Part 3　LC（LC/MS）カラム

弊社は、HPLC 分析が初まった時から、30 年以上にわたり、LC カラムを製造しております。

高純度シリカ製造から､化学結合基の導入、カラム充填まで全てのプロセスを自社で行っており、LC カラムの分野でのリーダーを自負いたしております。

最初の球状シリカである Hypersil（1976 年)、最初の不活性化処理シリカである Hypersil BDS(1988 年) 、最近発売の良好なピーク形状を与える Hypersil GOLD(2004 年)に到るまで、この間、常にクロマト分離技術の最前線に立ち続けて来ました。

弊社の優れた LC カラムは、あらゆる試料を分析できますし、グローバルに入手することが可能です。専門知識と深い経験に裏づけられた技術スタッフが皆様の LC 分析をこれからもサポートしてまいります。

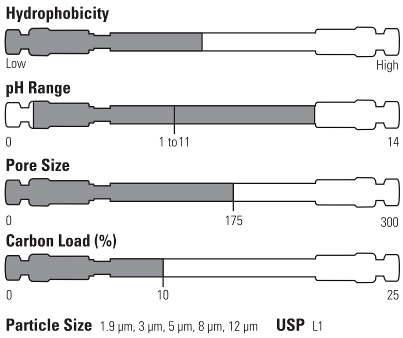
HPLCカラムの選択

次頁以降に、LC分析法を開発するに際し、参考となる有用な情報を記載していますので、ご参照ください。具体的には、LC/MS用カラムの選択やUSPのカラムコードについて記載しています。また、サーモサイエンティフィック製HPLCカラムの固定相仕様について、一覧表にまとめました。さらに他社カラムとそれに置き換えられる弊社カラムについてもまとめています。弊社LCカラム個々の特徴は右の図に示す様に、AUG(Advanced User Graphic)にて分かり易く表示をしています。例えば、Hydrophobicity(疎水性）の値が大きければ、中性試料に対する保持が強く（あるいは移動相に含まれる有機溶媒比率が大きく）なることが直感的に理解できます。逆にその値が小さければ、保持し分離する為には移動相中の水の割合いを増やす必要があることが分かります。

pH RangeのAUGにより、使用可能なpH範囲が直ちに分かります。Pore SizeのAUGにより、タンパク質、ペプチドに適するカラムか否かも、視覚的に理解できます。% CarbonのAUGは、疎水性と関連しています。C(%)が増えると保持が強くなり、少ないと保持が弱くなることが視覚的に理解できます。

数多いカラムの中であなたの試料が必要とするカラムを素早く選択する

ために、このAUGグラフィックス表示をお使い下さい。カラム選択で何か疑問点・不明点があれば、御気軽にお問合せ下さい。弊社カラムサポートがお答えいたします。

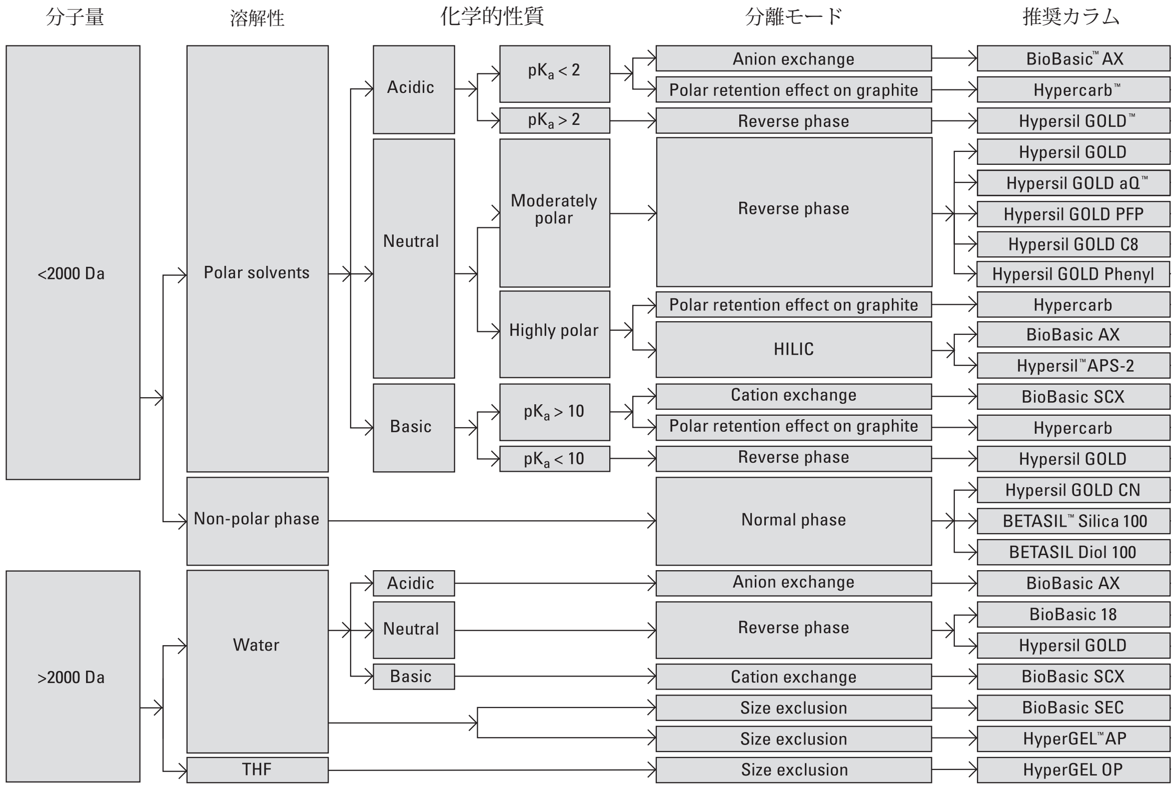


HPLC固定相と応用対象

一般名	別　名	Functional Group	Normal Phase	Reverse Phase	Ion Exchange	HILIC	応　用
Silica	Silica	-OH	✔			✔	非極性～中極性試料の分離に適する
C1	SAS	$-(CH_3)_3$		✔			アルキル基結合カラム中、最も保持力弱く、通常、中極性あるいは複数の官能基を持つ試料の分析に使用
C4	Butyl	$-C_4H_9$		✔			ペプチド、タンパクの分離用、C8,C18に比べ保持力は弱い
C8	MOS	$-C_8H_{17}$		✔			C18より保持力が弱く、一般に分子量の小さいペプチド、タンパク質の分離に使用する。医薬品、ステロイド、環境試料の分析にも使用される。
C18	ODS	$-C_{18}H_{37}$		✔			アルキル結合カラム中、保持力が最も強い。医薬品、ステロイド、脂肪酸フタル酸エステル、環境試料などに幅広く使用される
Cyano	CPS, CN	$-(CH_2)_3CN$	✔	✔			極性試料に対し、ユニークな分離選択性を示す。順相グラジエントでの使用は、シリカカラムより適している。逆相で使用の場合、C8, C18とは分離選択性が異なる。医薬品分析、多種類の化合物を含む試料の分析に適する
Amino	APS	$-(CH_2)_3NH_2$	✔	✔	✔	✔	HILIC(逆逆相）モードで炭水化物や高極性試料の分析に適する。弱陰イオン交換モードでは、アニオンや有機酸の分析に適する。
Phenyl		$-(CH_3)C_6H_5$		✔			芳香族化合物、中極性試料の分析に適する
Pentafluorophenyl	PFP	$-C_6Fl_5$		✔			他のカラムに比べて、分離選択性が異なり、保持力も強い。含ハロゲン化合物、極性化合物、異性体分離に適する。
Diol		$-(CH_2)_2O$ $CH_2(CH_2OH)_2$	✔	✔		✔	逆相では、タンパク質、ペプチドの分離に適する。順相ではシリカカラムと同様の分離選択性を示す。但し、シリカに比べ極性は弱い。
SCX	Strong Cation Exchanger	$-RSO_3H^-$			✔		有機塩基の分離
SAX	Strong Anion Exchanger	$-RN^+(CH_3)_3$			✔		有機酸、ヌクレオチド、ヌクレオシドの分離
AX	Anion Exchanger Polyethleneimine (PEI)	$-(CH_2CH_2NH-)_n$			✔	✔	有機酸、ヌクレオチド、オリゴヌクレオチドの分析
Porous graphitic carbon	PGC	100% carbon	✔	✔			汎用のシリカODS系カラムなどで保持が困難な高極性試料の分離や構造が似通った化合物（異性体）などの分離に優れる。

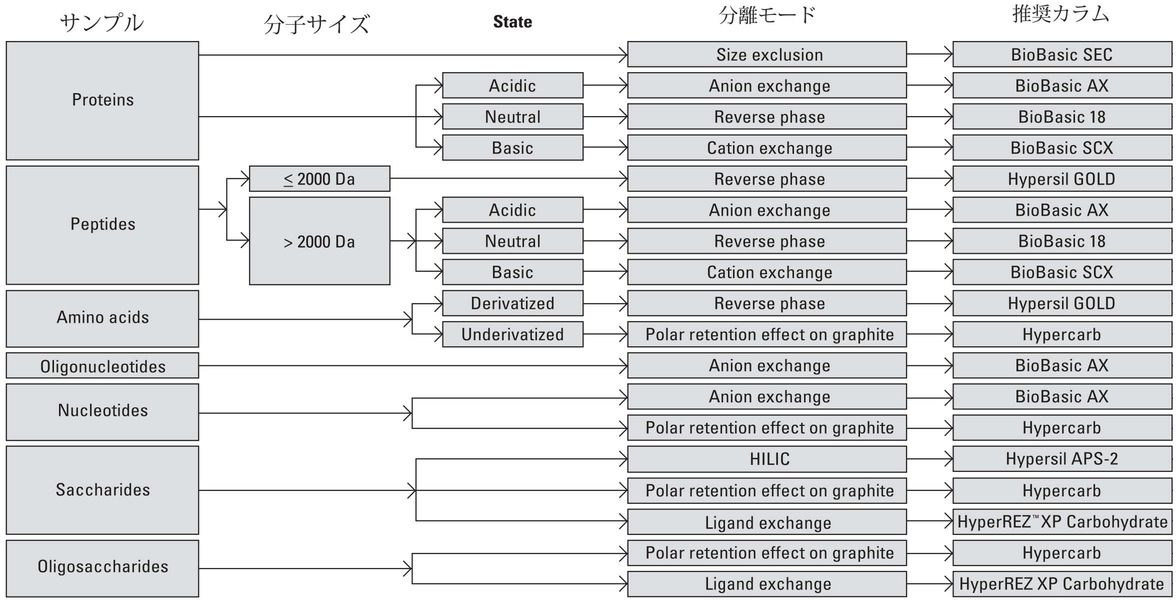
LCカラムの選択ガイド

新たに分析法を開発するに当たり、試料の物理的、化学的性質、分析モード、表面での固定相－試料間に働く力などを考慮する必要があります。カラム選択には、以下のガイドを参考にして下さい。



生体高分子サンプルでのLCカラムの選択

生体分子分析用のカラムの選択は、幾分複雑な面があります。それは、生体試料の分子量は大きいものから小さいものまで様々であり、さらには生体試料の組成は複雑で、化学的性質なども様々なためです。次のガイドに従って、カラムを選択されることをお薦めします。



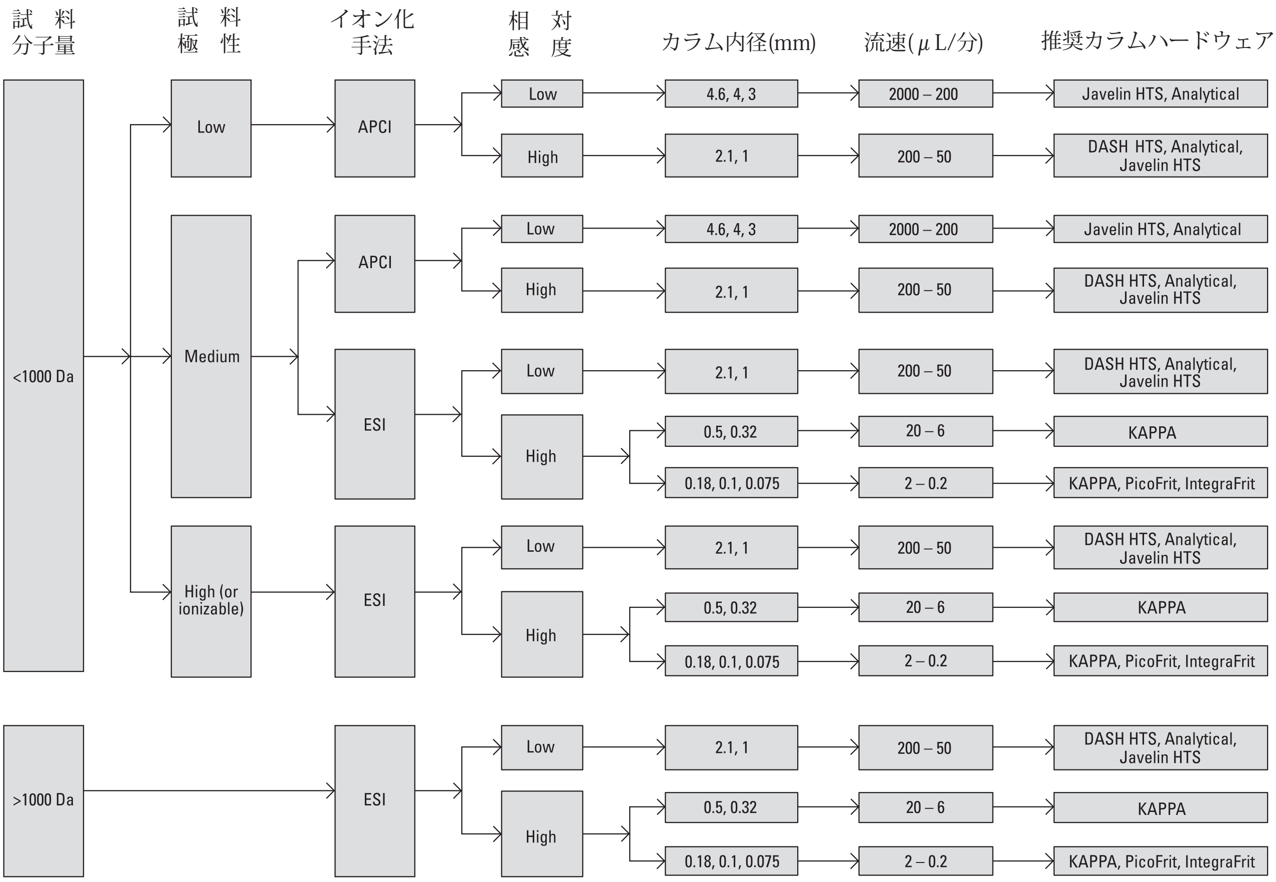
For more information on the HPLC analysis of biomolecules, please request our Technical Guide TG20026.

LC/MS用カラムの選択ガイド

LC/MS応用分析用に様々なカラムデザインの様々な充填剤を用意しております。以下のガイドに従って、カラムデザイン、内径、長さ、充填剤を選んでください。高速分析、高感度分析、高分離効率など、目的に応じて、種々のカラムハードウェアがあります。最適な分離が得られる様に、種々の充填剤を取り揃えています。

LC/MS分析用カラムハードウェアの選択

LC/MS Application	Column Hardware Design	Description
High throughput analysis	DASH™ HTS columns	Short, fast columns 20 x 2.1 mm Labeled and serialized Economical multi-packs
	Javelin™ HTS columns	Direct-connection columns Slim design, 20 mm length 1 mm to 4.6 mm ID
High sensitivity analysis	KAPPA™ capillary columns	Capillary columns 75 µm to 500 µm ID 30 mm to 250 mm lengths
Proteomics analysis	KAPPA capillary columns	Capillary columns 75 µm to 500 µm ID
	PicoFrit™ and IntegraFrit™ nanobore columns	Nanobore columns 75 µm ID Direct nanospray from column tapered-tip



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LC/MS用カラムの選択ガイド

Phase	Particle Sizes	Pore Sizes	Stationary Phase Chemistries	General Description
Hypersil GOLD™	1.9 µm, 3 µm, 5 µm	175 Å	C18 selectivity	Outstanding peak shape using generic gradients with C18 selectivity, providing increased peak capacity, improved resolution, sensitivity and signal to noise.
Hypersil GOLD C8	1.9 µm, 3 µm, 5 µm	175 Å	C8	Offers similar selectivity to Hypersil GOLD but with less retention.
Hypersil GOLD aQ™	1.9 µm, 3 µm, 5 µm	175 Å	C18 polar endcapped	Excellent for polar compounds. Good results with low buffer concentrations. Can be used for challenging reverse phase separations employing highly aqueous mobile phases.
Hypersil GOLD PFP	1.9 µm, 3 µm, 5 µm	175 Å	Perfluorinated phenyl	Offers alternative selectivity in reverse phase applications, particularly for halogenated analytes.
Hypersil GOLD CN	1.9 µm, 3 µm, 5 µm	175 Å	Cyano	Offers alternative selectivity. Can be used for both reversed and normal phase separations.
Hypersil GOLD Phenyl	1.9 µm, 3 µm, 5 µm	175 Å	Phenyl	Offers unique selectivity for the analysis of aromatic and moderately polar compounds.
BioBasic™ Reversed Phase	5 µm	300 Å	C18, C8, C4, CN, Phenyl	Based on 300 Å pore size silica specifically designed for the separation of protein and peptides with increasing hydrophobicity: cyano and phenyl phases to provide alternative selectivity where required.
BioBasic Ion Exchange Phase	5 µm	300 Å	SCX, AX	Large pore size for biomolecules. BioBasic SCX and AX stationary phases comprise silica particles coated with polymeric ion exchange ligands, which shield proteins from adsorbing to the silica surface.
BioBasic SEC	5 µm	60 Å, 120 Å, 300 Å, 1000 Å	SEC	BioBasic SEC columns are available with 60 Å, 120 Å, 300 Å and 1000 Å pore sizes, allowing separation of a wide range of molecular weights.
Hypercarb™	3 µm, 5 µm	250 Å	Porous Graphitic Carbon	Unique 100% porous graphitic carbon. Exceptional retention of very polar analytes. Separation of structurally similar substances. pH stable from 0 - 14. Ideal for high temperature applications.
BetaBasic™	3 µm, 5 µm	150 Å	C18, C8, C4, CN, Phenyl	General purpose packing. Superb high pH stability.
BETASIL™	3 µm, 5 µm 5 µm	100 Å	C18, C8, C6, Phenyl/Hexyl, Cyano, Silica C1, Diol	General purpose packing with high surface coverage for strong retention and use with high organic mobile phases.

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米国薬局方によるHPLCカラムの分類

USP Code	Description	Recommended Phase
L1	Octadecyl silane (C18) chemically bonded to porous or ceramic microparticles, 1.5 -10 µm in diameter, or a monolithic rod	Hypersil GOLD™
		Hypersil GOLD aQ™
		Hypersil GOLD 1.9 µm
		Hypersil GOLD aQ 1.9 µm
		BioBasic™ 18
		Hypersil BDS C18
		Hypersil™ ODS
L2	Octadecyl silane chemically bonded to a silica gel of controlled surface porosity bonded to a solid spherical core, 30 -50 µm in diameter	Pellicular ODS
L3	Porous silica microparticles, 5 -10 µm in diameter	BETASIL™ Silica
		Hypersil Silica
L4	Silica gel of controlled surface porosity bonded to a solid spherical core, 30 - 50 µm in diameter	Pellicular Silica
L7	Octyl silane (C8) chemically bonded to totally porous silica particles, 1.5 -10 µm in diameter	Hypersil GOLD C8
		Hypersil GOLD C8 1.9 µm
		BioBasic 8
		Hypersil BDS C8
		Hypersil MOS
		Hypersil MOS-2
L8	An essentially monomolecular layer of aminopropylsilane chemically bonded to totally porous silica gel support, 3 - 10 µm in diameter	Hypersil APS-2
L9	Irregular or spherical, totally porous silica gel having a chemically bonded, strongly acidic cation exchange coating (SCX), 3 - 10 µm in diameter	Partisil™ SCX
L10	Nitrile groups (CN) chemically bonded to porous silica particles, 3 -10 µm in diameter	Hypersil GOLD CN
		BioBasic CN
		Hypersil BDS Cyano
		Hypersil CPS
		Hypersil CPS-2
L11	Phenyl groups chemically bonded to porous silica particles, 1.5 - 10 µm in diameter	Hypersil GOLD Phenyl
		Hypersil GOLD Phenyl 1.9 µm
		BioBasic Phenyl
		Hypersil BDS Phenyl
		Hypersil Phenyl
		Hypersil Phenyl-2
L13	Trimethylsilane chemically bonded to porous silica particles, 3 - 10 µm in diameter	Hypersil SAS
		BETASIL C1
L14	Silica gel having a chemically bonded, strongly basic quaternary ammonium anion exchange (SAX) coating, 5 - 10 µm in diameter	Partisil SAX
		Hypersil SAX (5 µm)
L15	Hexylsilane (C6) chemically bonded to totally porous silica particles, 3 -10 µm in diameter	BETASIL C6
L17	Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the hydrogen form, 7 -11 µm in diameter	HyperREZ™ XP Carbohydrate H^+
		HyperREZ XP Organic Acids
L19	Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the calcium form, about 9 µm diameter	HyperREZ XP Carbohydrate Ca^{2+}
		HyperREZ XP Sugar Alcohols
L20	Dihydroxypropane groups chemically bonded to porous silica particles, 5 - 10 µm in diameter	BETASIL Diol
L21	A rigid spherical styrene-divinylbenzene copolymer, 5 - 10 µm in diameter	HyperREZ XP RP100
		HyperREZ XP RP300
L22	A cation exchange resin made of porous polystyrene gel with sulfonic acid groups, about 10 µm in size	HyperREZ XP SCX
L25	Packing having the capacity to separate compounds with a molecular weight range 100 - 5000 (as determined by polyethylene oxide) applied to neutral, anionic and cationic water-soluble polymers.	HyperGEL™ AP
L26	Butyl silane (C4) chemically bonded to totally porous silica particles, 3 -10 µm in diameter	BioBasic 4
		BetaBasic™ 4
L27	Porous silica particles, 30 - 50 µm in diameter	HyperPrep™ Silica
L33	Packing having the capacity to separate dextrans by molecular size over a range of 4,000 to 500,000 daltons.	BioBasic SEC 120
	It is spherical, silica-based, and processed to provide pH stability	BioBasic SEC 300
		BioBasic SEC 1000
L34	Strong cation exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the lead form, about 9 µm in diameter	HyperREZ XP Carbohydrate Pb^{2+}
L43	Pentafluorophenyl groups chemically bonded to silica particles by a propyl spacer, 5 -10 µm in diameter	Hypersil GOLD PFP
		Fluophase™ PFP
L52	A strong cation exchange resin made of porous silica with sulfopropyl groups by a propyl spacer, 5 - 10 µm in diameter	BioBasic SCX
L58	Strong cation-exchange resin consisting of sulfonated cross-linked styrene-divinylbenzene copolymer in the sodium form, about 7 to 11 µm in diameter	HyperREZ XP Carbohydrate Na^+
L59	Packing having the capacity to separate proteins by molecular weight over the range of 10 to 500 kDa. It is spherical (10 µm), silica-based, and processed to provide hydrophilic characteristics and pH stability	BioBasic SEC 300 (5 µm)
L60	Spherical, porous silica gel, 10 µm or less in diameter, the surface of which has been covalently modified with alkyl amide groups and endcapped	HyPURITY ADVANCE™

** These are the recommended Thermo Scientific HPLC columns for various USP categories although other columns for each category are also available.*

Thermo Scientific 製 LCカラム

The tables below list Thermo Scientific HPLC sorbents offered. Please also refer to the Advanced User Graphic (AUG) for each HPLC phase on the pages indicated.

Phase	Particle Type	Particle Size (μm)	Pore Size (Å)	Nominal Surface Area (m^2/g)	% Carbon	Endcapping	USP Code	Phase Code
AQUASIL								
C18	spherical, silica	3, 5	100	310	12	polar	L1	775
BetaBasic™								
18	spherical, silica	3, 5	150	200	13	Yes	L1	715
8	spherical, silica	3, 5	150	200	7	Yes	L7	714
4	spherical, silica	3, 5	150	200	6	Yes	L26	716
Phenyl	spherical, silica	3, 5	150	200	7	Yes	L11	718
CN	spherical, silica	3, 5	150	200	5	Yes	L10	717
BetaMax™								
Neutral	spherical, silica	5	60	540	29	Yes	L1	950
Acid	spherical, silica	5	60	540	15	Yes	L28	952
Base	spherical, silica	5	60	540	9	Yes	L10	951
BETASIL™								
C18	spherical, silica	3, 5,10	100	310	20	Yes	L1	701
C8	spherical, silica	3, 5, 10	100	310	12	Yes	L7	702
C6	spherical, silica	3, 5	100	310	11	Yes	L15	703
C1	spherical, silica	5	100	310	4	Yes	L13	705
Phenyl	spherical, silica	3, 5	100	310	11	Yes	L11	706
Phenyl-Hexyl	spherical, silica	3, 5	100	310	11	Yes	L11	730
CN	spherical, silica	3, 5	100	310	6	Yes	L10	708
Silica 100	spherical, silica	3, 5	100	310	–	–	L3	700
Diol 100	spherical, silica	5	100	310	6	–	L20	726
BioBasic™								
18	spherical, silica	5	300	100	9	Yes	L1	721
8	spherical, silica	5	300	100	5	Yes	L7	722
4	spherical, silica	5	300	100	4	Yes	L26	723
Phenyl	spherical, silica	5	300	100	3	Yes	L11	724
CN	spherical, silica	5	300	100	3.5	Yes	L10	729
AX	spherical, silica	5	300	100	3	No	–	731
SCX	spherical, silica	5	300	100	3	–	L52	732
DELTABOND™								
Resolution AK	spherical, polymer coated silica	5	300	100	12	No	–	322
Fast AK	spherical, polymer coated silica	5	300	100	12	No	–	323
Fluophase™								
RP	spherical, silica	5	100	310	10	Yes	–	825
PFP	spherical, silica	5	100	310	12	Yes	L43	827
WP	spherical, silica	5	300	100	5	Yes	–	826
Hypercarb™								
Hypercarb	spherical, porous graphitic carbon	3, 5, 7	250	120	100	–	–	350
HyperREZ™ XP								
Carbohydrate H^+	spherical, polymer	8	–	–	–	–	L17	690
Carbohydrate Pb^{2+}	spherical, polymer	8	–	–	–	–	L34	691
Carbohydrate Ca^{2+}	spherical, polymer	8	–	–	–	–	L19	692
Carbohydrate Na^+	spherical, polymer	10	–	–	–	–	–	693
Organic Acid	spherical, polymer	8	–	–	–	–	L17	696
Sugar Alcohol	spherical, polymer	8	–	–	–	–	L19	697

Thermo Scientific 製 LCカラム

Phase	Particle Type	Particle Size (µm)	Pore Size (Å)	Nominal Surface Area (m²/g)	% Carbon	Endcapping	USP Code	Phase Code
Hypersil™								
ODS (C18)	spherical, silica	3, 5, 10	120	170	10	Yes	L1	301
ODS-2 (C18)	spherical, silica	3, 5	80	220	11	Yes	L1	316
MOS (C8)	spherical, silica	3, 5, 10	120	170	6.5	No	L7	302
MOS-2 (C8)	spherical, silica	3, 5, 10	120	170	6.5	Yes	L7	303
Butyl (C4)	spherical, silica	3, 5, 10	120	170	–	–	L26	304
SAS (C1)	spherical, silica	3, 5, 10	120	170	2.5	Yes	L13	305
Phenyl	spherical, silica	3, 5, 10	120	170	5	No	L11	309
Phenyl-2	spherical, silica	5, 10	120	170	5	Yes	L11	319
CPS	spherical, silica	3, 5, 10	120	170	4	No	L10	308
CPS-2	spherical, silica	5, 10	120	170	4	Yes	L10	318
APS-2	spherical, silica	3, 5, 10	120	170	1.9	No	L8	307
Silica	spherical, silica	3, 5, 10	120	170	–	–	L3	300
SAX	spherical, silica	5	120	170	2.5	Yes	L14	341
Hypersil BDS								
C18	spherical, silica	3, 5	130	170	11	Yes	L1	281
C8	spherical, silica	3, 5	130	170	7	Yes	L7	282
Phenyl	spherical, silica	3, 5	130	170	5	Yes	L11	289
Cyano	spherical, silica	3, 5	130	170	4	Yes	L10	288
Hypersil GOLD™								
C18 selectivity	spherical, silica	1.9, 3, 5, 8, 12	175	220	10	Yes	L1	250
C8	spherical, silica	1.9, 3, 5	175	220	8	Yes	L7	252
CN (Cyano)	spherical, silica	1.9, 3, 5	175	220	4	Yes	L10	258
PFP	spherical, silica	1.9, 3, 5, 8, 12	175	220	8	Yes	L43	254
aQ	spherical, silica	1.9, 3, 5, 8, 12	175	220	12	Polar	L1	253
Phenyl	spherical, silica	1.9, 3, 5	175	220	8.5	Yes	L11	259
Hypersil Green								
PAH	spherical, silica	3, 5	120	170	13.5	Yes	–	311
HyPURITY™								
C18	spherical, silica	3, 5, 8, 12	190	200	13	Yes	L1	221
C8	spherical, silica	5	190	200	8	Yes	L7	222
C4	spherical, silica	5	190	200	4.5	Yes	L26	224
Cyano	spherical, silica	5	190	200	4	Yes	L10	228
ADVANCE™	spherical, silica	3, 5	190	200	10	–	L60	210
AQUASTAR™	spherical, silica	3, 5, 8, 12	190	200	10	Polar	L1	225

Size Exclusion Chromatography Phases

Phase	Type	Particle Type	Particle Size (µm)	Pore Size (Å)	Exclusion Limit Operating Range	USP Code	Packing Code
HyperGEL™							
OP5	organic	PS-DVB polymer	5, 10	50	up to 2,000*	–	430
OP10	organic	PS-DVB polymer	5, 10	100	up to 4,000*	–	431
OP25	organic	PS-DVB polymer	5, 10	500	500 - 30,000*	–	432
OP30	organic	PS-DVB polymer	5, 10	1,000	500 - 60,000*	–	433
OP40	organic	PS-DVB polymer	5, 10	10,000	10,000 - 600,000*	–	434
OP50	organic	PS-DVB polymer	5, 10	100,000	60,000 - 2,000,000*	–	435
OP60	organic	PS-DVB polymer	5, 10	1,000,000	600,000 - 10,000,000*	–	436
OP	organic	PS-DVB polymer	5, 10	–	–	–	437
BioBasic™							
SEC 60	aqueous	silica	5	60	0.1 - 6‡	–	733
SEC 120	aqueous	silica	5	120	0.1 - 50‡	L33	734
SEC 300	aqueous	silica	5	300	1 - 500‡	L33, L59	735
SEC 1000	aqueous	silica	5	1,000	20 - 4,000‡	L33	736

** Operating MW range PEO/PEG (g/mol)　　‡ Separation range, protein (kDa)*

他社LCカラムとそれに対応する弊社推奨LCカラム

他社LCカラムとそれに代わる弊社LCカラムの対応表を以下に示します。この関係表は、充填剤の物理的、化学的性質と保持の機構に基づいています。類似のあるいは改良された分離となることが期待しうるカラムですが全く同じ保持時間や同じ分離選択性を保証するものではありません。使用の際は、個々のカラムの特徴を確認し、代替可能か判断してください。

(注意)
製品情報に基づき、可能な限り正確であるように努力し作成しましたが、この表は完全な表であることは保証はいたしません。（書き写しミス等の可能性があるかも知れません。）この表の使用による責任は負いませんので、予めご了承願います。

Phase	Manufacturer	Pore Size (Å)	Area (m²/g)	% C	Recommended Thermo Scientific Alternative
ACE C18	ACT	100	300	15.5	Hypersil GOLD™
ACE C8	ACT	100	300	9	Hypersil GOLD C8
ACE C4	ACT	100	300	5.5	HyPURITY™ C4
ACE CN	ACT	100	300	5.5	Hypersil GOLD CN
ACE Phenyl	ACT	100	300	9.5	Hypersil GOLD Phenyl
ACE AQ	ACT	100	300	14	Hypersil GOLD aQ™
ACE C18-300	ACT	300	100	9	BioBasic™ 18
ACE C8-300	ACT	300	100	5	BioBasic 8
ACE C4-300	ACT	300	100	2.6	BioBasic 4
ACE CN-300	ACT	300	100	2.6	BioBasic CN
ACE Phenyl-300	ACT	300	100	5.3	BioBasic Phenyl
ACQUITY UPLC BEH C18	Waters	130	185	-	Hypersil GOLD (1.9 µm)
ACQUITY UPLC BEH C8	Waters	130	185	-	Hypersil GOLD C8 (1.9 µm)
ACQUITY UPLC BEH Phenyl	Waters	130	185	-	Hypersil GOLD Phenyl (1.9 µm)
ACQUITY UPLC HSS T3	Waters	100	230	-	Hypersil GOLD aQ (1.9 µm)
Alltima™ HP C18	Grace	190	200	12	Hypersil GOLD
Alltima HP C18 Amide	Grace	190	200	12	HyPURITY ADVANCE™
Alltima HP C18 AQ	Grace	100	450	20	Hypersil GOLD aQ
Alltima HP C18 HiLoad	Grace	100	450	24	BETASIL™ C18
Alltima HP C18-Amide	Grace	190	200	12	HyPURITY ADVANCE
Alltima HP C8	Grace	190	200	8	Hypersil GOLD C8
Alltima HP CN	Grace	190	200	4	Hypersil GOLD CN
Alltima HP Silica	Grace	190	200	–	BETASIL Silica
Aminex™ HPX42C	Bio-Rad	–	–	–	HyperREZ™ XP Carbohydrate Ca^{2+}
Aminex HPX72S	Bio-Rad	–	–	–	HyperREZ XP Carbohydrate H^{+}
Aminex HPX87C	Bio-Rad	–	–	–	HyperREZ XP Carbohydrate Ca^{2+}
Aminex HPX87H	Bio-Rad	–	–	–	HyperREZ XP Carbohydrate H^{+}
Aminex HPX87N	Bio-Rad	–	–	–	HyperREZ XP Carbohydrate Na^{+}
Aminex HPX87P	Bio-Rad	–	–	–	HyperREZ XP Carbohydrate Pb^{2+}
AQUA™ C18	Phenomenex	125	320	15	Hypersil GOLD aQ
Ascentis C18	Supelco	100	450	25	Hypersil GOLD
					BETASIL C18
Ascentis C8	Supelco	100	450	15	Hypersil GOLD C8
					BETASIL C8
Ascentis RP-Amide	Supelco	100	450	19.5	HyPURITY ADVANCE
					BetaMax™ Acid
Ascentis Phenyl	Supelco	100	450	19	Hypersil GOLD Phenyl
					BETASIL Phenyl
Atlantis™ dC18	Waters	100	330	12	Hypersil GOLD aQ
Columbus™ C18	Phenomenex	110	375	19	Hypersil GOLD
					BETASIL C18
Columbus C8	Phenomenex	110	375	13	Hypersil GOLD C8

他社LCカラムとそれに対応する弊社LCカラム

Phase	Manufacturer	Pore Size (Å)	Area (m^2/g)	% C	Recommended Thermo Scientific Alternative
DENALI™ C18	Grace	120	–	–	Hypersil GOLD™
Discovery™ Amide C16	Supelco	180	200	11	HyPURITY ADVANCE™
Discovery BIO Wide Pore C18	Supelco	300	–	–	BioBasic™ 18
Discovery BIO Wide Pore C8	Supelco	300	–	–	BioBasic 8
Discovery C18	Supelco	180	200	14	Hypersil GOLD
Discovery C8	Supelco	180	200	–	Hypersil GOLD C8
Discovery Cyano	Supelco	180	200	–	Hypersil GOLD CN
Fluofix™ 120	Neos	120	–	5	Fluophase™ RP
Gemini™ C18	Phenomenex	110	375	14	Hypersil GOLD
Genesis™ AQ	Grace	120	300	–	Hypersil GOLD aQ™
Genesis C4	Grace	120	300	–	HyPURITY™ C4
Genesis C8	Grace	120	300	–	Hypersil GOLD C8
Genesis CN	Grace	120	300	7	Hypersil GOLD CN
Genesis MOS	Grace	120	300	11	Hypersil GOLD C8
Genesis ODS	Grace	120	300	18	Hypersil GOLD
Genesis Phenyl	Grace	120	300	–	Hypersil GOLD Phenyl
Genesis Silica	Grace	120	300	–	BETASIL™ Silica
Inertsil™ C4	GL Sciences	150	320	8	HyPURITY C4
Inertsil C8	GL Sciences	150	320	11	Hypersil GOLD C8
Inertsil ODS3V	GL Sciences	100	450	15	Hypersil GOLD
Inertsil Phenyl	GL Sciences	150	320	10	Hypersil GOLD Phenyl
Inertsil Silica	GL Sciences	150	320	–	BETASIL Silica
Jupiter™ C18	Phenomenex	300	170	13	BioBasic 18
Jupiter C4	Phenomenex	300	170	5	HyPURITY C4
Kromasil™ C1	Akzo-Nobel	100	340	5	BETASIL C1
Kromasil C18	Akzo-Nobel	100	340	19	Hypersil GOLD
					BETASIL C18
Kromasil C4	Akzo-Nobel	100	340	8	HyPURITY C4
Kromasil Silica	Akzo-Nobel	100	340	–	BETASIL Silica
LiChrospher™ CN	Merck	100	350	7	Hypersil GOLD CN
LiChrospher Diol	Merck	100	350	–	BETASIL Diol
LiChrospher NH_2	Merck	100	350	5	Hypersil APS-2
LiChrospher RP 18	Merck	100	350	21	Hypersil GOLD
					BETASIL C18
LiChrospher RP-18e	Merck	100	350	22	Hypersil GOLD
					BETASIL C18
LiChrospher RP-8	Merck	100	350	13	Hypersil GOLD C8
LiChrospher RP-8e	Merck	100	350	13	Hypersil GOLD C8
Luna™ C18 (2)	Phenomenex	100	400	18	Hypersil GOLD
Luna C8 (2)	Phenomenex	100	400	14	Hypersil GOLD C8
Luna CN	Phenomenex	100	400	–	Hypersil GOLD CN
Luna NH_2	Phenomenex	100	400	10	Hypersil APS-2
Luna SCX	Phenomenex	100	400	–	BioBasic SCX
Luna Silica (2)	Phenomenex	100	400	–	BETASIL Silica
µBondapak™ C18	Waters	125	330	10	Hypersil GOLD
µBondapak CN	Waters	125	330	–	Hypersil GOLD CN
µBondapak NH_2	Waters	125	330	4	Hypersil APS-2
µBondapak Phenyl	Waters	125	330	–	Hypersil GOLD Phenyl
Nova-Pak™ (HR) C18	Waters	60	120	7	Hypersil GOLD
Nova-Pak C8	Waters	60	120	–	Hypersil GOLD C8
Nova-Pak CN	Waters	60	120	–	Hypersil GOLD CN
Nova-Pak Phenyl	Waters	60	120	5	Hypersil GOLD Phenyl
Nova-Pak Silica	Waters	60	120	–	BETASIL Silica
NUCLEODUR™ C18 EC	Macherey-Nagel	110	340	18	Hypersil GOLD
NUCLEODUR C18 Gravity	Macherey-Nagel	110	340	18	Hypersil GOLD
NUCLEODUR CN	Macherey-Nagel	110	340	7	Hypersil GOLD CN

他社LCカラムとそれに対応する弊社LCカラム

Phase	Manufacturer	Pore Size (Å)	Area (m²/g)	% C	Recommended Thermo Scientific Alternative
NUCLEODUR Pyramid	Macherey-Nagel	110	340	14	Hypersil GOLD aQ™
Nucleosil™ 100 C18	Macherey-Nagel	100	350	17	Hypersil GOLD™
Nucleosil 100 C18 AB	Macherey-Nagel	100	350	24	Hypersil GOLD
					BETASIL™ C18
Nucleosil 100 C_6H_5	Macherey-Nagel	100	350	–	Hypersil GOLD Phenyl
Nucleosil 100 C8	Macherey-Nagel	100	350	9	Hypersil GOLD C8
Nucleosil 100 CN	Macherey-Nagel	100	350	–	Hypersil GOLD CN
Nucleosil 100 $N(CH_3)_2$	Macherey-Nagel	100	350	–	Hypersil SAX
Nucleosil 100 NH_2	Macherey-Nagel	100	350	4	Hypersil APS-2
Nucleosil 100 OH	Macherey-Nagel	100	350	–	BETASIL Diol
Nucleosil 100 SA	Macherey-Nagel	100	350	7	BioBasic SCX
Nucleosil 100 SB	Macherey-Nagel	100	350	10	Hypersil SAX
Nucleosil 300 C18	Macherey-Nagel	300	100	7	BioBasic™ 18
Nucleosil 300 C4	Macherey-Nagel	300	100	–	BioBasic 4
Nucleosil 300 C_6H_5	Macherey-Nagel	300	100	–	BioBasic Phenyl
Nucleosil 300 C8	Macherey-Nagel	300	100	–	BioBasic 8
Nucleosil 300 CN	Macherey-Nagel	300	100	–	BioBasic CN
Partisil™ C8	Whatman	85	350	9	Hypersil GOLD C8
Partisil ODS	Whatman	85	350	5	Hypersil GOLD
Partisil ODS2	Whatman	85	350	16	Hypersil GOLD
Partisil ODS-3	Whatman	85	350	11	Hypersil GOLD
Partisil SAX	Whatman	85	350	–	Hypersil SAX
Partisil SCX	Whatman	85	350	–	BioBasic SCX
Partisil Silica	Whatman	85	350	–	BETASIL Silica
Pinnacle™ C1	Restek	120	170	2	Hypersil SAS
Pinnacle C18	Restek	120	170	10	Hypersil GOLD
Pinnacle C4	Restek	120	170	4	HyPURITY™ C4
Pinnacle CN	Restek	120	170	5	Hypersil GOLD CN
Pinnacle DB C18	Restek	140	–	11	Hypersil GOLD
Pinnacle DB C18 1.9 µm	Restek	140	–	11	Hypersil GOLD (1.9 µm)
Pinnacle DB C8	Restek	140	–	6	Hypersil GOLD C8
Pinnacle DB Cyano	Restek	140	–	4	Hypersil GOLD CN
Pinnacle DB Phenyl	Restek	140	–	5	Hypersil GOLD Phenyl
Pinnacle IBD	Restek	120	170	–	Hypersil GOLD
Pinnacle NH_2	Restek	120	170	2	Hypersil APS-2
Pinnacle Phenyl	Restek	120	170	5	Hypersil GOLD Phenyl
Pinnacle SAX	Restek	120	170	3	Hypersil SAX
Pinnacle Silica	Restek	120	170	–	BETASIL Silica
Pinnacle Ultra C18	Restek	100	–	20	Hypersil GOLD
					BETASIL C18
Pinnacle Wide Pore C4	Restek	300	–	2	BioBasic 4
Polaris™ C18 Ether	Varian	–	–	–	HyPURITY ADVANCE™
Polaris C18-A	Varian	–	–	–	HyPURITY ADVANCE
Polaris C8 Ether	Varian	–	–	–	HyPURITY ADVANCE
Polaris C8-A	Varian	–	–	–	HyPURITY ADVANCE
Polaris NH_2	Varian	–	–	–	Hypersil APS-2
Prodigy™ C8	Phenomenex	150	310	13	Hypersil GOLD C8
Prodigy ODS2	Phenomenex	150	310	18	Hypersil GOLD
					BETASIL C18
Prodigy ODS-3	Phenomenex	100	450	16	Hypersil GOLD
Prodigy ODS-3V	Phenomenex	100	450	16	Hypersil GOLD
Prodigy Phenyl-3	Phenomenex	100	450	10	BETASIL Phenyl
Purospher™ RP-18	Merck	60	500	–	Hypersil GOLD
Purospher STAR-8e	Merck	120	300	–	Hypersil GOLD C8
Purospher STAR RP-18e	Merck	120	300	–	Hypersil GOLD

他社LCカラムとそれに対応する弊社LCカラム

Phase	Manufacturer	Pore Size (Å)	Area (m²/g)	% C	Recommended Thermo Scientific Alternative
Purospher RP-18e	Merck	60	500	–	Hypersil GOLD™
Pursuit™ C18	Varian	–	–	–	Hypersil GOLD
Pursuit C8	Varian	–	–	–	Hypersil GOLD C8
Pursuit Diphenyl	Varian	–	–	–	BetaBasic™ Phenyl
Pursuit PFP	Varian	–	–	–	Hypersil GOLD PFP
Shodex™ OHpak SB802.5	Showa Denko	–	–	–	HyperGEL™ AP
Shodex OHpak SB803	Showa Denko	–	–	–	HyperGEL AP
Shodex OHpak SB804	Showa Denko	–	–	–	HyperGEL AP
Shodex OHpak SB806	Showa Denko	–	–	–	HyperGEL AP
Shodex PH	Showa Denko	100	–	–	Hypersil GOLD Phenyl
Shodex SIL	Showa Denko	100	–	–	BETASIL™ Silica
Shodex TMS	Showa Denko	100	–	–	Hypersil SAS
Waters™ Spherisorb™ C1	Waters	80	200	2	Hypersil SAS
Waters Spherisorb C6	Waters	80	200	5	BETASIL C6
Waters Spherisorb C8	Waters	80	200	6	Hypersil GOLD C8
Waters Spherisorb CN	Waters	80	200	3	Hypersil GOLD CN
Waters Spherisorb NH_2	Waters	80	200	2	Hypersil APS-2
Waters Spherisorb ODS1	Waters	80	200	6	Hypersil GOLD
Waters Spherisorb ODS2	Waters	80	200	12	Hypersil GOLD
Waters Spherisorb ODSB	Waters	80	200	12	Hypersil GOLD
Waters Spherisorb Phenyl	Waters	80	200	3	Hypersil GOLD Phenyl
Waters Spherisorb SAX	Waters	80	200	–	Hypersil SAX
Waters Spherisorb SCX	Waters	80	200	–	BioBasic™ SCX
Waters Spherisorb W (silica)	Waters	80	200	–	BETASIL Silica
Styragel™ HR0.5	Waters	50	–	–	HyperGEL OP 5
Styragel HR1	Waters	100	–	–	HyperGEL OP 10
Styragel HR2	Waters	500	–	–	HyperGEL OP 25
Styragel HR3	Waters	1,000	–	–	HyperGEL OP 30
Styragel HR4	Waters	10,000	–	–	HyperGEL OP 40
Styragel HT3	Waters	1,000	–	–	HyperGEL OP 30
Styragel HT4	Waters	10,000	–	–	HyperGEL OP 40
SunFire™ C18	Waters	90	340	16	Hypersil GOLD
SunFire C8	Waters	90	340	16	Hypersil GOLD C8
Supelcosil™ ABZ	Supelco	120	–	12	HyPURITY ADVANCE™
Supelcosil ABZ+	Supelco	120	–	12	HyPURITY ADVANCE
Supelcosil LC-1	Supelco	120	170	–	Hypersil SAS
Supelcosil LC-18	Supelco	120	170	11	Hypersil GOLD
Supelcosil LC-18DB	Supelco	120	170	11	Hypersil GOLD
Supelcosil LC-8	Supelco	120	170	–	Hypersil GOLD C8
Supelcosil LC-CN	Supelco	120	170	–	Hypersil GOLD CN
Supelcosil LC-NH_2	Supelco	120	170	–	Hypersil APS-2
Supelcosil LC-Si	Supelco	120	170	–	BETASIL Silica
Symmetry C18	Waters	100	335	19	Hypersil GOLD
Symmetry C8	Waters	100	335	12	Hypersil GOLD C8
SymmetryShield™ C18	Waters	100	335	17	HyPURITY ADVANCE
SymmetryShield C8	Waters	100	335	15	HyPURITY ADVANCE
Synergi™ Fusion-RP	Phenomenex	80	475	–	HyPURITY ADVANCE
Synergi Hydro-RP	Phenomenex	80	475	19	Hypersil GOLD aQ™
TSKgel™ G2000SW (incl XL)	Tosoh	125	–	–	BioBasic SEC 120
TSKgel Octyl-80TS	Tosoh	80	200	11	Hypersil GOLD C8
TSKgel ODS-120A	Tosoh	120	200	22	Hypersil GOLD
TSKgel ODS-120A	Tosoh	120	200	22	BETASIL C18

他社LCカラムとそれに対応する弊社LCカラム

Phase	Manufacturer	Pore Size (Å)	Area (m²/g)	% C	Recommended Thermo Scientific Alternative
TSKgel ODS-120T	Tosoh	120	200	22	Hypersil GOLD™
					BETASIL™ C18
TSKgel ODS-80TM	Tosoh	80	200	15	Hypersil GOLD
TSKgel Super Octyl	Tosoh	110	–	5	Hypersil GOLD C8
TSKgel Super ODS	Tosoh	110	–	8	Hypersil GOLD
TSKgel Super Phenyl	Tosoh	110	–	3	Hypersil GOLD Phenyl
TSKgel SuperSW3000	Tosoh	250	–	–	BioBasic™ SEC 300
Ultracarb™ C8	Phenomenex	60	550	14	Hypersil GOLD C8
Ultracarb ODS (20)	Phenomenex	90	320	22	Hypersil GOLD
					BETASIL C18
Ultracarb ODS (30)	Phenomenex	60	550	31	BetaMax™ Neutral
Ultrahydrogel™ 1000	Waters	1000	–	–	HyperGEL™ AP 30
Ultrastyragel™ 100A	Waters	100	–	–	HyperGEL OP 10
Ultrastyragel 103A	Waters	1,000	–	–	HyperGEL OP 30
Ultrastyragel 104A	Waters	10,000	–	–	HyperGEL OP 40
Ultrastyragel 105A	Waters	100,000	–	–	HyperGEL OP 50
Ultrastyragel 106A	Waters	1,000,000	–	–	HyperGEL OP 60
Ultrastyragel 500A	Waters	500	–	–	HyperGEL OP 25
Viva™ C18	Restek	300	–	9	BioBasic 18
Viva C4	Restek	300	–	4	BioBasic 4
Viva C8	Restek	300	–	5	BioBasic 8
Vydac™ 201SP C18	Grace	90	–	–	Hypersil GOLD
Vydac 201SP Selectapore 90M C18	Grace	90	250	–	Hypersil GOLD
Vydac 201TP C18	Grace	300	–	–	BioBasic 18
Vydac 202TP C18	Grace	300	–	–	BioBasic 18
Vydac 208TP C8	Grace	300	–	–	BioBasic 8
Vydac 214TP	Grace	300	–	–	BioBasic 4
Vydac 218TP	Grace	300	–	–	BioBasic 18
Vydac 218WP Selectapore 300M C18	Grace	300	70	–	BioBasic 18
Vydac 219TP	Grace	300	–	–	BioBasic Phenyl
Vydac 238TP	Grace	300	–	–	BioBasic 18
Vydac 259VHP	Grace	300	–	–	HyperREZ™ XP RP 300
Vydac 300VHP	Grace	300	–	–	HyperREZ XP SAX
Vydac 301VHP	Grace	300	–	–	HyperREZ XP SAX
Vydac 400VHP	Grace	300	–	–	HyperREZ XP SCX
XBridge™ C18	Waters	–	–	–	Hypersil GOLD
XBridge C8	Waters	–	–	–	Hypersil GOLD C8
XBridge Phenyl	Waters	–	–	–	Hypersil GOLD Phenyl
XBridge Shield RP18	Waters	–	–	–	HyPURITY ADVANCE™
XTerra™ MS C18	Waters	125	180	16	Hypersil GOLD
XTerra MS C8	Waters	125	180	12	Hypersil GOLD C8
XTerra Phenyl	Waters	125	180	12	Hypersil GOLD Phenyl
XTerra RP18	Waters	125	180	16	HyPURITY ADVANCE
XTerra RP8	Waters	125	180	14	HyPURITY ADVANCE
YMCbasic™	YMC	–	–	–	Hypersil GOLD C8
YMC-Pack™ C4	YMC	120	300	7	HyPURITY™ C4
YMC-Pack C8	YMC	120	300	10	Hypersil GOLD C8
YMC-Pack CN	YMC	120	300	7	Hypersil GOLD CN
YMC-Pack Diol	YMC	120	300	–	BETASIL Diol
YMC-Pack NH_2	YMC	120	–	–	Hypersil APS-2
YMC-Pack ODS AQ	YMC	120	300	16	Hypersil GOLD aQ™
YMC-Pack ODS-A	YMC	120	300	17	Hypersil GOLD
YMC-Pack ODS-A	YMC	300	150	6	BioBasic 18
YMC-Pack Phenyl	YMC	120	300	9	Hypersil GOLD Phenyl
YMC-Pack Phenyl	YMC	300	150	3	BioBasic Phenyl

他社LCカラムとそれに対応する弊社LCカラム

Phase	Manufacturer	Pore Size (Å)	Area (m^2/g)	% C	Recommended Thermo Scientific Alternative
YMC-Pack Polyamine 2	YMC	120	–	–	HyperREZ™ SAX
YMC-Pack Polymer C18	YMC	–	–	–	Hypersil GOLD™
YMC-Pack Pro C18	YMC	120	350	16	Hypersil GOLD
YMC-Pack Silica	YMC	120	–	–	BETASIL™ Silica
YMC-Pack TMS (C1)	YMC	120	300	4	BETASIL C1
Zorbax™ Bonus RP – Amide C14	Agilent	80	180	10	HyPURITY ADVANCE™
Zorbax Eclipse XDB C18	Agilent	80	180	10	Hypersil GOLD
Zorbax Eclipse XDB C8	Agilent	80	180	8	Hypersil GOLD C8
Zorbax Eclipse XDB Phenyl	Agilent	80	180	8	Hypersil GOLD Phenyl
Zorbax Eclipse Plus C18	Agilent	95	160	8	Hypersil GOLD
Zorbax Eclipse Plus C8	Agilent	95	160	6	Hypersil GOLD C8
Zorbax RRHT Eclipse Plus C18	Agilent	95	160	8	Hypersil GOLD (1.9 μm)
Zorbax RRHT Eclipse Plus C8	Agilent	95	160	6	Hypersil GOLD C8 (1.9 μm)
Zorbax RRHT Eclipse XDB-C18	Agilent	80	180	10	Hypersil GOLD (1.9 μm)
Zorbax RRHT Eclipse XDB-C8	Agilent	80	180	7.5	Hypersil GOLD C8 (1.9 μm)
Zorbax RRHT SB-CN	Agilent	80	180	4	Hypersil GOLD CN (1.9 μm)
Zorbax SB Aq	Agilent	80	180	–	Hypersil GOLD aQ™
Zorbax SB C18	Agilent	80	180	10	Hypersil GOLD
Zorbax SB C18	Agilent	300	45	3	BioBasic™ 18
Zorbax SB C8	Agilent	80	180	6	Hypersil GOLD C8
Zorbax SB C8	Agilent	300	45	2	BioBasic 8
Zorbax SB CN	Agilent	80	180	4	Hypersil GOLD CN
Zorbax SB CN	Agilent	300	45	1	BioBasic CN
Zorbax SB Phenyl	Agilent	80	180	6	Hypersil GOLD Phenyl