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RELIZYME[®]



**2011 Industrial and Preparative
Resin Catalog**

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Strongly Acidic Cation Exchange Resins

These are the resins of cross linked polystyrene matrix having sulfonic acid groups. There are SK-grade of gel type, PK-grade of porous type, and RCP160M of highly porous type (on the next page). The standard shipping form is sodium salt. In some cases, the hydrogen form is available for catalysis applications such as esterification, alkylation, hydrolysis, hydration...

SK1B resin is our “flagship” premium grade, gel-type, strong acid cation resin. It has excellent properties for industrial applications and is recommended for industrial scale softening and demineralization applications. It has standard crosslinkage. In situations where the raw water contains oxidizing substances, the higher crosslinkage resins such as SK110 and SK112 are recommended to provide better performance and longer operating life. SK110 is also recommended for regenerable mixed bed applications. SK102 (2%) and SK104 (4%) have low crosslinkage. They are mainly used as a catalyst and special applications where low crosslinked density is necessary to allow penetration of large organic molecules, or where faster reaction rate is required.

The PK resin grades are based on a porous styrene DVB polymer matrix. Their porous structure provides excellent durability against osmotic shock by swelling and shrinkage. PK216 is recommended for general water treatment. PK228 is recommended for condensate demineralization (L grade is recommended for best pressure flow performance). PK grades are also recommended for special applications such as deashing, decolonization, and as a catalyst (as they have higher reaction rate in organic solvents than gel-type resins).

Grades	SK102		SK104		SK1B*		SK110*		SK112	
Brand Name	Diaion									
Matrix type	Gel (styrene, DVB) :					R-SO ₃ ⁻ Na ⁺				
Counter Ion	Na ⁺ for standard form, H ⁺ for catalyst applications and demineralization									
Total Capacity (meq/ml-R)	>0.6 Na form >0.6 H form		> 1.2 Na form >1.1 H form		>2.0 Na form >1.7 H form		>2.0 Na form		>2.1 Na form	
Water Retention (%)	72-82 Na form 75-85 H form		57-67 Na form 62-72 H form		43-50 Na form 50-60 H form		35-45 Na form		32 -42 Na form	
Shipping Density (grams/liter)	~ 745 Na form ~ 750 H form		~ 780 Na form ~ 740 H form		~ 825 Na form ~ 780 H form		~ 845 Na form		~ 855 Na form	
Particle Size Distribution	On 1180 μm: 5% max Thru 300 μm: 1% max									
Effective Size (mm)	0.40 min									
Uniformity Coefficient	1.6 max									
Whole Bead Count (%)	90% min									
Operating Temperature	120°C (H form, Na form) max									
Crosslinked	2%		4%		8%		10%		12%	

Grades	PK208*		PK212*		PK216*		PK220*		PK228*	
Brand Name	Diaion									
Matrix type	Porous (styrene, DVB) :					R-SO ₃ ⁻ Na ⁺				
Counter Ion	Na ⁺ for standard form, H ⁺ for catalyst applications and demineralization									
Total Capacity (meq/ml-R)	>1.2 Na form >1.0 H form		> 1.5 Na form		>1.75 Na form >1.6 H form		>1.9 Na form		>2.05 Na form >1.9 H form	
Water Retention (%)	58-68 Na form 63-73 H form		52-58 Na form		46-52 Na form 50-60 H form		41-47 Na form		37-43 Na form 39-49 H form	
Shipping Density (grams/liter)	~ 745 Na form ~ 720 H form		~ 765		~ 780 Na form ~ 740 H form		~ 790		~ 805 Na form ~ 770 H form	
Particle Size Distribution	On 1180 μm: 5% max Thru 300 μm: 1% max									
Effective Size (mm)	0.40 min									
Uniformity Coefficient	1.6 max									
Whole Bead Count (%)	95% min									
Operating Temperature	120°C (H form, Na form) max									
Crosslinked	4%		6%		8%		10%		14%	

* Also available as L grades where the particle size thru 425 μm is 1% max.

More Strongly Acidic Cation Exchange Resins

Ion exchange resins with good uniformity in particle size increase their necessity to reduce the reagents costs and spent waste waters in manufacturing pure waters. They are also used in other fields because they have little amount of large particles easy to be broken by swelling and shrinkage. Gel type UBK ion exchange resins of uniform particle size are now launched to meet such necessity. UBK16 has high (16%) crosslinkage. It is used for special process applications such as purification of pharmaceuticals.

SKL10 is a strong gel cation resin specially formulated using an optimized matrix of styrene and divinyl benzene for lysine isolation.

The Relite brands were added later to support the growing water treatment business as well as other applications.

JC600, JC610, JC660 have excellent properties for industrial application and are suitable for industrial scale softening and demineralization applications and other various uses such as catalyst, sugar processing, amino acid purification etc... JC603 is the hydrogen form resin for JC600. While the JC600 series are gel resins, JC700 are porous type resins that are suitable for water treatment, sugar processing, and other special chemical process applications.

Diaion RCP160M is based on a macroporous crosslinked polystyrene matrix with sulfonic acid functional groups. This matrix is more open and porous than conventional grade resin with increased polymer surface available for intimate contact with solutes. In catalysis, the reaction rates are faster with RCP160M than standard grade resins, resulting in a higher degree of conversion during catalytic applications.

Grades	UBK08		UBK10		UBK12		UBK16		SKL10	
Brand Name	Diaion									
Matrix type	Gel (styrene, DVB) :					R-SO ₃ ⁻ Na ⁺				
Counter Ion	Na ⁺ for standard form, H ⁺ for catalyst applications and demineralization									
Total Capacity (meq/ml-R)	>2.0	Na form	> 2.2	Na form	>2.3	Na form	>2.3	Na form	>2.0	Na form
Water Retention (%)	43-50	Na form	35-45	Na form	33-39	Na form	27-37	Na form	41-48	Na form
Shipping Density (grams/liter)	~ 840	Na form	~ 850	Na form	~ 855	Na form	~ 865	Na form	~ 835	Na form
Particle size Distribution	600 ± 50 µm		580 ± 20 µm		650 ± 50 µm		600 ± 50 µm		<i>On 1180 µm: 5% max Thru 300 µm: 1% max</i>	
Effective Size (mm)										0.40 min
Uniformity Coefficient	1.2 max									1.6 max
Whole Bead Count (%)	90% min									
Operating Temperature	120°C (H form, Na form) max									
Crosslinked	8%		10%		12%		16%		Confidential	

Grades	JC600		JC603		JC660		JC703		RCP160M	
Brand Name	Relite									
Matrix type	Gel styrene, DVB R-SO ₃ ⁻ Na ⁺		Gel styrene, DVB R-SO ₃ ⁻ H ⁺		Gel styrene, DVB R-SO ₃ ⁻ Na ⁺		Porous styrene, DVB R-SO ₃ ⁻ H ⁺		Highly Porous styrene, DVB R-SO ₃ ⁻ H ⁺	
Counter Ion	Na ⁺ for standard form, H ⁺ for catalyst applications and demineralization									
Total Capacity (meq/ml-R)	>2.0	Na form	> 1.8	H form	>1.8	Na form	>1.7	H form	>1.5	H form
Water Retention (%)	43-50	Na form	49-55	H form	50-55	Na form	54-57	H form	45-55	H form
Particle Size Distribution	<i>On 1180 µm: 5% max Thru 300 µm: 1% max</i>									<i>On 710 µm: 25% max Thru 250 µm: 1% max</i>
Effective Size (mm)	0.45 min									
Uniformity Coefficient	1.7 max									1.6 max
Whole Bead Count (%)	90% min						95% min			
Operating Temperature	120°C (H form, Na form) max									
Crosslinked	8%		8%		6%		6%		High	

Strongly Basic Anion Exchange Resins

Diaion Strong base anion exchange resins are based on crosslinked polystyrene matrix having quaternary ammonium groups (NR_3^+). Among the Diaion product line, there are SA-grades of gel type, PA-grades of porous type, and HPA-grades of highly porous-type. The standard shipping is Cl^- form (in some cases OH^- form is available). Type I resins have trimethyl ammonium groups which impart higher basicity. In the co-current regeneration mode, the treated water will have the lowest silica leakage. Type I resins also have higher chemical stability and can be applied at higher temperature than type II or acrylic based resins.

SA10A is a type I resin with standard crosslinkage. SA12A is a type I resin with slightly lower crosslinkage and typically recommended for treatment of surface waters with troublesome organic content. These resins are mainly used for water treatment. SA11A is type I resin with low crosslinkage used for special applications such as high organic removal or as a primary bed polisher anion. NSA100 is a gel type I resin with high crosslinkage. It is used for special applications such as iodine isolation from brine.

Porous-type ion exchange resins of porous polymer matrix have good resistance against swelling and shrinking, though their exchange capacity is lower than gel-type ion exchange resins of the same degree of crosslinkage. These are effective when highly purified effluents are needed, e.g. removal of silica to very low concentration. They are suitable for treatments of waste waters with organic compounds. PA312 and PA316 are generally used in waste water treatments, and PA308 is used for demineralization and decolonization of sugar liquors.

Ion Exchange resins with good uniformity particle size are necessary to reduce the reagents costs and spent waste waters in manufacturing pure waters. UBA100 and 120 are also used in other fields for their osmotic stability.

Grades	SA10A*	SA11A* ¹	SA12A* ¹	NSA100	UBA100	UBA120 (UBA122)
Brand Name	Diaion					
Matrix type	Gel (styrene, DVB) :			$\text{R-CH}_2\text{-N(CH}_3)_3^+$		
Counter Ion	Cl^- for standard form, OH^- for catalyst applications and demineralization					
Total Capacity (Cl^- form) (meq/ml-R)	>1.3	> 0.85	>1.3			
Water Retention (%) (Cl^- form)	43-47	55-65	48-55	37-44	43-50	48-55
Shipping Density (grams/liter) (Cl^- form)	~ 670	~ 685	~ 670	~ 685	~ 680	~ 675
Particle Size Distribution	On 1180 μm : 5% max Thru 300 μm : 1% max				550 \pm 50	575 \pm 50 (515 \pm 50)
Effective Size (mm)	0.40 min				-	
Uniformity Coefficient	1.6 max				1.2 max	
Whole Bead Count (%)	90% min					
Operating Temperature	60°C (OH form) ---- 80°C (Cl form) max					

Grades	PA306S	PA308* ¹	PA312*	PA316	HPA25
Brand Name	Diaion				
Matrix type	Porous (styrene, DVB) :			$\text{R-CH}_2\text{-N(CH}_3)_3^+$	
Counter Ion	Cl^- for standard form, OH^- for catalyst applications and demineralization				
Total Capacity (Cl^- form) (meq/ml-R)	>0.8	>1.0	>1.2	>1.3	>0.5
Water Retention (%) (Cl^- form)	66-76	57-67	49-55	44-50	58-68
Shipping Density (grams/liter) (Cl^- form)	~ 645	~ 710	~ 675	~ 670	~ 680
Particle Size Distribution	14% max >425 μm 1% max <150 μm	On 1180 μm : 5% max Thru 300 μm : 1% max			On 250 μm : 5% min
Effective Size (mm)	-	0.40 min			0.25 min
Uniformity Coefficient	1.6 max				
Whole Bead Count (%)	95% min				
Operating Temperature	60°C (OH form) ---- 80°C (Cl form) max				
Crosslinked	3%	4%	6%	8%	High

* Also available as L grades where the particle size thru 425 μm is 1% max.

1- Low-odor and low leachable anion exchange resins are available as F grade

More Strongly Basic Anion Exchange Resins

Type II resins have dimethylethanol ammonium groups which impart slightly lower basicity. This provides an advantage of easier regeneration than type I and slightly higher capacity.

SA20A is type II resin of standard crosslinkage. It is popularly used for water treatment with its easy regeneration. SA21A is Type II resin of low crosslinkage and is used for special applications such as purifications of pharmaceuticals and food products. UBA200 is a uniform type 2 gel anion resin for better osmotic stability.

Porous-type type II resins have better efficiency during regeneration though they have lower basicity and chemical stability than type I. PA418 is generally used in water treatment while PA408 is used to demineralize and to decolorize sugar liquors.

The Relite brands were added later to support the growing water treatment business as well as other applications.

JA100, JA200, and JA400 have excellent properties for industrial application and are suitable for industrial scale demineralization applications and other various uses such as organic trap, sugar processing, etc... JA100 is a gel type I strongly basic anion resin while JA200 is a gel type II strongly basic anion resin used in water treatment operation. JA400 is a porous type I strongly basic anion resin mainly for organic removal, water treatment, sugar processing, and other special chemical process applications.

Relite JA450 is a porous type I strongly basic anion resin which is suitable for removing nitrate ions from water for potable use. Relite JA800 and JA830 are a high capacity, organic fouling resistant, gel, acrylic type I strongly basic anion resin used in all types of deionization systems and chemical process applications.

Grades	SA20A*	SA21A	UBA200	PA408	PA412*	PA418* ¹
Brand Name	Diaion					
Matrix type	Gel (styrene, DVB)			Porous (styrene, DVB)		
Functionality	$R-CH_2-N(CH_3)_2(CH_3CH_2OH)^+Cl^-$ for standard form					
Total Capacity (Cl ⁻ form) (meq/ml-R)	>1.3	>0.8	>1.3	>0.9	>1.1	>1.3
Water Retention (%) (Cl ⁻ form)	45-52	55-65	45-52	54-64	46-52	38-44
Shipping Density (grams/liter) (Cl ⁻ form)	~ 715	~ 710	~ 715	~ 720	~ 685	~ 685
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>		575 ± 50	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>		
Effective Size (mm)	0.40 min		-	0.40 min		
Uniformity Coefficient	1.6 max			1.6 max		
Whole Bead Count (%)	90% min			95% min		
Operating Temperature	40°C (OH form) ---- 60°C (Cl form) max					
Crosslinked	-			4%	6%	9%

Grades	JA100	JA400	JA450	JA800	JA830	JA200
Brand Name	Relite					
Matrix type	Gel (styrene-DVB) Type I	Porous (styrene-DVB) Type I		Porous Acrylic-DVB Type I	Gel Acrylic-DVB Type I	Gel (styrene-DVB) Type II
Counter Ion	Cl ⁻ for standard form					
Total Capacity (Cl ⁻ form) (meq/ml-R)	>1.2	>0.8	>0.9	>0.8	>1.2	>1.2
Water Retention (%) (Cl ⁻ form)	48-54	57-66	45-55	65-72	55-65	45-51
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>					
Effective Size (mm)	0.45 min					
Uniformity Coefficient	1.7 max					
Whole Bead Count (%)	90% min	95% min			90% min	
Operating Temperature	60°C (OH form)	---- 80°C (Cl form) max		40°C (OH form), 60°C (Cl form) max		

* Also available as L grades where the particle size thru 425 μm is 1% max.

1- Low-odor and low leachable anion exchange resins are available as F grade

Weakly Acidic Cation Exchange Resins

WK10 grades (methacrylic type) are weak acid cation exchange resins having carboxylic acid functionalities. They have a pK value of approximately 6. WK10 has high reaction rate, and WK11 has a high total exchange capacity. These methacrylic grades are mainly used for special applications such as purification of pharmaceuticals, foods, and organic chemicals.

WK100 and WT01S have high reaction rate and high adsorption capacity. They are mainly used for the purification of pharmaceuticals and foods. WT01S is offered in 100-300 μm particle distribution while WK10S is a small particle size version of WK10 designed for high performance whey processing.

WK40L and WK80L are weak acid cation exchange resins with carboxylic acid functionality based on porous acrylic polymer matrix. They have a pK value of approximately 5.3. The acrylic type resins have higher total capacity than methacrylic type resins. They are mainly used for water treatment applications such as the removal of hardness ions in the presence of bicarbonate alkalinity.

The Relite brands were added later to support the growing water treatment business as well as other applications. Relite JC800 is a gel type weakly acidic cation exchange resin based on cross-linked polyacrylic matrix. It is suitable for applications such as metal recovery, waste water treatment, etc...

Grades	WK10	WK11	WK100	WT01S	WK10S
Brand Name	Diaion				
Matrix type	Porous – Methacrylic				
Functionality	Carboxylic acid				
Total Capacity (meq/ml-R)	>2.5	>2.9	>2.8	>3.0	>2.5
Water Retention (%)	53-59	45-52	45-55	45-55	50-60
Shipping Density (grams/liter)	~ 635	~ 660	~ 660	~ 750	~ 695
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>			(300-106 μm) – 85% min	(600-150 μm) – 90% min
Effective Size (mm)	0.40 min			0.10 - 0.14	0.15 min
Uniformity Coefficient	1.6 max				
Whole Bead Count (%)	95% min				
Operating Temperature	150°C max				
Effective pH range	5 - 14				

Grades	WK40L	WK80L	JC800
Brand Name	Diaion		Relite
Matrix type	Porous – Acrylic		
Functionality	Carboxylic acid		
Total Capacity (meq/ml-R)	>4.4	> 4.4	>4.0
Water Retention (%)	41-48	44 -52	46-54
Shipping Density (grams/liter)	~ 765	~ 800	-
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 425 μm: 3% max</i>		<i>On 1180 μm: 5% max Thru 300 μm: 2% max</i>
Effective Size (mm)	0.45 min		0.40 min
Uniformity Coefficient	1.6 max		1.7 max
Whole Bead Count (%)	95% min		90% min
Operating Temperature	120°C max		
Effective pH range	4 - 14		

Weakly Basic Anion Exchange Resins

WA10 resin is based on gel-type acrylic polymer matrix. It has tertiary amine functionality with high regeneration efficiency. The acrylic polymer matrix provides good chemical stability and good resistance to organic fouling. WA10 is mainly used for pretreatment of starch hydrolysates, beet sugar solutions, and formaldehyde.

WA20 and WA21J do not have any neutral salt splitting capacity. They have high total exchange capacity and high regeneration efficiency. The porous styrene polymer imports high chemical stability, high mechanical strength against attrition loss, high thermal stability, and high durability against organic fouling. These resins are used for the removal of strong mineral acids in standard water treatment applications. They can also be applied in special process separations such as the treatment of organic solvents.

WA30 resin is a weak base anion exchange resin based on porous, styrene-DVB polymer matrix with dimethyl amine functionality. The high porous styrenic matrix has excellent chemical stability, mechanical and osmotic strength, high thermal stability, and durability against organic fouling. WA30 is the bench mark which all macroporous weak base exchange resin are compared with. It is used for a variety of applications, such as removal of organic substances of high molecular weight, pretreatment of raw waters containing organic foulants, deionization and decolorization of starch hydrolysates, and purification of glycerine and enzymes.

Relite JA300 is a weak base anion exchange resin based on high porous, styrene-DVB polymer matrix. JA300, like WA30, has tertiary amine functionality with high regeneration efficiency. The high porous styrenic matrix imparts excellent chemical stability, excellent mechanical and osmotic strength, high thermal stability, and excellent durability against organic fouling.

Diaion DCA11 is a lightly functionalized adsorbent resin based on a crosslinked styrene/DVB polymer matrix. Diaion DCA11 has a highly developed macroporous polymer structure with a narrow pore size distribution. The matrix is lightly functionalized with dimethylamino groups to provide some weakly basic anion exchange capacity. The styrene/DVB matrix offers hydrophobic interaction mechanisms and the amino group provides some ion exchange selectivity for improved decolorization performance. Diaion DCA11 is recommended for decolorization of natural organic aqueous solutions, such as fermentation liquids.

Diaion DCA06 is an ion exchange resin specially designed for removal of patulin, 4-hydroxy-4H-furo[3,2-c]pyran-2(6H)-one, a mycotoxin produced by several species of *Penicillium* and *Aspergillus*, that is mainly found in apple products such as apple juice and apple juice concentrate.

Grades	WA10	WA20	WA21J	WA30	JA300
Brand Name	Diaion				Relite
Matrix type	Gel – Acrylic		Porous – Styrene-DVB		
Functionality	$-\text{CONH}(\text{CH}_2)_n\text{N}(\text{CH}_3)_2$	$-\text{CH}_2\text{NH}(\text{CH}_2\text{CH}_2\text{NH})_n\text{H}$		$-\text{CH}_2\text{N}(\text{CH}_3)_2$	
Total Capacity (free base form) (meq/ml-R)	>1.2	>2.5	>2.0	>1.5	>1.5
Water Retention (%)	63-69	41-47	40-52	43-55	47-55
Shipping Density (grams/liter)	~ 695	~ 660	~ 655	~ 635	~ 650
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>				
Effective Size (mm)	0.35 min	0.40 min			
Uniformity Coefficient	1.6 max				1.7 max
Whole Bead Count (%)	90% min	95% min			
Operating Temperature	60°C max	100°C max			80°C max
Effective pH range	0-9				

Grades	DCA11	DCA06
Brand Name	Diaion	
Matrix type	High Porous – Styrene-DVB	
Functionality	$-\text{CH}_2\text{N}(\text{CH}_3)_2$	
Total Capacity	>0.3 meq/ml-resin	> 0.1 meq/ml-resin
Water Retention (%)	50-60	53-63
Shipping Density	~ 630 grams/liter	~ 670 grams/liter
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>	
Effective Size (mm)	0.40 min	0.35 min
Uniformity Coefficient	1.6 max	
Whole Bead Count (%)	95% min	
Operating Temperature	100°C max	
Specific Surface Area	600 m ² /dry gram	1400 m ² /dry gram
Pore Volume	0.7 ml/dry gram	

Chelating Resins

Iminodiacetate Type: CR11 is based on a high porous styrenic matrix, and provides rapid kinetics, high operating capacity, low swell / shrink ratio, and excellent mechanical stability. CR11 captures metal ions by chelation with its iminodiacetate functionality. CR11 has a higher selectivity than strong and weak acid cation exchange resins for divalent ions, especially transitional metal elements such as copper, Iron, etc... CR11 can capture metal ions at much lower pH than strong and weak acid resins. As CR11 has higher selectivity for divalent metal ions than monovalents, it can be used for such selective separation.

Polyamine Type: CR20 is a special chelating resin with polyamine functionality. CR20 captures metal ions by chelation with its polyamine functionality with its high porous styrene-DVB matrix. CR20 has a high selectivity to heavy metal ions. It does not absorb alkali metal and alkali earth metal ions, and therefore, it can be used for heavy metal recovery from highly concentrated alkali earth solutions.

Glucamine Type: CRB03 and CRB05 are special chelating resin with glucamine groups based on a high porous styrene-DVB matrix. It has high selectivity for borate ions. It is used for borate separation from various solutions, including brine and sea water.

Aminophosphonic Type: Relite JS020 is an amino phosphonic exchange resin based on styrene-DVB polymer matrix. It is suitable for applications such as decalcification of secondary brine in the chloralkali industry.

CHL10P, CHL20P, and CLB10P are smaller resins of the CR11, CR20, and CRB05 respectively

Grades	CR11	CR20	CRB03	CRB05
Brand Name	Diaion			
Matrix type	Porous – Styrene-DVB			
Functionality	$-\text{CH}_2\text{N}(\text{CH}_2\text{COONa})_2$	$-\text{CH}_2\text{NH}(\text{CH}_2\text{CH}_2\text{NH})_n\text{H}$	$-\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2(\text{CHOH})_4\text{CH}_2\text{OH}$	
Total Exchange Capacity (meq/ml-R)	-	-	>0.7	>0.95
Cu Adsorption Capacity (mmole/ml-R)	>0.5	>0.4	-	
Water Retention (%)	55-65	60-60	45-55	43-53
Shipping Density (grams/liter)	~ 730	~ 635	~ 665	~ 770
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 355 μm: 2% max</i>	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>	<i>On 850 μm: 10% max Thru 300 μm: 1% max</i>	
Effective Size (mm)	0.40 min		0.35-0.55	0.35 min
Uniformity Coefficient	1.6 max			
Whole Bead Count (%)	95% min			
Operating Temperature	80°C max (H form) 120°C max (Na form)	100°C max (free base)		

Grades	JS020	CHL10P	CHL20P	CLB10P
Brand Name	Relite	MCI GEL		
Matrix type	Porous – Styrene-DVB			
Functionality	$-\text{CH}_2\text{NHCH}_2\text{PO}_3\text{Na}$	Same as CR11	Same as CR20	Same as CRB05
Total Exchange Capacity (meq/ml-R)	>2.0	>1.5	>1.8	>2.0
Water Retention (%)	60-67	-		
Shipping Density (grams/liter)	~ 750	-		
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>	<i>>150μm: 15% max 63-150μm: 70% min <63μm: 20% max</i>		
Effective Size (mm)	0.45 min	-		
Uniformity Coefficient	1.7 max	1.6 max		
Whole Bead Count (%)	90% min	-		
Operating Temperature	75°C max (Na form)	80°C max (H form) 120°C max (Na form)	100°C max (free base)	

Ultrapure Ion Exchange Resins

Mitsubishi Chemical offers several grades of mixed resin for non-regenerable mixed bed ion exchange applications. All mixed resins are typically offered in a 1:1 stoichiometric ratio (1 equivalence of cation equilibrium capacity to 1 equivalence of anion equilibrium capacity).

Relite JM100 is a nuclear grade mixed ion exchange resin with indicator. It is a mixture of high purity and highly regenerated color indicating JC600 and JA100 in 1:1 volume ratio.

The Diaion SMNUP mixed resin is offered for critical applications which require high purity treated water. This mixed resin is prepared from component resins which have been prepared with a high degree of purity and conversion to the H/OH form. Diaion SMNUP is often supplied for applications which require nuclear grade resin.

Diaion KAM115 is a mixture OH form gel type strongly basic anion resin and H form gel type strongly acid cation resin mixed ionic exchange resin. The mixture is 1 H type to 1.5 OH type on volume basis. Diaion KAM115 is recommended for the pure-water no-regeneration type resin. KAM120 is similar to KAM115 but is a mixture of 1 H type to 2 OH type on volume basis.

SMT100L and SMT200L are manufactured to very stringent performance specifications, and prepared from component resins with the highest degree of conversion and considerations of purity. They will also provide exceptional performance relative to electrical resistivity and TOC leakage. In fact, rinse to 18 megaohm resistivity is near instantaneous, and clearly superior to conventional mixed bed resins. The performance for TOC meets or exceeds all conventional mixed bed resins. The TOC rinse down performance is maintained over 12 month's storage.

Diaion SMT200L offers remarkable performance relative to metals leakage. The cation component, SKT20L, has been prepared with low levels of metals in the resin phase (500 ppb). This improvement allows ppt metals leakage in the product water quality (actual performance is <0.1 ppt for 13 metals within 4 hrs of rinse).

Grades	JM110	KAM115	KAM120	SMNUP	SMT100L	SMT200L
Brand Name	Relite	Diaion				
Matrix type	Gel (styrene, DVB) with Ionic form H/OH					
Capacity (meq/ml resin)	>1.9 cation >1.1 anion	>1.7 cation >0.9 anion				
Water Retention (%)	47-54 cation 46-52 anion	50-60 cation 62-72 anion				
Conversion (eq%)	>99 H form >90 OH form				>99.9 H form >90.0 OH form <1.0 Cl form	
Particle Size Distribution	On 1180 μ m: 5% max Thru 300 μ m: 1% max	On 1180 μ m: 5% max Thru 425 μ m: 1% max	On 1180 μ m: 5% max Thru 300 μ m: 1% max			
Effective Size (mm)	0.40 min					
Uniformity Coefficient	1.7 max	1.6 max				
Performance Properties*						
Resistivity (m Ω . Cm)	>12 (30 min)			>15 (30 min)	>18 (3 hrs)	>18.1 (12 hrs)
TOC (ppb)	Mixed Resin with Indicator	-			<10 (3 hrs)	<10 (3 hrs)
Metal Water Quality (ppt)	-					<0.1 (12 hrs)
Particles (>0.05 μ m/ml)	-					<10 (12 hrs)

*Test condition: Feed of 18.1 m³ cm to 1500ml resin packed in 50mm ϕ x 1000mmH column at SV 20. Resistivity measured by DKK: AQ-11; TOC by Anatel A-100PSE.

More Ultrapure Ion Exchange Resins

Diaion SKT10L is a premium grade, gel-type strong acid cation exchange resin based on a crosslinked polystyrene matrix with sulfonic acid functional groups. Diaion SKT10L is prepared in the hydrogen form with special attention to resistivity rinse up, TOC and metal leachables. Diaion SKT10L is used as the cation component for Diaion SMT100 non-regenerable mixed bed resin. This ultra-hi-purity mixed bed resin is recommended for semiconductor plant final polishing loop applications. An improved copolymerization process provides low level TOC leachables. SKT10L is remarkable for its extremely low content of ionic contaminants in the resin phase. Diaion SKT10L is recommended for critical applications requiring low metal leakage.

Diaion SAT10L is a premium grade, gel-type strong base, Type I, anion exchange resin based on a crosslinked polystyrene matrix with quaternary ammonium functional groups. Diaion SAT10L is prepared with an extremely high conversion to the hydroxide form with special attention to resistivity rinse up, TOC and metal leachables. Diaion SAT10L is used as the anion component for Diaion SMT100 non-regenerable mixed bed resin. This ultra-hi-purity mixed bed resin is recommended for semiconductor plant final polishing loop applications. SAT10L is remarkable for its extremely low content of ionic contaminants in the resin phase. The method of preparation provides TOC leakage in the ppb range.

Diaion SKT20L is an improved version of Diaion SKT10L since it has been prepared with low levels of metals in the resin phase (500 ppb). This improvement allows ppt metals leakage in the product water quality (actual performance is <0.1 ppt for 13 metals within 4 hrs of rinse). Diaion SAT20L is an improved version of Diaion SAT10L since it has been prepared with low levels of metals in the resin phase (500 ppb). This improvement allows ppt metals leakage in the product water quality (actual performance is <0.1 ppt for 13 metals within 4 hrs of rinse).

Grades	SKT10L	SAT10L	SKT20L	SAT20L
Brand Name	Diaion			
Matrix type	Gel (styrene, DVB)			
Counter Ion	>99.9 H form	>90.0 OH form	>99.9 H form	
Total Capacity (meq/ml-R)	>1.7	>0.9	>1.7	>1.9 Na form
Water Retention (%)	50-60	55-65	50-60	41-47 Na form
Particle Size Distribution	<i>On 1180 μm: 5% max Thru 300 μm: 1% max</i>			
Effective Size (mm)	0.45 min	0.40 min	0.45 min	
Uniformity Coefficient	1.6 max			
Performance Properties*				
Resistivity (m Ω . Cm)	>12 (3 hrs)	>15 (3 hrs)	>16 (12 hrs)	>18.1 (12 hrs)
TOC (ppb)	<20 (3hrs)	<20 (3hrs)	<5 (12 hrs)	<1.0 (12 hrs)
Metal Content (ppb/dry resin)			Na, Ca, Fe, Zn <1000	Na, Ca, Fe, Zn <1000

* Single Bed with inlet water quality of 15m Ω • cm resistivity at Flow Rate: SV30

Fractionation Resins for Industrial Chromatography

Chromatographic separation is widely industrialized in pharmaceuticals, fermentation, and food applications. Ion exchange resins of small particles with uniform particle size distribution are applied for these purposes. The smaller particles with the more uniform particle size distribution, the higher yields and purities can be obtained. These types of resins are suitable for industrial chromatography such as fructose/glucose separation...

Diaion UBK resin are prepared via monodispersed production technology, and offered with narrow particle size distributions in either sodium or calcium form. The high bead uniformity provides fractionation resins with excellent resolving power and mechanical stability. These products are often applied in simulated moving beds (SMB) equipment with 4 to 8 column design for separation of binary and ternary mixtures in both small and large scale industrial applications.

MA01SS and MA03SS are strong base anion exchange resins, gel type, based on styrene-DVB polymer matrix, manufactured with Mitsubishi Chemical most up-to-date technology. These resins are used in special application such as the biomass industry for salt retardation. These MA resin were improved significantly when the monodispersed version came out. The UMA series is a new addition to the Mitsubishi Chemical offering enabling better fractionation and improved osmotic stability.

AMP03 is a monodispersed amphoteric resin that contains both a strong basic anion exchanger and a weak acid cation exchanger on the same covalently bonded functional group. Such unusual resin is used to fractionate salts such as sodium chlorides from sodium sulfates etc...

Grades	UBK510L	UBK530	UBK535	UBK550	UBK555
Brand Name	Diaion				
Matrix type	Gel (styrene, DVB) :			R-SO ₃ ⁻	
Counter Ion	Na ⁺ form		Ca ⁺ form	Na ⁺ form	Ca ⁺ form
Total Capacity (meq/ml-R)	>1.2	> 1.6		>1.9	>2.0
Water Retention (%)	61-65	52-56	48-52	46-50	42-46
Shipping Density (grams/liter)	~ 780	~ 810	~ 845	~ 825 Na form	~ 865
Particle Size	L grade – 320 μm K grade – 350 μm G grade – 390 μm	Standard-220 μm J grade – 280 μm L grade – 320 μm K grade – 350 μm G grade – 390 μm	Standard-220 μm J grade – 280 μm L grade – 320 μm	Standard-220 μm K grade – 350 μm G grade – 390 μm	Standard-220 μm K grade – 350 μm
Uniformity Coefficient	1.1 max				
Whole Bead Count (%)	90% min				
Operating Temperature	120°C max				
Crosslinked	4%	6%	6%	8%	8%

Grades	MA01SS	MA03SS	UMA130J (UMA150) [UMA130K]	UMA140S	AMP03
Brand Name	Diaion				
Matrix type	Gel (styrene, DVB) :			R-CH ₂ -N(CH ₃) ₃ ⁺	R-CH ₂ N ⁺ (CH ₃) ₂ CH ₂ COO ⁻
Counter Ion	Cl ⁻ for standard form				
Total Capacity (meq/ml-R)	>1.3	> 1.5	>1.35	>1.25	>0.75
Water Retention (%)	43-47	43-47	43-53	43-49	55-60
Particle Size	Thru 212 μm: 1% max	150-250 μm: 85% min	280 μm (220 μm) [350μm]	170 μm	260 μm
Effective Size (mm)	-	0.15-0.25	-	-	-
Uniformity Coefficient	1.6 max		1.1 max		1.2 max
Whole Bead Count (%)	90% min		95% min		
Operating Temperature	60°C (OH form) ---- 80°C (Cl form) max				60°C max

Preparative Ion Exchange Resins

The CK grade resins are based on a crosslinked polystyrene matrix having sulfonic acid groups with a sodium counter-ion for easy substitution. With varying the crosslinking degree or the DVB content (divinyl-benzene ratio) and the bead size of these resins, one can control the efficiency and the resolution in the separation of amino-acids, carbohydrates, sugars, organic acids and amines etc... These styrenic matrices have excellent mechanical strength with wide range pH stability (1 to 14) and resistance to high temperatures (up to 120 °C operating temperature).

Grades	CK02A	CK04S	CK06S	CK08S	CK10S
Brand Name	MCI GEL				
Matrix type	Gel				
Counter Ion	Na ⁺				
Total Capacity	>0.5 meq/ml	>0.8 meq/ml	>1.5 meq/ml	>1.9 meq/ml	>2.0 meq/ml
Crosslinked	2%	4%	6%	8%	10%
Mean size	20 µm	11 µm			
Particle range	16 – 24 µm	9 – 13 µm			
Column Dimension	20 x 250 mm	10 x 200 mm	none	8 x 500 mm	none
Packing size*	10 grams	10, 25, 50 g			
Typical usage	Oligosaccharide	Oligosaccharide	Oligosaccharide	Sugars, Carboxylic acids	Sugars, Carboxylic & Amino acids

Grades	CK08Y	CK08P	CK10Y
Brand Name	MCI GEL		
Matrix type	Gel		
Counter Ion	Na ⁺		
Total Capacity	>1.9 meq/ml	>1.9 meq/ml	>2.0 meq/ml
Crosslinked	8%	8%	10%
Mean size	25 µm	110 µm	25 µm
Particle range	20 – 30 µm	75 – 150 µm	20 – 30 µm
Column Dimension	None		
Packing size*	50, 300 g	100 ml	50 g
Typical usage	Sugars, Carboxylic acids	Sugars, Carboxylic acids	Amino Acids

*Larger packing sizes are available as custom packing

- Note:
- a) The above products are available in uniform bead sizes of 220 µm as well as bead sizes > 250 µm for large industrial applications.
 - b) The above products are available in uniform bead sizes < 10 µm which are available in bulk or HPLC columns for small analytical applications. Please request our MCI GEL catalog of these analytical resins.

More Preparative Ion Exchange Resins

The CA grade resins are based on a crosslinked polystyrene matrix having quaternary amine groups (trimethyl amine) with a chloride counter-ion for easy substitution. With varying the crosslinking degree or the DVB content (divinyl-benzene ratio) and the bead size of these resins, one can control the efficiency and the resolution in the separation of nucleotides, carbohydrates, sugars, carboxylic acids and anionic substances (e.g. Humic) etc... These styrenic matrices have excellent mechanical strength with wide range pH stability (1 to 14) and resistance to high temperatures (up to 60 °C operating temperature).

Grades	CA06S	CA08S	CA10S
Brand Name	MCI GEL		
Matrix type	Gel		
Counter Ion	Cl ⁻		
Total Capacity	>1.2 meq/ml		
Crosslinked	6%	8%	10%
Mean size	11 µm		
Particle range	9 – 13 µm		
Column Dimension	None		
Packing size*	10, 25, 50 g	10, 25, 50 g	10, 25, 50 g
Typical usage	Sugars, Carboxylic acids	Sugars, Carboxylic acids	Sugars, Carboxylic acids

Grades	CA08Y	CA08P	CHPA25**
Brand Name	MCI GEL		
Matrix type	Gel		Highly porous
Counter Ion	Cl ⁻		
Total Capacity	>1.2 meq/ml	>1.3 meq/ml	0.5 meq/ml
Crosslinked	8%	8%	25%
Mean size	25 µm	110 µm	
Particle range	20 – 30 µm	75 – 150 µm	
Column Dimension	None		
Packing size*	50 g	100 ml	20 ml
Typical usage	Sugars, Carboxylic acids	Sugars, Carboxylic acids	Anionic substances

*Larger packing sizes are available as custom packing

**CHPA25 is also considered as a functionalized adsorbent with 20 m²/dry gram surface area

Note: a) The above products are available in bead sizes > 150 µm for large industrial applications.
 b) The above products are available in uniform bead sizes < 10 µm which are available in bulk or HPLC columns for small analytical applications. Please request our MCI GEL catalog of these analytical resins.

Synthetic Adsorbents

Diaion HP20 synthetic adsorbent resin is a macroporous styrenic polymeric bead type resin designed for adsorption/desorption process scale applications. Its matrix provides an aromatic non-polar surface with excellent selectivity for hydrophobic areas of molecules, including biomolecules like antibiotics via low energy van der Waal's interactions. It is remarkable for its wide pore polymeric structure which provides excellent broad spectrum adsorption characteristics. Diaion HP21 has slightly smaller pores, and slightly higher surface area than Diaion HP20.

The Sepabeads SP825 and SP850 resins provide a smaller more uniform pore size distribution and higher surface area as compared to Diaion HP20. The increase in surface area is approximately 2x traditional adsorbents, and nearly matches the surface area of activated carbon. In many applications, this means twice the working capacity for the same volume of resin. They are recommended for industrial chemical process applications, bio/pharmaceutical applications such as desalting and extraction, and waste treatment...

Sepabeads SP70, SP700, and SP710 are premium grade resins designed for the debittering of juices and related food products. These high surface area resins offer excellent kinetics and high capacity for naringin (and other bittering agents). They meet the compositional requirements for Secondary Direct Food Additives (21 CFR Section 173.65). Sepabeads SP70 and S710 are provided pre-conditioned to meet the extractive requirements on date of manufacture.

The Sepabeads SP207 resin is a macroporous chemically modified brominated styrenic polymeric type resin. The bromination of the aromatic ring provides increased hydrophobicity, and consequently, increased selectivity for hydrophobic molecules versus conventional styrene/DVB synthetic adsorbents like Diaion HP20 resin. In addition, the bromination increases the resin density which allows for settling in fermentation broths, and for usage in upflow fluidized beds.

Diaion HP2MG is a macroporous methacrylate polymeric resin. It has no aromatic character. Diaion HP2MG grades have different selectivity than the classic Diaion HP20. It is recommended for broad spectrum adsorption and desorption of small and large molecules, long chain aliphatic molecules, decolorization and desalting applications, and should be evaluated as an alternate resin matrix to the styrenic based adsorbents.

Grades	HP20	HP21	SP825L	SP850	SP70
Brand Name	Diaion		Sepabeads		
Matrix type	Highly porous (styrene, DVB)				
Ceph C Capacity* (g/L)	~ 38	~ 40	~ 80	~ 85	-
Water Retention (%)	55-65	45-55	52-62	46-52	55-65
Shipping Density (g/L)	~ 680	~ 685	~ 685	~ 695	~ 685
Particle Size Distribution	On 250 µm: 90% min				
Effective Size (mm)	0.25 min				
Surface Area (m ² /dry-g)	~ 590	~ 640	~ 930	~ 930	~ 870
Pore Volume (ml/gram)	~ 1.3	~ 1.3	~ 1.4	~ 1.1	~ 1.5
Pore Radius (Å)	290	110	70	45	70
Specific gravity	1.01				
Swelling water to toluene	30%	30%	20%	20%	24%
Operating Temperature	130°C max				

Grades	SP700	SP710	SP207	HP2MG
Brand Name	Sepabeads			Diaion
Matrix type	Highly porous (styrene, DVB)		(brominated styrene-DVB)	(Methacrylate)
Ceph C Capacity* (g/L)			~ 120	< 10
Water Retention (%)	60-70	60-70	43-53	55-65
Shipping Density (g/L)	~ 680	~ 685	~ 790	~ 720
Particle Size Distribution	On 250 µm: 90% min			On 300 µm: 90% min
Effective Size (mm)	0.25 min			0.30 min
Surface Area (m ² /dry-g)	~ 1200	~ 900	~ 600	~ 570
Pore Volume (ml/gram)	~ 2.3	-	~ 1.0	~ 1.3
Pore Radius (Å)	90	90	110	240
Specific gravity	1.01		1.19	1.09
Reversible Swelling % (water to toluene)	7	-	20	5
Operating Temperature	130°C max			-

- Based on 4300 ppm feed loaded at 4 BV/hr (at 20 °C) to 50% leakage (resin volume of 20 ml)

Synthetic Adsorbents for Chromatography Separation

It is well known that smaller size resins are required to obtain higher purity and better recovery in chromatographic separation of pharmaceuticals. Mitsubishi Chemical offers several types of synthetic adsorbent grades in very useful particle size distribution for industrial scale chromatography.

HP20SS and SP20SS are directly polymerized, small particle size version of HP20. The wide pore polymer matrix provides excellent kinetics and capacity for small biomolecules of both preparative and process scale. They offer nice balance of pressure flow characteristics and true chromatographic fractionation and have also been successfully applied in simulated moving bed (SMB) applications for a variety of small biomolecules. They often compete with bonded silica supports for preparative and industrial applications.

SP2MGS is a small and uniform particle size version of methacrylate types Diaion HP2MG. It gives higher dynamic capacity than HP2MG and shows strong retention and unique selectivity in normal phase chromatography.

SP207SS is a small size version of modified aromatic type Sepabeads SP207. It is applied to reversed phase chromatography. The brominated polymeric matrix provides unique selectivity, full pH operating range and long operating life versus the conventional bonded silica packing materials used in preparative and industrial applications.

Grades	HP20SS	SP20SS	SP207SS	SP2MGS
Brand Name	Diaion	Sepabeads		
Matrix type	Highly porous (styrene, DVB)		(brominated styrene-DVB)	(Methacrylate)
Water Retention (%)	55-67	55-65	43-53	61-69
Shipping Density (g/L)	~ 670	~ 660	~ 780	~ 720
Particle Size Distribution	>150 μ m:15% max 63-150 μ m:70%min <63 μ m:20%max	>75 μ m:30% max 63-75 μ m:55%min <63 μ m:15%max	>150 μ m:15% max 63-150 μ m:70%min <63 μ m:20%max	>220 μ m:1% max 120-160 μ m:85%min <90 μ m:1%max
Surface Area (m ² /dry-g)	~ 560		~ 590	~ 520
Pore Volume (ml/gram)	~ 1.2		~ 1.0	~ 1.3
Pore Radius (Å)	~ 290		~ 110	~ 230
Operating Temperature	130°C max			-

Styrenic Reversed Phase Resins

The CHP grade resins are based on highly crosslinked polystyrene matrix with no functionality. With varying the pore size, the surface area, and the bead size of these resins, the chromatographer can control the efficiency and the resolution in the separation of pharmaceuticals (e.g. heterocyclic compounds), steroids, small peptides and proteins, oligonucleotides, amphoteric molecules (e.g. sulfonamides, antibiotics, nucleic bases), basic drugs (e.g. anticonvulsants), simple amines (e.g. catecholamine), and antihistamines etc... These styrenic matrices have excellent mechanical strength with wide range pH stability (1 to 14) and resistance to high temperatures (up to 120 °C operating temperature).

CHP20 grades are the preparative size for HP20. CHP50 grades are the preparative size for HP21. CHP07 grades are the preparative size for SP207. SP70Y is the preparative size of SP70 and therefore can be used in food applications.

CSP800 is used for enrichment traces of organic compounds in environmental water with high concentration ratio and high recovery, is recommended for sample preparation for mutagenicity study. CHP85/P120 and CHP87/P120 with controlled micro-pore size, in particular, have a distinctive advantage not to adsorb high molecular weight proteins but to adsorb only low molecular weight organic compounds.

Grades	CHP50/P10	CHP50/P20	CHP20P/P20	CHP50/P30	CHP20/P30	SP70Y
Brand Name	MCI GEL					
Matrix	Styrene-DVB					
Mean size	10 µm	20 µm		30 µm		
Particle range	9 – 11 µm	18-22 µm		20 – 40 µm		
Pore Diameter (Ang)	250		450	250	450	150
Column Dimension	4.6 x 150 mm 10 x 250 mm 20 x 150 mm 20 x 250 mm	None				
Packing sizes	10 g, 1000 g	25, 100, 1000ml	25, 100, 1000ml	25, 100, 1000ml	25, 100, 1000ml	

Grades	CHP20/P50 dry	CHP20P/P120	CSP800	CHP85/P120	CHP87/P120
Brand Name	MCI GEL				
Matrix	Styrene-DVB				
Mean size	50 µm	120 µm			
Particle range	37 – 75 µm	75 – 150 µm			
Pore Diameter (Ang)	450		-	Small	Very Small
Column Dimension	None				
Packing sizes	100 gram	.1, .5,1,10,50L	50ml	100 ml	

Grades	CHP07/P10	CHP07/P120
Brand Name	MCI GEL	
Matrix	Brominated Styrene-DVB	
Mean size	10 µm	110 µm
Particle range	9 – 11 µm	75 – 150 µm
Pore Diameter (Ang)	250	
Column Dimension	4.6 x 150 mm 10 x 250 mm 20 x 150 mm 20 x 250 mm	None
Packing sizes	500 ml, 40 L	1,10,50L

- Note:**
- Most of the above products are available in bead sizes > 200 µm for large industrial applications. Please check the Synthetic Adsorbent section.
 - The above products are available in uniform bead sizes < 10 µm which are available in bulk or HPLC columns for small analytical applications. Please request our MCI GEL catalog of these analytical resins.

Methacrylic Reversed Phase Resins

The CMG grade resins are based on highly crosslinked polymeth acrylic matrix with no functionality. Polymethacrylate resins have no aromatic character, offering medium hydrophobicity (less hydrophobic than styrenic resins or octadecyl silane). They are mainly used in the separation of pharmaceuticals (e.g. polyaromatic and polyaliphatic compounds), water soluble vitamins, small peptides and proteins, oligonucleotides, simple amines (e.g. catecholamine), and agricultural chemicals etc... These methacrylic matrices have excellent mechanical strength and wide range pH stability (1 to 13), and resistance to high temperatures (up to 120 °C operating temperature). CMG grades are the preparative size for HP2MG.

The CHPOD is an unusual product as it has surface hydrophobicity as well as hydrophobic functionality. It is an Octadecyl-alkylated aliphatic porous polymer which is less hydrophobic than the other CHP resin but more hydrophobic than the CMG grades.

Grades	CMG20/P10	CMG20/P30	CMG20/P150	CHPOD/P30
Brand Name	MCI GEL			
Matrix	Methacrylate			Octadecyl-Alkylated Aliphatic
Mean size	10 µm	30 µm	10 µm	30 µm
Particle range	9 – 11 µm	25 – 35 µm	9 – 11 µm	25 – 35 µm
Pore Diameter (Ang)	250			
Column Dimension	4.6 x 150 mm 10 x 250 mm 20 x 150 mm 20 x 250 mm	None		
Packing size*	10 g, 1000 g	25, 100, 1000ml	10 g,	100 g

Note: a) Most of the above products are available in bead sizes > 200 µm for large industrial applications. Please check the Synthetic Adsorbent section.
 b) The above products are available in uniform bead sizes < 10 µm which are available in bulk or HPLC columns for small analytical applications. Please request our MCI GEL catalog of these analytical resins.

Bioseparation: Wide Pore Hydrophilic Cation Exchange Resins

The CQ grade resins are based on highly crosslinked polymethacrylic matrix, which is further hydroxylated for added hydrophilicity. These matrices are functionalized with either sulfonic acid or carboxymethyl to form strong acid and weak acid cation exchangers respectively with a sodium counter ion. By varying the bead size of these resins, the chromatographer can control the efficiency and the resolution in the separation of cationic proteins, peptides, and polynucleotides (separation at a pH < PI of the target molecule). These methacrylic polymer matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (can be autoclaved at 121 °C for 20 minutes). The calibration curve for CQ grades is presented on Pg. 7 of this brochure.

MCI GEL PrepEx SP is a unique product to Mitsubishi Chemical. In addition to the hydroxylated polymethacrylic matrix of the CQ resins, PrepEx SP has an additional hydrophilic layer of glycol chain covalently bonded onto the matrix for additional hydrophilicity. PrepEx SP is remarkable for high recovery with negligible non-specific binding (which increases operating life in preparative chromatography).

Relisorb media are also based on highly crosslinked polymerthacrylic matrix, which is hydroxylated for added hydrophilicity. These matrices are functionalized with either a carboxymethyl or a sulfopropyl. These resins are used in the large scale separation of cationic proteins, peptides, and polynucleotides (separation ran at a pH < PI of the target molecule) as well as enzyme immobilization supports. These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (up to 60°C operating temperature). They enable an easy scale-up from the CQ series into industrial size applications.

Grades	CQK30S	CQK30P	CQK31S	CQK31P
Brand Name	MCI GEL			
Mean size	10 µm	30 µm	10 µm	30 µm
Particle range	9 – 11 µm	25 – 35 µm	9 – 11 µm	25 – 35 µm
Functional Group	SP		CM	
Counter Ion	Na ⁺			
Functional degree	0.3-0.5 meq/g		0.2-0.4 meq/g	
Exclusion Limit	Up to 10 ⁶			
Pore Diameter (Ang)	600			
Column Dimension	7.5 x 75 mm	None	7.5 x 75 mm	None
Packing size*	10, 25, 50 g	100 ml	10, 25, 50 g	100 ml

Grades	CM400/SS* (CM400) [CM405/EB]	SP400/SS* (SP400) [SP405/EB]
Brand Name	Relisorb	
Particle range	50-150 µm (75-200 µm) [200-500 µm]	
Functional Group	CM	SP
Counter Ion	H ⁺	Na ⁺
Total Capacity	>0.15 meq/ml	>0.10 meq/ml
Lysozyme binding Capacity**	>30 mg/ml	>40 mg/ml
Bulk density	~ 800 grams per liter	
Specific Gravity	>1.10 grams/ml	
Pore Diameter (Ang)	400 to 500	

*Resins available in packed SPE columns called ReliChrom. 5 ml each x 100mm deep.

** Feed solution: 8 g/L lysozyme in 20mM sodium acetate buffer, PH 5; flow rate = 150 cm/hr

Bioseparation: Wide Pore Hydrophilic Anion Exchange Resins

The CQ grade resins are based on highly crosslinked polymethacrylic matrix, which is further hydroxylated for added hydrophilicity. These matrices are functionalized with either a quaternary amine (trimethyl amine) or a diethyl-aminoethyl to form strong basic and weak basic anion exchangers respectively with a chloride counter ion. By varying the bead size of these resins, the chromatographer can control the efficiency and the resolution in the separation of anionic proteins, peptides, and polynucleotides (separation ran at a pH > PI of the target molecule). These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (up to 60°C operating temperature). The calibration curve for CQ grades is presented on Pg. 7 of this brochure.

The FP grade resins are based on highly crosslinked polymethacrylic matrix, which is hydroxylated for added hydrophilicity. These matrices are functionalized with either a diethyl-amino, or hexyldiamine to form weak basic anion exchangers. These resins are used in the large scale separation of anionic proteins, peptides, and polynucleotides (separation ran at a pH > PI of the target molecule) as well as enzyme immobilization supports. These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (up to 60°C operating temperature). FP-DA13 is a unique product to Mitsubishi Chemical. The diethylamine (DEA) functionality is a secondary amine base group which provides increased capacity towards target molecules. FP-HA13 is a unique product to Mitsubishi Chemical. The diaminoethyl functionality is a polyamine (2 amine) branches with both secondary and primary amine sites. This will increase capacity towards anionic target molecules.

Relisorb media are also based on highly crosslinked polymerthacrylic matrix, which is hydroxylated for added hydrophilicity. These matrices are functionalized with either a tertiary amine or quaternary amine. They are used in similar fashion to the FP grade series.

Grades	CQA35S	CQA35P	CQA31S	CQA31P	FP-DA13
Brand Name	MCI GEL				Sepabeads
Mean size	10 µm	30 µm	10 µm	30 µm	120 µm
Particle range	9 – 11 µm	25 – 35 µm	9 – 11 µm	25 – 35 µm	100– 150 µm
Functional Group	QA	QA	DEAE	DEAE	Diethyl amine
Counter Ion	Cl ⁻		Free Base		
Functional degree	0.3-0.5 meq/g		0.5-0.7 meq/g		1.90 meq/ml
Capacity BSA	---	---	---	---	15-20 mg/ml
Exclusion Limit	Up to 10 ⁶				
Pore Diameter (Ang)	600				
Column Dimension	7.5 x 75 mm	None	7.5 x 75 mm	None	
Packing size*	10, 25, 50 g	25, 50, 100, 1000 ml	10, 25, 50 g	25, 50, 100, 1000 ml	500 ml, 40 L

Grades	FP-HA13	DA400/SS* (DA400) [DA405/EB]	QA400/SS* (QA400) [QA405/EB]
Brand Name	Sepabeads	Relisorb	
Mean size	120 µm	-	-
Particle range	100 – 150 µm	50-150 µm (75-200 µm) [200-500 µm]	
Functional Group	hexyldiamine	Diethyl amine	QA
Counter Ion	Free Base	Free Base	Cl ⁻
Functional degree	2.05 meq/ml	>0.3 meq/ml	
Capacity BSA	25-30 mg/ml	>30 mg/ml	-
Exclusion Limit	Up to 10 ⁶	-	
Pore Diameter (Ang)	1000	400 to 500	
Packing size*	500 ml, 40 L	various	various
Bulk density	-	~ 800 grams per liter	
Specific Gravity	-	>1.10 grams/ml	

*Resins available in packed SPE columns called ReliChrom. 5 ml each x 100mm deep.

** Feed solution: 10 g/L BSA in 20 mM TRIS-HCl buffer, pH 7; flow rate = 150 cm/hr

Bioseparation: Wide Pore HIC Resins

The CQ grade resins are based on highly crosslinked polymethacrylic matrix which is hydroxylated for added hydrophilicity. These matrices are functionalized with either butyl, ether, or phenyl groups. By varying the bead size of these resins, the chromatographer can control the efficiency and the resolution in the separation of proteins, peptides, and polynucleotides (hydrophobicity decreases from phenyl to butyl to ether). These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (up to 60°C operating temperature). The calibration curve for CQ grades is presented on Pg. 7 of this brochure.

Relisorb media are also based on highly crosslinked polymerthacrylic matrix, which is hydroxylated for added hydrophilicity. These matrices are functionalized with either a butyl, phenyl, or octadecyl. These resins are used in the large scale separation of proteins, peptides, and polynucleotides as well as enzyme immobilization supports. These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (up to 60°C operating temperature). They enable an easy scale-up from the CQ series into industrial size applications.

Grades	CQH3BS	CQH3BP	CQH3PS	CQH3PP	CQH3ES
Brand Name	MCI GEL				
Mean size	10 µm	30 µm	10 µm	30 µm	10 µm
Particle range	9 – 11 µm	25 – 35 µm	9 – 11 µm	25 – 35 µm	9 – 11 µm
Functional Group	Butyl		Phenyl		Ether
Functional degree	Proprietary				
Exclusion Limit	Up to 10 ⁶				
Pore Diameter (Ang)	600				
Column Dimension	7.5 x 75 mm	None	7.5 x 75 mm	None	7.5 x 75 mm
Packing size*	10, 25, 50 g	100 ml	10, 25, 50 g	100 ml	10, 25, 50 g

Grades	BU400/SS* (BU400) [BU405/EB]	PH400/SS* (PH400) [PH405/EB]	OD400/SS* (OD400) [OD405/EB]
Brand Name	Relisorb		
Particle range	50-150 µm (75-200 µm) [200-500 µm]		
Functional Group	Butyl	Phenyl	Octadecyl
Counter Ion	-		
Capacity Bovine serum Albumin	>30 mg/ml		>20 mg/ml
Bulk density	~ 800 grams per liter		
Specific Gravity	>1.10 grams/ml		
Pore Diameter (Ang)	400 to 500		

*Resins available in packed SPE columns called ReliChrom. 5 ml each x 100mm deep.

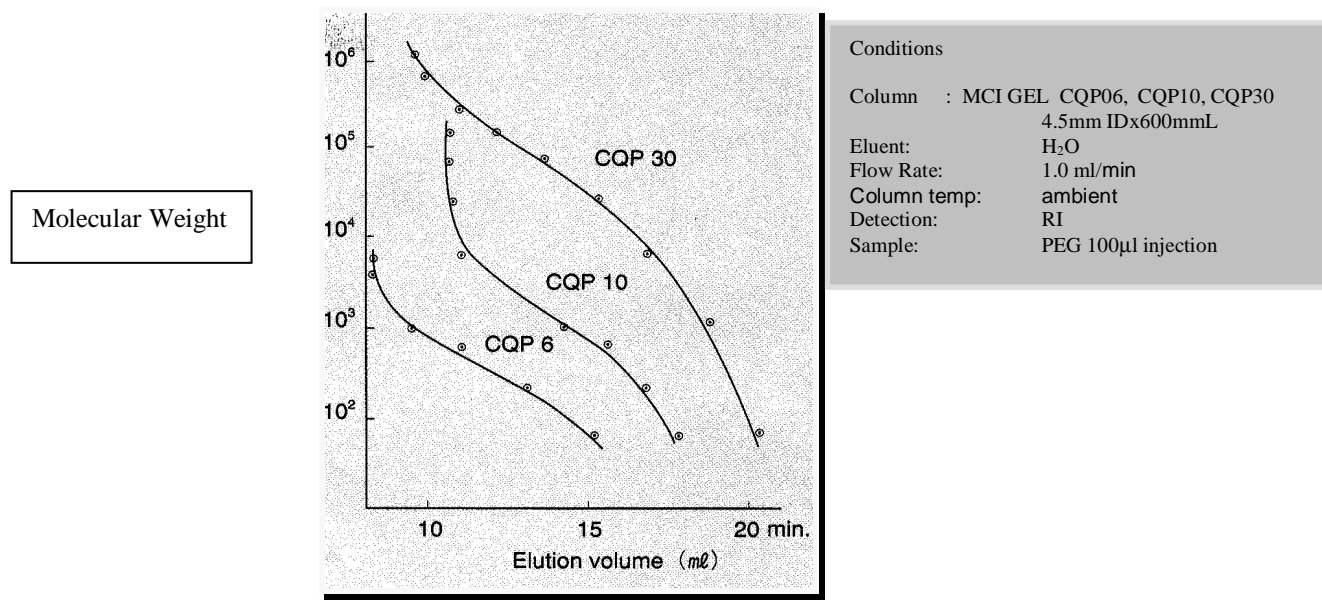
** Feed solution: 10 g/L BSA in 20 mM phosphate buffer, pH 7; + 2M ammonium sulfate; flow rate = 150 cm/hr

Bioseparation: Hydrophilic Aqueous Gel Filtration Resins

The CQ grade resins are based on highly crosslinked polymethacrylic matrix, which is further hydroxylated for added hydrophilicity. These matrices are not functionalized, and have no interfering ionic interaction to achieve maximum separation by size exclusion. By varying the bead size and pore size of these resins, the chromatographer can control the efficiency and the resolution in the separation of proteins, peptides, lipids, and polynucleotides. These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (these resins can be autoclaved at 121°C for 20 minutes). The calibration curve for MCI GEL CQP grades is presented below.

Grades	CQP06	CQP10	CQP30	CQP30P	FP-HG13
Brand Name	MCI GEL				Sepabeads
Mean size	10 μm			30 μm	120 μm
Particle range	9 – 11 μm			25 – 35 μm	100 – 150 μm
Functional Group	Diol				
Counter Ion	None				
Exclusion Limit	Up to 1,000	Up to 10,000	Up to 10^6		
Pore Diameter (Ang)	120	200	600		
Column Dimension	7.5 x 75 mm			None	
Packing size*	10, 25, 50 g			100 ml	500 ml, 40 L

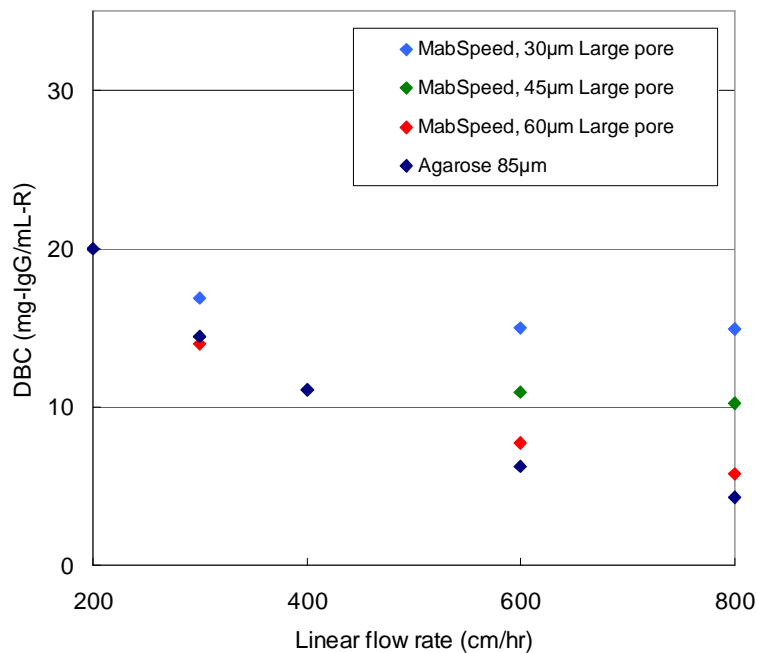
*Larger packing sizes are available as custom packing



Bioseparation: MabSpeed™: New high throughput Antibody Affinity Media

- Suitable for large scale operation
- No limitation of flow rate and bed height
- Rigid, spherical and totally porous polymer matrix
- Excellent particle size uniformity
- Stable for cycle operation
- Flexible for particle size and porosity

Grades	MabSpeed
Brand Name	MCI GEL
Matrix	Methacrylate
Mean size	30 μm 45 μm 60 μm
Functional Group	r-Protein A
Dynamic Binding Capacity for igG	> 30 g/L at 100 cm/h > 20 g/L at 600 cm/h
Exclusion Limit	Up to 10 ⁶
Pore Diameter (Ang)	1000
Operating Linear Velocity	~ 1,000 cm/h



Column: 5 I.D. x 127mm MabSpeed.
DBC of mouse IgG at 10% breakthrough.
Buffer: PBS, pH 7.4

Other Resins: Enzyme Carrier Resins

Relizyme and Sepabeads EC media are based on highly crosslinked polymethacrylic matrix. These matrices are functionalized with various groups to allow for covalent or hydrophobic bonding to occur. These resins are used as enzyme immobilization supports. These methacrylic matrices have excellent mechanical strength with wide range pH stability (1 to 13) and resistance to high temperatures (up to 60°C operating temperature). Immobilized proteases, inulases, lipases, amidases are already available commercially. Assistance is also available to recommend or perform custom immobilization or screening.

Grades	EP403 [ECEP]	HFA403 [ECHFA]	EA403 [ECEA]	HA403 [ECHA]	HG403 [ECHG]
Brand Name	Relizyme [Sepabeads]				
Matrix	Methacrylate				
Functional Group	Epoxy	Epoxy on a hydrophilic spacer	Ethylamine	Hexylamine	Diol
Functional Group Density (µmole/g wet)	>30 [>100]	>40 [>75]	>500 [>600]	>500 [>700]	-
Particle range	100-300 µm for S grades 200 to 500 µm for M grades				
Pore Diameter (Ang)	400 to 600 [100 to 200]				
Immobilization Technique	Covalent				

Grades	BU403 [ECBU]	OD403 [ECOD]
Brand Name	Relizyme [Sepabeads]	
Matrix	Methacrylate	
Functional Group	Butyl	Octadecyl
Functional Group Density (µmole/g wet)	-	-
Particle range	100-300 µm for S grades 200 to 500 µm for M grades	
Pore Diameter (Ang)	400 to 600 [100 to 200]	
Immobilization Technique	Hydrophobic	

Note: The products above are also available as part of a screening kit.

Other Resins: Ligand Adsorption for Affinity Chromatography

Relisorb media are based on highly crosslinked polymethacrylic matrix. These matrices are functionalized with various groups to allow for covalent or ionic bonding to occur. These resins are used to immobilize ligands for affinity chromatography. It is based on the specific adsorption of a molecule to a ligand or macromolecule. Many biological molecules can be purified on the basis of specific interaction between their chemical or biological structure and a suitable affinity ligand. Typical molecular pairs are antigens and antibodies, enzymes and coenzymes, and sugars with lectins. Affinity Chromatography media have ligands that are bonded via a spacer arm to the packing material. A specific biological molecule is then reversibly adsorbed to the immobilized ligand. The ReliSorb resins for Affinity Chromatography permit this action. Relisorb IDA400, for example, is suitable for His-tag proteins.

Relisorb products are also available as prepacked columns for easy screening. Such columns are available under the name brand of Relichrom.

Grades	IDA400/SS (IDA400) [IDA405/EB]	HG400/SS (HG400) [HG405/EB]	EP400/SS (EP400) [EP405/EB]	SA400/SS (SA400) [SA405/EB]]	LA400/SS (LA400) [LA405/EB]]
Brand Name	Relisorb				
Matrix	Methacrylate				
Functional Group	Iminodiacetic	Diol	Epoxy	Ethyl Amine	Hexyl Amine
Ion Exchange Capacity*	>100 μ mole/ml Ni^{2+} resin	-			
Dynamic Binding Capacity for Papaine**	>10 mg/ml resin	-			
Particle range	50-150 μ m (75-200 μ m) [200-500 μ m]				
Pore Diameter (Ang)	400 to 600				
Bulk density	~ 800 grams per liter				
Specific Gravity	>1.10 grams/ml				
Immobilization Technique	Ionic (e.g. Ni as His-tag site)	Covalent		Covalent or Ionic	

* Ni^{2+} ionic form is applied only for the Relichrom prepacked columns; different ionic forms are also available upon request

** 20 grams/liter Papaine crude extract in 20 mM Phosphate buffer, pH 7.2 + NaCl 200 mM; flow rate = 150 cm/hr

Remarks in handling Ion Exchange Resins

Handling:

Wear suitable personal protective equipments to prevent exposure to eyes and skin, and handle ion exchange resins at well-ventilated places from the windward. Eye-washing facilities should be set nearby. When contacted with eyes, rinse eyes with much water and consult a doctor. When swallowed, drink a lot of water and consult a doctor depending on symptoms. Spilt ion exchange resins should be collected and the floors should be cleaned, lest they may be slippery. Separate from high temperature machinery and materials, fireworks, flames, and avoid contacts and/or mixing with oxidizing materials

Sufficient care must be taken not to contact with oxidizing agents, e.g. nitric acid, since ion exchange resins may degrade or even explode when contacted with them.

Storage:

Store in cool, dry, well-ventilated, and dark places. Close tightly to prevent contamination and solvent vaporization. Separate from oxidizing materials.

Ion exchange resins deteriorate fast at high temperatures and containing water may freeze and break the beads at temperatures below freezing.

Disposal:

Disposal of unused ion exchange resins should be done by reclamation and/or incineration according to the instructions at the notice of handling and storage. Incineration should be implemented by incinerators that have proper facilities to treat Sox, NOx, CO, and other gases. The used ion exchange resins that adsorb heavy metals must be disposed subject to the direction of the wastes disposal and public clean laws.

Preparation before use:

After filling brand new ion exchange resins into towers, backwashing and conditionings are recommended in order to eliminate the remaining elution impurities.

The backwashing and conditioning conditions vary depending on the designs and the reagents that can be applied.

There are two ways in conditioning: one is reciprocal washings with dilute acid water, e.g. 2N-HCl, and with dilute alkali water, e.g. 1N-NaOH, and the other is reciprocal flows of regenerating reagents and rinse water. The conditioning method and the number of such repetition are decided on the required quality of the treated water and other factors.

Consult the designer/engineer of your packed columns before the actual operations.

CONTACT INFORMATION

Please do not hesitate to contact us when in need of samples, pricing, MSDS as well as technical information and guidance.

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