KINETEX®
Core-Shell Technology

10™
Year Anniversary

Tabletop **HPLC/UHPLC Reference Tool** Inside

Utilize your ***Origami Skills*** to maximize your chromatographic power!

Exclusive Offers Just For You!

phenomenex®
. . . breaking with tradition℠

www.phenomenex.com/Kinetex

KINETEX®
Core-Shell Technology

10™ Year Anniversary

Guess what? I just turned 10 years old!

Over the last decade, I've been written into tens of thousands of methods, appeared in over 4,500 journals, and received several awards thanks to your confidence in me! I've also been cloned over 3.2 tresvigintillion times, packed into hundreds of thousands of columns, and sent all over the world. It's been a pretty cool ride so far.

2010 R&D 100 Award Recipient

But my proudest moment is being brought into YOUR lab to help you do all the great things you do.

I hope you'll take on this little "origami" project I've sent to you and construct your new tabletop core-shell reference tool. I want to ensure you get the absolute best performance out of me day after day—for 10 more years.

Yours in the Lab,

Kinetex Ball-Guy

Phenomenex | WEB: **www.phenomenex.com**

KINETEX® Core-Shell Technology

THE RESOLUTION EQUATION

As You Know, It's All About Resolution

By modifying any one or all three of these important chromatographic factors (retention, selectivity, and efficiency), you can change or improve your resolution.

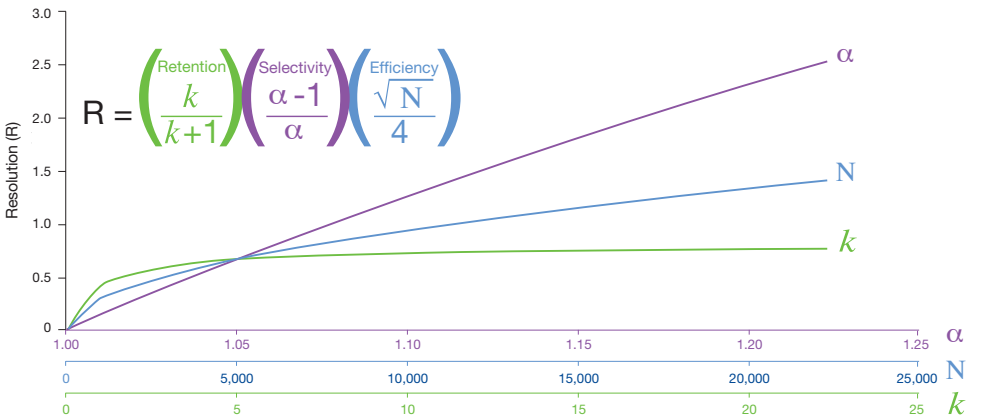
Utilize this tabletop tool to help make the modifications you need to supercharge your separations.

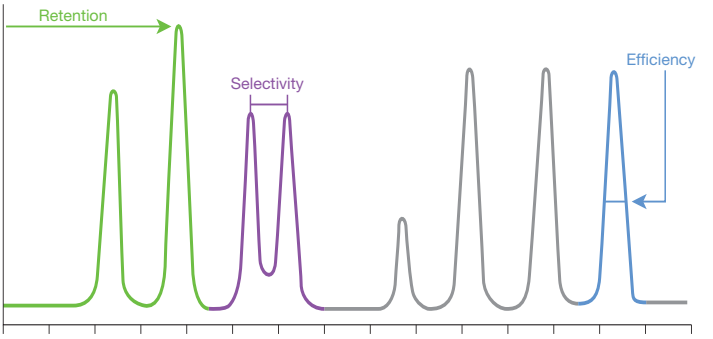
Questions?
www.phenomenex.com/Chat

The Resolution Equation:

$$R = \left(\frac{k}{k+1}\right)\left(\frac{\alpha - 1}{\alpha}\right)\left(\frac{\sqrt{N}}{4}\right)$$

Retention Selectivity Efficiency





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KINETEX Core-Shell Technology

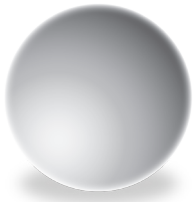
COLUMN RETENTION

$$\text{Retention} \left(\frac{k}{k+1} \right)$$

Estimate of Column Void Volume

Core-Shell Column

Column Internal Diameter (mm)	Length (mm)	Void Volume (mL)	Column Internal Diameter (mm)	Length (mm)	Void Volume (mL)
1.0	30	0.01	3.0	30	0.11
1.0	50	0.02	3.0	50	0.19
1.0	100	0.04	3.0	100	0.38
1.0	150	0.06	3.0	150	0.57
1.0	250	0.11	3.0	250	0.95
2.1	30	0.06	4.6	30	0.27
2.1	50	0.09	4.6	50	0.45
2.1	100	0.19	4.6	100	0.90
2.1	150	0.28	4.6	150	1.35
2.1	250	0.47	4.6	250	2.24



Fully Porous Column

Column Internal Diameter (mm)	Length (mm)	Void Volume (mL)	Column Internal Diameter (mm)	Length (mm)	Void Volume (mL)
1.0	30	0.02	3.0	30	0.14
1.0	50	0.03	3.0	50	0.24
1.0	100	0.05	3.0	100	0.48
1.0	150	0.08	3.0	150	0.72
1.0	250	0.13	3.0	250	1.20
2.1	30	0.07	4.6	30	0.34
2.1	50	0.12	4.6	50	0.57
2.1	100	0.24	4.6	100	1.13
2.1	150	0.35	4.6	150	1.70
2.1	250	0.59	4.6	250	2.83

Estimates of core-shell and fully porous column void volumes are based on a particle volume exclusion factor of 68 % for fully porous and 54 % for core-shell particles.

To determine the empirical column void volume of a particular column installed on a particular system, we suggest an evaluation by injecting a non-retained compound as a void marker and utilizing the following formula to determine void volume:
Void Volume = Retention Time of Void Peak (Vo) * Flow Rate.

Material Characteristics

Packing Material Kinetex Phases	Particle Sizes (µm)	Pore Size (Å)	Effective Surface Area (m^2/g)	Effective Carbon Load (%)	pH Range	Pressure Stability (bar)	Shipping Solvent
Kinetex Polar C18	2.6	100	200	9	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (50:50)
Kinetex PS C18	2.6	100	200	9	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (50:50)
Kinetex C18	1.3, 1.7, 2.6, 5	100	200	12	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (50:50)
Kinetex EVO C18	1.7, 2.6, 5	100	200	11	1.5 – 12	1,000/600**	Acetonitrile/Water (45:55)
Kinetex XB-C18	1.7, 2.6, 3.5, 5	100	200	10	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (50:50)
Kinetex C8	1.7, 2.6, 5	100	200	8	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (45:55)
Kinetex Biphenyl	1.7, 2.6, 5	100	200	11	1.5 – 8.5*	1,000/600**	Acetonitrile/Water w/ 0.1 % Formic Acid (50:50)
Kinetex Phenyl-Hexyl	1.7, 2.6, 5	100	200	11	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (45:55)
Kinetex F5	1.7, 2.6, 5	100	200	9	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (40:60)
Kinetex HILIC	1.7, 2.6, 5	100	200	0	2.0 - 7.5*	1,000/600**	Acetonitrile/ 100 mM Ammonium Formate (93:7)
Kinetex PAH	3.5	—	—	12	1.5 – 8.5*	1,000/600**	Acetonitrile/Water (65:35)

* pH stability under gradient conditions. pH stability is 1.5 - 10 under isocratic conditions.
** 2.1 mm ID Kinetex columns are pressure stable up to 1,000 bar.

When using Kinetex 1.3 µm or 1.7 µm, increased performance can be achieved, however high pressure-capable instrumentation is required.

Visit **www.phenomenex.com/Chat** to connect with our Technical Team nearly 24/7!

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KINETEX Core-Shell Technology

MOBILE PHASE SELECTIVITY

$$\text{Selectivity} \left(\frac{\alpha - 1}{\alpha} \right)$$

Table of Common HPLC/UHPLC Buffers and Additives

Name	Chemical Formula	Molecular Weight	pKa	UV (nm) Cutoff @ 1 AU	Buffer Range
Hydrochloric Acid	HCl	36.46	-7.00		
Sodium Hydroxide	NaOH	40.00	13.80		
Potassium Hydroxide	KOH	56.11	15.70		
Trifluoracetic Acid**	$C_2HF_3O_2$	114.03	0.23	210 nm (0.1 %)	< 1.5
Acetic Acid*	$C_2H_4O_2$	60.05	4.76	210 nm (10 mM)	3.76 ~ 5.76
Sodium Acetate	$C_2H_3NaO_2$	82.03	4.54		3.76 ~ 5.76
Potassium Acetate	$C_2H_3KO_2$	98.13	4.54	210 nm (10 mM)	3.76 ~ 5.76
Phosphoric Acid	H_3O_4P	98.00	2.15 7.20 12.32	< 200 nm (0.1 %)	1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Monosodium Dihydrogen Phosphate	H_2NaO_4P	119.98	2.15 7.20 12.32		1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Monosodium Dihydrogen Phosphate Monohydrate	H_4NaO_5P	137.99	2.15 7.20 12.32		1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Monosodium Dihydrogen Phosphate Dehydrate	H_6NaO_6P	156.01	2.15 7.20 12.32		1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Disodium Monohydrogen Phosphate	HNa_2O_4P	141.96	2.15 7.20 12.32		1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Monopotassium Dihydrogen Phosphate	H_2KO_4P	136.08	2.15 7.20 12.32		1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Dipotassium Monohydrogen Phosphate	HK_2O_4P	174.18	2.15 7.20 12.32		1.15 ~ 3.15 6.20 ~ 8.20 11.15 ~ 13.15
Citric Acid	$C_6H_8O_7$	192.12	3.13 4.76 6.40	230 nm (10 mM)	2.13 ~ 4.13 3.76 ~ 5.76 5.40 ~ 7.40
Formic Acid*	CH_2O_2	46.02	3.74	210 nm (10 mM)	2.74 ~ 4.74
Sodium Formate	$CHNaO_2$	68.01	3.74		2.74 ~ 4.74
Potassium Formate	$CHKO_2$	84.11	3.74	210 nm (10 mM)	2.74 ~ 4.74
Ammonium Hydroxide	H_5NO	35.05	9.24	200 nm (10 mM)	8.24 ~ 10.24
Ammonium Chloride	ClH_4N	53.49	9.24		8.24 ~ 10.24
Ammonium Acetate*	$C_2H_7NO_2$	77.08	4.76 9.24	205 nm (10 mM)	3.76 ~ 5.76 8.24 ~ 10.24
Ammonium Formate*	CH_5NO_2	63.06	3.74 9.24		2.74 ~ 4.74 8.24 ~ 10.24
Tris	$C_4H_{11}NO_3$	121.14	8.08		7.08 ~ 9.08
Tris Hydrochloride	$C_4H_{12}ClNO_3$	157.60	8.08		7.08 ~ 9.08
Triethylamine*	$C_6H_{15}N$	101.19	10.72	< 200 nm (10 mM)	9.72 ~ 11.72
Triethylamine Hydrochloride	$C_6H_{16}ClN$	137.65	10.72		9.72 ~ 11.72
Pyrrolidine	C_4H_9N	71.12	11.30		10.30 ~ 12.30

* Volatile buffer, compatible with Mass Spectroscopy analysis.

** Compatible with Mass Spectroscopy but at low concentrations due to ion suppression effects.

Solvent Table

Solvent	Polarity Index	Refractive Index @ 20˚C	UV (nm) Cutoff @ 1 AU	Solubility in Water (% w/w)
Acetic Acid	6.2	1.372	230	100
Acetone	5.1	1.359	330	100
Acetonitrile	5.8	1.344	190	100
Benzene	2.7	1.501	280	0.18
n-Butanol	4.0	1.394	254	0.43
Butyl Acetate	3.9	1.399	215	7.81
Carbon Tetrachloride	1.6	1.466	263	0.08
Chloroform	4.1	1.446	245	0.815
Cyclohexane	0.2	1.426	200	0.01
1,2-Dichloroethane[1]	3.5	1.444	225	0.81
Dichloromethane[2]	3.1	1.424	235	1.6
Dimethylformamide	6.4	1.431	268	100
Dimethyl Sulfoxide[3]	7.2	1.478	268	100
Dioxane	4.8	1.422	215	100
Ethanol	5.2	1.360	210	100
Ethyl Acetate	4.4	1.372	260	8.7

Solvent	Polarity Index	Refractive Index @ 20˚C	UV (nm) Cutoff @ 1 AU	Solubility in Water (% w/w)
Di-Ethyl Ether	2.8	1.353	220	6.89
Heptane	0.0	1.387	200	0.0003
Hexane	0.0	1.375	200	0.001
Methanol	5.1	1.329	205	100
Methyl-t-Butyl Ether[4]	2.5	1.369	210	4.8
Methyl Ethyl Ketone[5]	4.7	1.379	329	24
Pentane	0.0	1.358	200	0.004
n-Propanol	4.0	1.384	210	100
Iso-Propanol[6]	3.9	1.377	210	100
Di-Iso-Propyl Ether	2.2	1.368	220	
Tetrahydrofuran	4.0	1.407	215	100
Toluene	2.4	1.496	285	0.051
Trichloroethylene	1.0	1.477	273	0.11
Water	9.0	1.333	200	100
Xylene	2.5	1.500	290	0.018

Synonym Footer

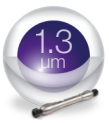
1. Ethylene Chloride
2. Methylene Chloride
3. Methyl Sulfoxide
4. tert-Butyl Methyl Ether
5. 2-Butanone
6. 2-Propanol

KINETEX® Core-Shell Technology

COLUMN EFFICIENCY

$$\text{Efficiency} \propto \frac{\sqrt{N}}{4}$$

Typical HPLC/UHPLC Backpressure by Particle Size

Particle Size (µm)	Internal Diameter (mm)	Typical Flow (mL/min)	Typical Pressure (PSI) 50 mm**	150 mm**	250 mm**
	2.1	0.5	10,500	—	—
	1.0	0.1	2,600	—	—
	2.1	0.5	5,300	7,300	—
	3.0	0.3	7,000	—	—
	1.0	0.1	1,700	4,300	—
	2.1	0.5	3,000	6,800	—
	3.0	0.8	2,300	5,900	—
	4.6	1.8	2,800	5,300	6,900
	4.6	1.5	—	2,600	—
	2.1	0.3	580	1,200	—
	3.0	0.5	620	1,050	—
	4.6	1.3	1,100	1,600	1,700
	10	5	—	2,100	3,000
	21.2	25	630	1,300	2,300
	30	50	670	1,600	2,300
	50	80	—	1,000	—

** Column length in mm.

Typical Flow Rates by Column Internal Diameters

Column	Column Internal Diameter	Typical Flow Rates	Sample Load (Typical Estimate)	Application
Nano	50 - 75 µm	~200 - 500 nL/min	100 - 200 ng	Higher Sensitivity, Very Limited Sample, LC-MS/MS
Capillary	0.3 - 0.5 mm	0.001 - 0.02 mL/min	1 - 10 µg	High Sensitivity, Limited Sample, LC-MS/MS
Microbore	1.0 mm	0.02 - 0.1 mL/min	10 - 50 µg	Increased Sensitivity, LC-MS/MS
Analytical	2.0 - 4.6 mm	0.1 - 3.0 mL/min	0.1 - 1.5 mg	General Analytical LC Applications
Semi-Prep	7.8 w- 10.0 mm	5 - 10 mL/min	1 - 10 mg	Analytical and Limited Purification Applications
Preparative	21.2 - 100.0 mm	20 - 250 mL/min	20 - 250 mg	Higher Purification Yield