

# HPLC Column Comparison

## HPLC Column Selection: A Comparison of Alltech C18 and C8 Columns

Alltech has developed a method for choosing C18 and C8 columns based on peak capacities and column selectivity of polar and nonpolar compounds. Typically chromatographers must choose HPLC columns by comparing the surface area and carbon load data supplied by the column manufacturers. This data does not provide enough information about column selectivity or capacity for adequate column selection. The charts Alltech has assembled provide a reliable means of choosing HPLC columns, whether for back-up columns having similar selectivity or for columns with very different selectivity.

## Chromatographic Conditions and Calculations

The test mix used for this comparison contains uracil as a void volume marker, pyridine and N,N-dimethylaniline as basic probes, 4-butylbenzoic acid and phenol as acidic probes, and toluene as a neutral probe. Toluene tests the hydrophobic character of the columns, and the polar components test the activity of the base silica. The mobile phase contains 65% acetonitrile and 35% phosphate buffer at pH 3.2, which protonates the 4-butylbenzoic acid and insures consistent retention times for the amine compounds.

Capacity factor ( $k'$ ) was calculated using  $k' = (t_r - t_0)/t_0$ , where  $t_r$  is the retention time of the peak of interest and  $t_0$  is the uracil void time. The tailing factor was calculated using the USP formula  $T = W_{0.05}/2f$ .

## Directions for Using the Column Chart

The chart lists the columns in descending order of toluene capacity. To find similar HPLC columns to test as back-up columns, follow these 4 steps.

- 1) Find the column you are currently using and note neighboring columns which have similar toluene capacity factors.
- 2) Compare the peak order and capacity factors for the polar compounds.
- 3) Check whether any of the compounds tail, especially pyridine, N,N-dimethylaniline, and 4-butylbenzoic acid. Any peak with a tailing factor greater than 2.0 is listed as a tailing peak.
- 4) Compare uracil void times to insure similar retention times.

If there is more than one choice for a back-up column, then compare your actual sample to the test probes. If your sample is nonpolar like toluene, then place more emphasis on the toluene capacity. If your sample is a polar amine sample, then pay special attention to the pyridine and N,N-dimethylaniline probes. If your sample is an acid, note the activity of the 4-butylbenzoic acid and phenol probes.

### Key Chart

**P** — Pyridine  
**L** — Phenol  
**N** — N,N-Dimethylaniline  
**B** — 4-Butylbenzoic Acid  
**T** — Toluene

Column	0	1	2	3	4	5	6
Adsorbosphere® UHS C18		P L					N T=6.94
Inertsil® ODS-3	P	L		N B			T
Alltima™ C18	P	L		N B			T
Kromasil™ C18	P	L		N B			T
Luna™ C18	P	L		N B			T
Columbus™ C18	P	L		N B			T
LiChrospher® RP-18				N B			T
Brownlee Spheri™-5 RP-18				N B			T
LiChrospher RP®-18 (endcapped)	P	L		N B			T
Inertsil® ODS-2	P	L		N B			T
Adsorbosil® C18		L P					N B T
Econosil™ C18		L P					N B T
Brownlee Spheri-5™ ODS		L P					N B T
Prodigy™ ODS (3)	P	L		N B			T
PuroChrom™ ODS	P	L		N B			T
Symmetry® C18	P	L		N B			T
Luna™ C8	P	L		N B			T
Adsorbosphere® HS C18	P	L		N B			T
Zorbax® ODS				N B			T
AquaSep™ AQS C8				N B			T
Waters Spherisorb® ODS-2				N B			T
Ultrasphere® C18	P	L		N B			T
YMC ODS-A	P	L		N B			T
Microsorb™-MV C18				N			T B=18.71
Nucleosil® C18 AB	P	L		N B			T

URACIL VOID TIME (MIN)	TAILING PEAKS	SEE PAGE
1.04		400
1.39		460
1.19		408
1.17		444
1.28		N/A
1.35		N/A
1.30	P	488
1.22	P, B	457
1.30		488
1.28		460
1.27	P	392
1.26	P	422
1.25	P, N, B	457
1.31		N/A
1.30		N/A
1.20		N/A
1.29		N/A
1.38	P	398
1.20	P, B	N/A
1.46	P	N/A
1.16	P, B	491
1.22	P, B	450
1.41		N/A
1.23	P, B	N/A
1.25	P, B	484

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	Capacity Factor					URACIL VOID TIME (MIN)	TAILING PEAKS	SEE PAGE
Resolve™ C18	L		PB	NT		1.36	P, N	N/A
YMC ODS-AQ	P L		N B	T		1.48		N/A
Kromasil™ C8	P L		N B	T		1.31	P	444
Adsorbosphere® XL C18	LP		N	T		1.22	P, N, B	402
Allsphere™ ODS-2	LP		N	T		1.20	P, N, B	405
Ultrasphere® C18-IP	P L		N B	T		1.18	P, B	450
Partisil® ODS-2	LP		N B T			1.38	B	492
Versapak™ C18	IP		NB	T		1.43	P	N/A
LiChrosorb® RP-18	PL		N B T			1.46		487
Adsorbosphere® C18	L		N B T	N		1.29	P, N	394
Nucleosil® C18	P L		NB	T		1.45	P	484
Symmetry® C8	P L		N B T			1.31	B	N/A
Zorbax® SB-C18	P L		N B T			1.22		N/A
Brownlee Spheri™-5 RP-8	PL		N	T	B	1.29	P, B	457
LiChrosorb® RP Select B	P L		N	BT		1.32	B	487
Alltima™ C18-LL	P L		N B T			1.35		408
Zorbax® Rx-C18	PL		NB	T		1.15		N/A
Supelcosil™ LC-18-DB	P L		N	BT		1.40	P, B	N/A
Alltima™ C8	P L		N B T			1.36		408
Ultrasphere® C8	P L		N B T			1.33	P, B	450
Nova-Pak® C18	PL		NB	T		1.18		N/A
Pinnacle™ C18	L P		NB	T		1.40	P, N, B	N/A
Hypersil® ODS	L	P	NB	T		1.41	P, N, B	470
Partisil® ODS-3	P L		N B T			1.51	B	492
SynChropak® SCD-100	PL		N B T			1.42	P, B	N/A
alphaBond™ C18	P L		N B T			1.58		415
Econosphere™ C18	L	P	B	N		1.36	P, N	425
Waters Spherisorb® ODS-B	PL		N	T	B=7.10	1.25	B	491
Hypersil® BDS C18	P L		N B T			1.37		466
Inertsil® C8	P L		N B T			1.50		460
Partisil® C8	P L		N B T			1.51	B	492
Prism® RP	P L	N	T		B	1.52		N/A
SynChropak® RPP-100 (C18)	P L		N B T			1.45	B	N/A
μBondapak® C18	P L		N B T			1.63		N/A
Allsphere™ ODS-1	L P		N T	B		1.26	B	405
Zorbax® SB C8	PL		N B T			1.31		N/A
Waters Spherisorb® ODS-1	L P		NB	T		1.31		491
Adsorbosphere® XL C8	PL		NB	T		1.34	P, B	402
Allsphere™ Octyl	PL		NB	T		1.33	P, B	405
Supelcosil™ ABZ+	P L	N	T		B	1.48		N/A
Platinum™ C18	P L		NB	T		1.38		436
Adsorbosil® C8	L P		N	T		1.46	P	392
Econosil™ C8	L P		N	T		1.45	P	422
HyPURITY™ Elite C18	P L		N B T			1.69		N/A
Suplex pKb-100	P L	N	T		B=7.22	1.39	B	N/A
Waters Spherisorb® Octyl	P		N	T		1.32	P	491
Hypersil® BDS C8	P L		N B T			1.45		466
Adsorbosphere® C8	L P		N B T			1.40	P, N, B	394
Hypersil® MOS-2 C8	L		B T N		P	1.49	P, N, B	470
Hypersil® MOS-1 C8	L		N B T	P		1.46	P, N, B	470
Nucleosil® C8	LP		NB	T		1.53		484
Vydac® 201HS, C18	PL		N B T			1.51		N/A
Econosphere™ C8	LP		N B T			1.42	P, B	425
YMC Basic	P L		N B T			1.67		N/A
LiChrosorb® RP-8	PL		NB	T		1.65		487
Prism® RPN	P L	N	T		B	1.68		N/A
Jupiter™ C18	P L		N B T			1.77		N/A
Nucleosil® C18 (300Å)	PL		NB	T		1.69	B	484
Platinum™ C8	P L		NB	T		1.44		436
Waters Spherisorb® Wide Pore C18	PL		N B T			1.79	B	491
Platinum™ EPS C18	L P		NB	T		1.48		436
Nucleosil® C8 (300Å)	PL		NB	T		1.67		484
Adsorbosphere® XL C18 (300Å)	PL		NB	T		1.68		402
Vydac® 201TP, C18	PL		N B T			1.55		N/A
Vydac® 218TP, C18	PL		N B T			1.46		N/A
Jupiter™ C5	P L		N B T			1.88		N/A
Partisphere® C18	PL		N B T			1.60		494
Adsorbosphere® XL C18-B	PL		N T		B=7.31	1.43	B	402
Deltabond® ODS	PL		N T			1.67		N/A
Macrosphere™ C18	PL		N B T			1.62		430
Partisil® ODS	LP		NB	T		1.75		492
Hypersil® WP MOS C8	PL		N B T			1.73	P, B	470
Vydac® 208TP, C8	PL		N B T			1.58		N/A
SynChropak® RPP (C18, 300Å)	PL		N B T			1.59		N/A
Platinum™ EPS C8	L		NB	T		1.58		436
Adsorbosphere® XL C8 (300Å)	PL		NB	T		1.78		402
Macrosphere™ C8	PL		NB	T		1.81	B	430
Adsorbosphere® XL C8-B	PL		N T		B=14.04	1.59	B	402

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# Alltech HPLC Column Packing Characteristics

## Packing Characteristics Reference Guide

The table below lists the physical characteristics of the most common Alltech HPLC packings. This table is provided as a tool to help you make informed decisions regarding Alltech HPLC

columns. Please note that Alltech HPLC technical specialists are available from 7:30am-6:00pm (central time zone) to help you choose an appropriate column for your application. The USP L-code listing lets you know that these columns meet the specifications set forth in USP Volume 24.

PACKING	BASE MATERIAL	PARTICLE SHAPE	PARTICLE SIZE (µm)	CARBON LOAD (%)	PORE SIZE (Å)	SURFACE AREA (M <sup>2</sup> /G)	PHASE TYPE	END-CAPPED?	USP L-CODE
<b>Alltech HPLC Column Packing Characteristics</b>									
<b>Adsorbosil®</b>									
C18	Silica	Irregular	5, 10	15%	60	450	Polymeric	Yes	L1
C2	Silica	Irregular	5, 10	—	60	450	Polymeric	—	L16
C8	Silica	Irregular	5, 10	10%	60	450	Polymeric	Yes	L7
CN	Silica	Irregular	5, 10	—	60	450	Polymeric	Yes	L10
NH <sub>2</sub>	Silica	Irregular	5, 10	—	60	450	Polymeric	No	L8
Silica	Silica	Irregular	5, 10	—	60	450	Polymeric	—	L3
<b>Adsorbosphere®</b>									
C18	Silica	Spherical	3, 5, 10	12%	80	200	Monomeric	Yes	L1
C8	Silica	Spherical	3, 5, 10	8%	80	200	Monomeric	Yes	L7
CN	Silica	Spherical	3, 5, 10	—	80	200	Monomeric	Yes	L10
CN-AQ	Silica	Spherical	5	—	120	170	Polymeric	No	L10
NH <sub>2</sub>	Silica	Spherical	3, 5, 10	—	80	200	Polymeric	No	L8
PAC	Silica	Spherical	5	—	80	200	Monomeric	Partial	L18
SAX	Silica	Spherical	5	—	80	200	Monomeric	—	—
SCX	Silica	Spherical	5	—	80	200	Monomeric	Yes	—
Silica	Silica	Spherical	3, 5, 10	—	80	200	—	—	L3
HS C18	Silica	Spherical	3, 5, 7	20%	60	350	Monomeric	Yes	L1
HS Silica	Silica	Spherical	3, 5, 7	—	60	350	—	—	L3
UHS C18	Silica	Spherical	10	30%	60	500	Monomeric	Yes	L1
Phenyl	Silica	Spherical	5, 10	5%	60	200	Monomeric	Yes	L11
TMS	Silica	Spherical	5, 10	—	80	200	Monomeric	—	L13
<b>Adsorbosphere® XL</b>									
C18	Silica	Spherical	3, 5, 10	11%	90	200	Monomeric	Yes	L1
C18-B	Silica	Spherical	3, 5, 10	12%	90	200	Monomeric	Yes	L1
C8	Silica	Spherical	3, 5, 10	6%	90	200	Monomeric	Yes	L7
C1	Silica	Spherical	5, 10	—	90	200	Monomeric	Yes	L13
Phenyl	Silica	Spherical	3, 5	—	90	200	Monomeric	Yes	L11
CN	Silica	Spherical	3, 5, 10	—	90	200	Monomeric	Yes	L10
NH <sub>2</sub>	Silica	Spherical	3, 5, 10	—	90	200	Monomeric	No	L8
Silica	Silica	Spherical	3, 5, 10	—	90	200	—	—	L3
SAX	Silica	Spherical	5, 10	—	90	200	Monomeric	Yes	—
SCX	Silica	Spherical	5, 10	—	90	200	Monomeric	Yes	—
<b>Adsorbosphere® XL 300</b>									
C18	Silica	Spherical	3, 5, 10	6%	300	100	Monomeric	Yes	L1
C8	Silica	Spherical	3, 5, 10	3%	300	100	Monomeric	Yes	L7
<b>Allsphere™</b>									
ODS-2	Silica	Spherical	3, 5, 10	12%	80	220	Monomeric	Yes	L1
ODS-1	Silica	Spherical	5, 10	7%	80	220	Monomeric	Partial	L1
C8	Silica	Spherical	3, 5, 10	6%	80	220	Monomeric	Yes	L7
C6	Silica	Spherical	5	4%	80	220	Monomeric	Yes	L15
Phenyl	Silica	Spherical	5, 10	3%	80	220	Monomeric	Yes	L11
CN	Silica	Spherical	3, 5, 10	3.5%	80	220	Monomeric	No	L10
NH <sub>2</sub>	Silica	Spherical	3, 5, 10	3%	80	220	Monomeric	No	L8
C1	Silica	Spherical	5, 10	3%	80	220	Monomeric	No	L13
SAX	Silica	Spherical	5	4%	100	220	Monomeric	No	—
SCX	Silica	Spherical	5	4%	100	220	Monomeric	No	—
Silica	Silica	Spherical	3, 5, 10	—	80	220	—	—	L3
<b>Alltima™</b>									
C18	Silica	Spherical	3, 5, 10	16%	100	—	Polymeric	Yes	L1
C18 LL	Silica	Spherical	5	9%	100	—	Polymeric	Yes	L1
C8	Silica	Spherical	3, 5, 10	9%	100	—	Polymeric	Yes	L7
Phenyl	Silica	Spherical	3, 5, 10	7.5%	100	—	Polymeric	Yes	L11
Silica	Silica	Spherical	3, 5, 10	—	100	—	—	—	L3
NH <sub>2</sub>	Silica	Spherical	3, 5	—	100	—	Polymeric	No	L8
CN	Silica	Spherical	3, 5	—	100	—	Polymeric	Yes	L10
<b>Alltima™ WP</b>									
C18	Silica	Spherical	5	17%	200	—	Polymeric	YES	L1
C4	Silica	Spherical	5	6.5%	200	—	Polymeric	YES	L26
<b>alphaBond™</b>									
C18	Silica	Irregular	5, 10	10%	125	300	Monomeric	Yes	L1
C8	Silica	Irregular	10	—	125	300	Monomeric	Yes	L7
Phenyl	Silica	Irregular	10	—	125	300	Monomeric	Yes	L11

# Alltech HPLC Column Packing Characteristics

PACKING	BASE MATERIAL	PARTICLE SHAPE	PARTICLE SIZE (µM)	CARBON LOAD (%)	PORE SIZE (Å)	SURFACE AREA (m <sup>2</sup> /g)	PHASE TYPE	END-CAPPED?	USP L-CODE
<b>Alltech HPLC Column Packing Characteristics</b>									
<b>alphaBond™ (cont.)</b>									
CN	Silica	Irregular	10	—	125	300	Monomeric	Yes	L10
NH <sub>2</sub>	Silica	Irregular	10	—	125	300	Polymeric	No	L8
Silica	Silica	Irregular	5, 10	—	125	300	—	—	L3
<b>Brava™</b>									
BDS C18	Silica	Spherical	3, 5	8.5%	145	185	Monomeric	Yes	L1
BDS C8	Silica	Spherical	3, 5	5.5%	145	185	Monomeric	Yes	L7
BDS CN	Silica	Spherical	5	—	145	185	Monomeric	No	L10
Silica	Silica	Spherical	3, 5	—	130	195	—	No	L3
ODS (C18)	Silica	Spherical	3, 5	8.5%	130	195	Monomeric	Yes	L1
C8	Silica	Spherical	3, 5	6%	130	195	Monomeric	Yes	L7
CN	Silica	Spherical	5	—	130	195	Monomeric	No	L10
Phenyl	Silica	Spherical	5	—	130	195	Monomeric	No	L11
NH <sub>2</sub>	Silica	Spherical	5	—	130	195	Monomeric	No	L8
<b>Carbohydrate</b>									
Anomer Analysis	Silica	Spherical	7	—	100	350	Polymeric	No	—
Amino Phase	Silica	Irregular	10	—	80	550	Polymeric	No	—
<b>Econosil™</b>									
C18	Silica	Irregular	5, 10	15%	60	450	Polymeric	Yes	L1
C8	Silica	Irregular	5, 10	10%	60	450	Polymeric	Yes	L7
CN	Silica	Irregular	5, 10	—	60	450	Polymeric	Yes	L10
NH <sub>2</sub>	Silica	Irregular	5, 10	—	60	450	Polymeric	No	L8
Silica	Silica	Irregular	5, 10	—	60	450	—	—	L3
<b>Econosphere™</b>									
C18	Silica	Spherical	3, 5, 10	10%	80	200	Monomeric	Yes	L1
C8	Silica	Spherical	3, 5, 10	5%	80	200	Monomeric	Yes	L7
CN	Silica	Spherical	5, 10	—	80	200	Monomeric	Yes	L10
NH <sub>2</sub>	Silica	Spherical	5, 10	—	80	200	Polymeric	No	L8
Silica	Silica	Spherical	3, 5, 10	—	80	200	—	—	L3
<b>Macrosphere™ GPC</b>									
GPC 60	Silica	Spherical	7	—	60	450	Polymeric	No	L25
GPC 100	Silica	Spherical	7	—	100	350	Polymeric	No	—
GPC 150	Silica	Spherical	7	—	150	200	Polymeric	No	—
GPC 300	Silica	Spherical	7	—	300	100	Polymeric	No	—
GPC 500	Silica	Spherical	7	—	500	35	Polymeric	No	—
GPC 1000	Silica	Spherical	7	—	1000	25	Polymeric	No	—
GPC 4000	Silica	Spherical	7	—	4000	10	Polymeric	No	—
<b>Macrosphere™ 300</b>									
C18	Silica	Spherical	5, 7	10%	300	100	Monomeric	Yes	L1
C8	Silica	Spherical	5, 7	2.2%	300	100	Monomeric	Yes	L7
C4	Silica	Spherical	5, 7	—	300	100	Monomeric	Yes	L26
WAX	Silica	Spherical	7	—	300	100	Monomeric	No	—
WCX	Silica	Spherical	7	—	300	100	Polymeric	No	—
SAX	Silica	Spherical	7	—	300	100	Monomeric	No	—
SCX	Silica	Spherical	7	—	300	100	Polymeric	No	—
<b>Mixed Mode™</b>									
C8/Anion	Silica	Spherical	7	—	100	350	Polymeric	No	—
C18/Anion	Silica	Spherical	5	—	100	350	Polymeric	No	—
C8/Cation	Silica	Spherical	5	—	100	350	Polymeric	No	—
C18/Cation	Silica	Spherical	5, 7	—	100	350	Polymeric	No	—
<b>Platinum™</b>									
C18	Silica	Spherical	1.5, 3, 5, 10	6%	100	200	Monomeric	Yes	L1
C8	Silica	Spherical	3, 5, 10	4%	100	200	Monomeric	Yes	L7
Phenyl	Silica	Spherical	3, 5, 10	—	100	200	Monomeric	Yes	L11
CN	Silica	Spherical	3, 5, 10	—	100	200	Monomeric	No	L10
NH <sub>2</sub>	Silica	Spherical	3, 5, 10	—	100	200	Monomeric	No	L8
SAX	Silica	Spherical	3, 5	—	100	200	Monomeric	No	—
Silica	Silica	Spherical	3, 5, 10	—	100	200	—	—	L3
<b>Platinum™ EPS</b>									
EPS C18	Silica	Spherical	1.5, 3, 5, 10	5%	100	200	Monomeric	No	L1
EPS C8	Silica	Spherical	3, 5, 10	2.5%	100	200	Monomeric	No	L7
<b>Platinum™ 300</b>									
C18	Silica	Spherical	5, 10	—	300	100	Monomeric	Yes	L1
C8	Silica	Spherical	5, 10	—	300	100	Monomeric	Yes	L7
C4	Silica	Spherical	5, 10	—	300	100	Monomeric	Yes	L26
<b>Prosphere™ 300</b>									
C18	Silica	Spherical	5, 10	9%	300	100	Polymeric	Yes	L1
C4	Silica	Spherical	5, 10	3%	300	100	Polymeric	Yes	L26
PAH	Silica	Spherical	5	9%	300	100	Polymeric	Yes	L1

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