic Carbonates	4.70 ±1.0%	< 5
Ionic Chlorides	0.06 ±16%	< 0,2
Percentage of OH active sites	95.2±0.2%	> 95
Total exchange Capacity	1.14 ±2.4%	> 1.1

	Granulometry			
SIZE (µm)	Vol (%)	Average height	Spécification	Technique
0.010 at 316.228	0.00	637.1µm	590±50µm	Laser granulometry
316.228 at 363.078	0.44			
363.078 at 416.869	2.47			
416.869 at 478.630	8.59			
478.630 at 549.541	14.88			
549.541 at 630.957	22.03			
630.957 at 724.436	22.20			
724.436 at 831.764	16.00			
831.764 at 954.993	9.41			
954.993 at 1096.478	3.34			
1096.478 at 1258.925	0.64			
1258.925 at 1445.440	0.01			
1445.440 at 10000	0.00			

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7. Product line of TRILITE

Power Plant

• Veritas Analysis Data

SAMPLE: cationic resin 400887;

Product name: cationic resin Trilite MC-08H
Batch: 8JB04

Déterminations	Results	Spécifications
Percentage of H^+ active sites	> 99.9	> 95
Total exchange Capacity	1.95 ±1.9%	> 1.8

Granulometry				
SIZE (µm)	**Vol (%)**	**Average height**	**Spécification**	**Technique**
0.010 at 275.423	0.00	619.5µm	620±50µm	Laser granulometry
275.423 at 316.228	0.02			
316.228 at 363.078	0.51			
363.078 at 416.869	3.83			
416.869 at 478.630	8.72			
478.630 at 549.541	17.61			
549.541 at 630.957	22.37			
630.957 at 724.436	21.88			
724.436 at 831.764	14.46			
831.764 at 954.993	7.85			
954.993 at 1096.478	2.33			
1096.478 at 1258.925	0.42			
1258.925 at 10000	0.00			

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7. Product line of TRILITE

Power Plant

• Veritas Analysis Data

SAMPLE: anionic resin 400890;

Product name: anionic resin Trilite MA-12
Batch: 9BC06

Déterminations	Results	Spécifications
Total exchange Capacity	2.48 ±2.4%	> 1.3

	Granulometry			
SIZE (µm)	**Vol (%)**	**Average height**	**Spécification**	**Technique**
0.010 at 275.423	0.00	600.5µm	575±50µm	Laser granulometry
275.423 at 316.228	0.07			
316.228 at 363.078	0.93			
363.078 at 416.869	4.36			
416.869 at 478.630	11.06			
478.630 at 549.541	18.84			
549.541 at 630.957	23.08			
630.957 at 724.436	20.68			
724.436 at 831.764	13.58			
831.764 at 954.993	5.96			
954.993 at 1096.478	1.58			
1096.478 at 1258.925	0.06			
1258.925 at 10000	0.00			

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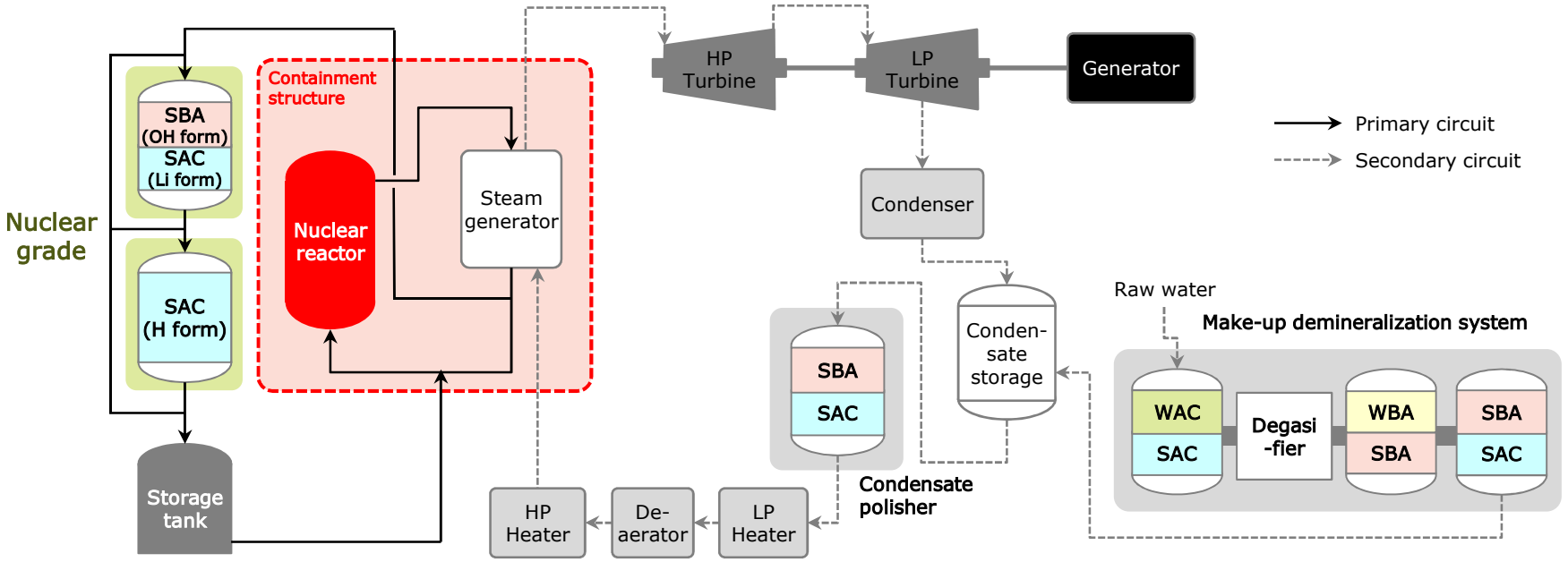
7. Product line of TRILITE

Power Plant

(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)							
	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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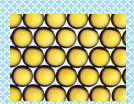
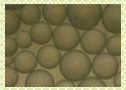
10. Cross reference guide

Type		TRILITE 삼양 트리라이트 Ion Exchange Resin	Mitsubishi DIAION	Dupont (Former DOW)		Lanxess Lewatit	Purolite
				Dowex	HPR (Amberjet/lite)		
		UC 1.1↓	UC 1.1↓	UC 1.1~1.25↓		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	Mono 99 series	CR series	MDS series	PCR 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
	Mixed Bed(UPW)	UPRM100U				NM60	UCW 3600
		UPRM200U		MR-450 UPW	UP6150	NM60SG, 1292MD	UCW 3700
		UPRM300U		MR-3 UPW	UP6040	1294/1296MD	UCW 9966
UPS Porous	WBA	AW80		Monosphere 66		MP64, MP68	
		UC 1.4~1.6↓	UC 1.6↓	UC 1.6~1.8↓			
Gaussian Gel 	SAC	KC-08 (SCR-B)	SK1B	HCR-S	IR120Na	C249/C267	C100
	SAC(Food)	KH-70		HCR-S/S	SR1L		C100E
	SBA_Type 1	KA-12/KA-10 (SAR10)	SA10	SBRP	IRA410	ASB1	A400
	SBA_Type 2	KA-20 (SAR20)	SA20		IRA410		A200
	Mixed Bed	SM200/210/300			MB20	NM91	MB400
Gaussian Porous 	SAC(Catalyst)	CMP/SPC Series	PK series			SP120	C150, C160
	SBA	AMP series	PA series	MSA	IRA900 OH	MP500	A500
	SBA(Food)_Styrene	AMP14(L)	PA308		FPA90	S6368	A502PS
	SBA(Food)_Acryl	ASP10			FPA98	S5528	A860S
	WAC	WCA10L	WK40/WK60L		IRC86	CNP80	C105
	WBA	AW30	WA30		IRA93SP	MP62	A100
	Chelating	CLR series	CR series			TP207/208	S930Puls
Inert resin		TR70		62i(IF-62)	14i(RF14)	IN42	IP1

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11. Product analysis / Quality control

Basic | Performance

samyang Corporation (Ulsan Plant)

samyang fine technology (Gunsan Plant)

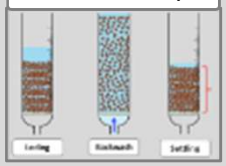
Product hopper

Sampling

ISO9001 Lloyd's Register LRQA

(Basic product analysis)

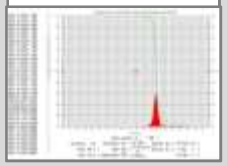
Bulk density



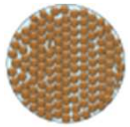
Moisture retention

Exchange capacity

Particle distribution



Whole bead count



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

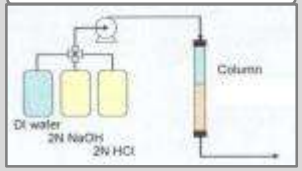
H/OH Conversion rate

Resistivity

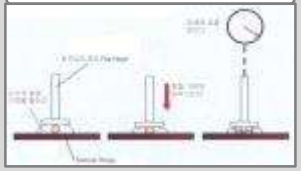
ΔTOC

(Periodical product analysis)

osmotic shock stability



Friability



Keeping samples (for 4years)

DB

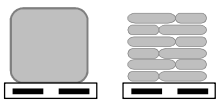
Quality test

N

Y

Process analysis

Packing



COA (From DB)

Shipping

Customer

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12. 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
KMF(JAKIM)

MAJELIS ULAMA INDONESIA
THE INDONESIAN COUNCIL OF ULAMA

شهادة حلال

SERTIFIKAT HALAL - HALAL CERTIFICATE

No : 00170093290119

Majelis Ulama Indonesia (MUI), setelah melakukan pengujian dan pembahasan, menetapkan bahwa produk pangan, obat-obatan, atau kosmetika yang disebutkan namanya di bawah ini adalah HALAL menurut Syari'at Islam.

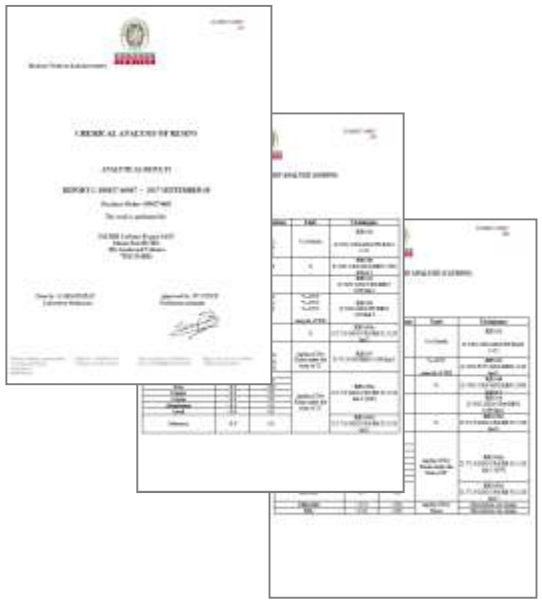
The Indonesian Council of Ulama, after examining, inspecting/auditing and discussing the ingredients, has declared that the undermentioned food, drug and cosmetic products as HALAL according to the Islamic Law.

Jenis Produk / Type of Product	AS ATTACHED
Nama Produk / Name of Product	AS ATTACHED
Nama Perusahaan / Name of Company	SAMYANG CORPORATION ULSAN PLANT 1
Alamat Perusahaan / Company's Address	285, JANGSAENGPO-RO, NAM-GU, ULSAN, REPUBLIC OF KOREA
Dikeluarkan di Jakarta pada / Issued in Jakarta on	JANUARY 17, 2019
Berlaku sampai dengan / Valid until	JANUARY 16, 2021

selama bahan-bahan dan proses produksinya masih sesuai dengan keputusan Komisi Fatwa MUI.
as long as the ingredients, and production processes are in accordance to the decree of Fatwa Commission of the Indonesian Council of Ulama.

Prof. Dr. H. HASANUDDIN AF
Dr. LUKMANUL HAKIM M.Si
Prof. Dr. K.H. Ma'ruf Amin

Veritas Certificate



13. Packing line, packing type

(Automatic packing line : 25ℓ PE Bag)

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

25Liters
PE bag

1,000Liters
Ton bag

50Liters
Plastic drum

5 or 7ft^3
Fiber Drum

Palletizing, container loading

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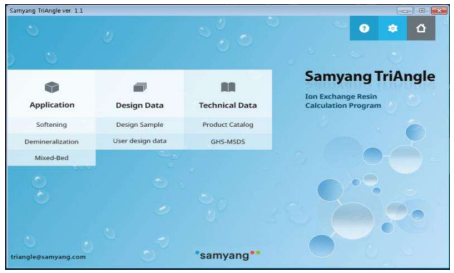
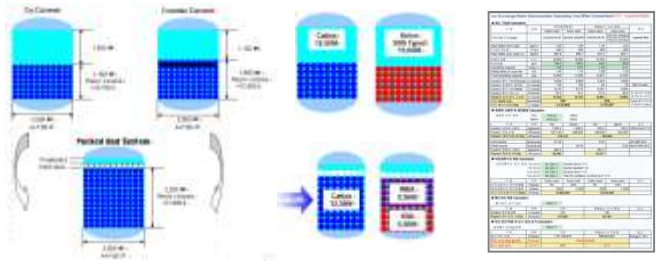
14. Technical service

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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