

Normal Phase Chemistries

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Introduction

HPLC Columns for Normal Phase Chromatography

Whilst historically it was the earliest form of HPLC, normal phase separations have recently less attention due to the belief that it is complicated and unpredictable. But normal-phase chromatography is a powerful tool for the separation of positional isomers that are difficult to separate in reversed-phase mode. Due to a rigid surface in comparison with the more flexible carbon chains of reversed phase stationary phases the analytes are effected by well defined steric interaction with polar groups. This section gives a comprehensive overview of the stationary phases available from YMC for the use in normal phase separation mode. YMC offers columns packed with non-bonded silica or packed with silica gel modified with polar groups.

YMC-Pack SIL (Silica)

- ultra high purity silica
- high mechanical stability
- highly porous, totally spherical particles
- fully scalable for analytical, semi-prep, preparative and process scale applications
- convenient for separating small organic compounds with similar structures



YMC-Pack SIL	Specification			
Particle Size / μm	3; 5	3; 5	3; 5	5
Pore Size / nm	6	12	20	30
Surface area / m^2g^{-1}	450	330	175	100
Recommended pH range	2.0 - 7.5	2.0 - 7.5	2.0 - 7.5	2.0 - 7.5

General

Due to the highly sophisticated production process YMC's spherical silica material shows outstanding performance and great lot-to-lot reproducibility. The reason for this can be summarised in two main qualities: very narrow physical and chemical product specifications and outstanding purity.

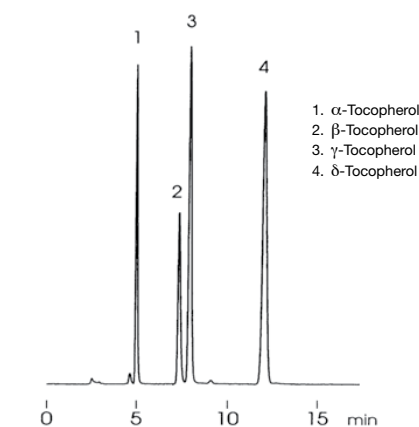
Properties

The high purity YMC-Pack SIL (Silica) allows almost total sample recovery because the low content of impurities such as residual metals reduces non-specific sample adsorption. This also prevents unusual peak-shapes thereby encouraging higher sample loading. In addition, the porous structure of the spheres gives a high surface area which further improves sample loading. Compared with irregular silica, YMC's spherical material is subject to a much lower degree of mechanical degradation during packing and usage. This results in lower backpressures and extended column life times due to the absence of 'fines'.

Since YMC spherical silica is the basis for most YMC bonded phases, this is a further reason for the premium quality of YMC stationary phases as far as backpressure and chromatographic stability is concerned.

YMC-Pack SIL (Silica) is also available in preparative particle sizes, e.g. 10 - 20 - 50 μm (YMC*Gel SIL-HG) and in multi-ton scale (refer to page 344-347).

Ultra High Purity Silica*

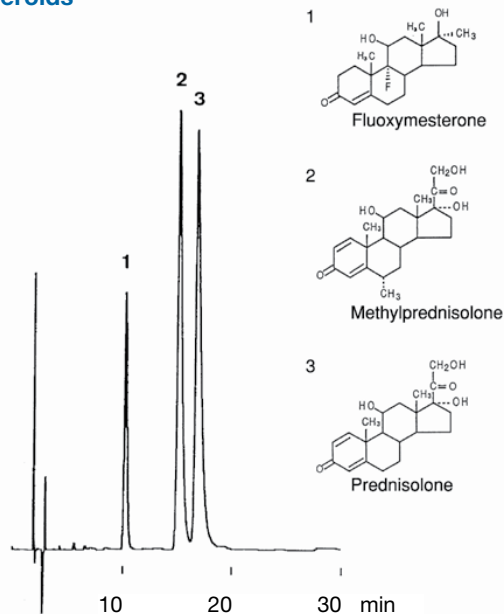


1. α -Tocopherol
2. β -Tocopherol
3. γ -Tocopherol
4. δ -Tocopherol

Column: YMC-Pack SIL (5 μm , 12 nm) 250 x 4.6 mm ID
 Part No.: SL12S05-2546WT
 Eluent: hexane / 2-propanol / acetic acid (1000/6/5)
 Flow: 1.4 mL/min
 Detection: FLS at Ex 298 nm, Em 325 nm
 Temperature: 35 °C
 Injection: 20 μL (5 - 20 mg/mL)

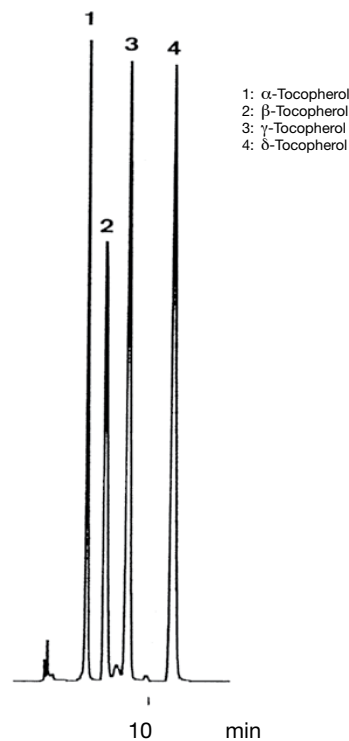
YMC-Pack SIL (Silica)

Steroids*



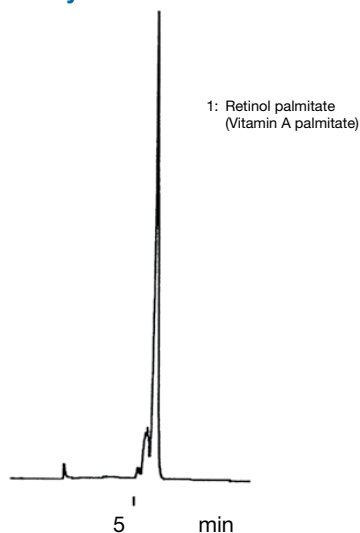
Column: YMC-Pack SIL (5 μ m, 6 nm) 250 x 4.6 mm ID
 Part No.: SL06S05-2546WT
 Eluent: hexane / THF / acetic acid (60/40/1)
 Flow: 1.5 mL/min
 Detection: UV at 250 nm, 0.16 AUFS
 Temperature: 30 °C
 Injection: 10 μ L (0.25 mg/mL)

Tocopherols*



Column: YMC-Pack SIL (5 μ m, 12 nm) 150 x 4.6 mm ID
 Part No.: SL12S05-1546WT
 Eluent: hexane / THF / acetic acid (97/3/0.25)
 Flow: 1.0 mL/min
 Detection: UV at 295 nm, 0.08 AUFS
 Temperature: 30 °C
 Injection: 10 μ L (0.20 ~ 0.31 mg/mL)

Vitamin A fatty acid ester*



Column: YMC-Pack SIL (5 μ m, 12 nm) 150 x 4.6 mm ID
 Part No.: SL12S05-1546WT
 Eluent: cyclohexane / dichloromethane / acetic acid (100/0.5/0.5)
 Flow: 1.0 mL/min
 Detection: UV at 350 nm, 0.32 AUFS
 Temperature: 30 °C
 Injection: 5 μ L (1.0 mg/mL)

Column care

YMC-Pack SIL is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack PVA-Sil

- bonded phase alternative to silica for normal phase applications
- consistent surface activity, unaffected by water
- vinyl alcohol polymerised silica support
- suitable for supercritical fluid chromatography (SFC)



YMC-Pack PVA-Sil	Specification
Particle Size / μm	5
Pore Size / nm	12
Surface area / m^2g^{-1}	330
Recommended pH range	2.0 - 9.5

Polyvinyl Alcohol Functionalised Silica

PVA-Sil is prepared from a 5 micron 12nm silica support which is bonded with a monomolecular polymer coating of vinyl alcohol. The polymerised PVA completely covers both external and internal surfaces of the silica support, protecting it against aggressive, high pH buffers and solvents.

Normal phase alternative to Silica

PVA-Sil, which possesses a polyvinyl alcohol (PVA) surface chemistry, is an excellent alternative to silica gel or other polar bonded phases which are used in normal phase chromatography. In many situations it exhibits better performance characteristics and a unique selectivity and can often resolve compounds that behave poorly on silica. The alcohol functionality present on PVA-Sil is better suited for troublesome compounds, such organic bases, than acidic silanols present in unbonded silica.

Highly stable and reproducible

Since PVA-Sil is a bonded stationary phase, it can be washed with solvents of any polarity, from hexane through water, without altering the surface activity. Therefore selectivity, retention and resolution are reproducible regardless of the column's previous history. This is not true of bare silica, which easily becomes completely deactivated following the introduction of even small quantity of water.

Provides high sample recovery

The surface of PVA-Sil is very uniform without the highly active acidic silanol sites on bare silica which can cause decomposition of sensitive molecules. Because of consistent surface activity, PVA-Sil exhibits neither non-specific irreversible adsorption nor sample degradation. This is a problem often encountered with bare silica columns. The lack of non-specific adsorption and the uniformity of the polyvinyl alcohol bonded surface means that, unlike silica, PVA-Sil can be reused over and over without fear of contamination or carryover. Sample recoveries on PVA-Sil typically average 90% or higher.

Excellent choice for packed column SFC

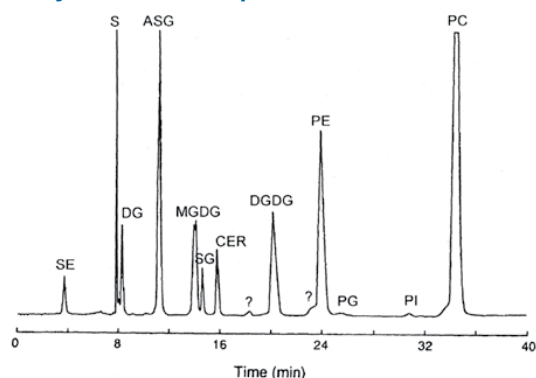
The PVA polymer shell on PVA-Sil deactivates the silica support while providing a hydrophilic surface. YMC-Pack PVA-Sil columns are well suited for SFC separations.

Column Care

YMC-Pack PVA-Sil is stable towards hydrolysis between pH 2.0-9.5. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack PVA-Sil

Analysis of Potato Lipids*



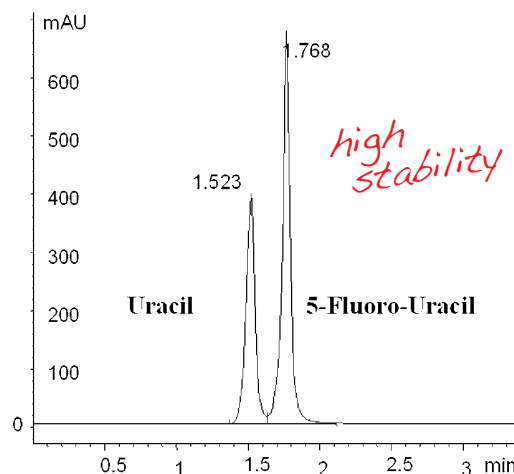
Column: YMC-Pack PVA-Sil (5 µm, 12 nm) 250 x 4.6 mm ID
 Part No.: PV12S05-2546WT
 Flow rate: 1 to 2 mL/min
 Mobile Phase: A: iso-hexane / methyl ter butyl ether (98:2)
 B: propan-2-ol / ACN / CHCl₃ / CH₃OOH (84:8:8:0.025)
 C: propan-2-ol / water / triethylamine (50:50:0.2)
 Gradient:
 Tmin: 0 5 15 40 40.1 45 50
 B%: 0 20 52 52 70 0 0
 C%: 0 0 4 14 0 0 0
 Flow (mL/min): 1 1 1 1.4 1.4 2 2

Nebuliser temperature: 25 °C, Evaporation temperature: 35 °C

S: Sterols SE: Sterol Esters SG: Steryl glycosides
 MGDG: Monogalactosyldiacylglycerols DGDG: Digalactosyldiacylglycerols
 PE: Phosphatidylethanolamine PG: Phosphatidyl glycerols
 PC: Phosphatidylcholine ASG: Acylsterlyglycosides
 PI: Phosphatidylinositol DG: Diacylglycerol
 CER: Cerebrosides

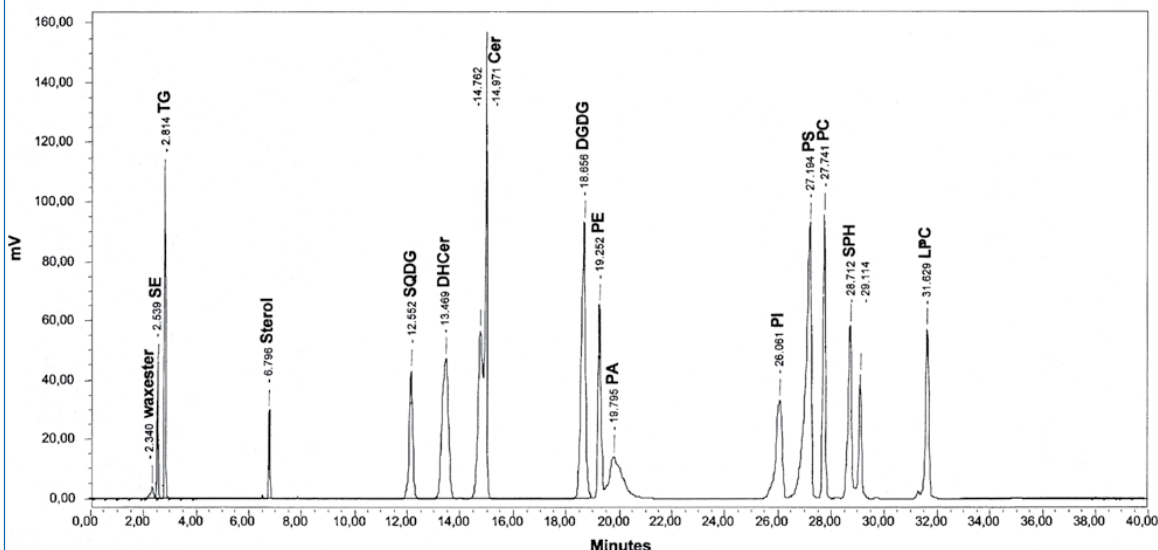
Literature: W.W. Christie; R.A. Urwin, J. high Resol. Chromatogr., Vol. 18 (1995) p.97 - 100

Uracil (in HILIC-mode)*



Column: YMC-Pack PVA-Sil (5 µm, 12 nm) 100 x 3.0 mm ID
 Part No.: PV12S05-1003WT
 Eluent: acetonitrile / CH₃COONH₄; 200 mM, pH 5.5
 isocratic (95/5)
 Flow rate: 0.9 mL/min
 Detection: UV at 275 nm

Analysis of Lipids



Column: YMC-Pack PVA-Sil (5 µm, 12 nm) 250 x 4.0 mm ID
 Part No.: PV12S05-2504QT
 Eluent: A: n-hexane / tert-methylbutyl ether (98:2)
 B: isopropanol / acetonitrile / chloroform / acetic acid (84:8:8:0.025)
 C: isopropanol / water / triethylamine (50:50:0.2)
 plus 5 mM ammonium sulfate
 Flow rate: 1 mL/min
 Detector: ELSD

SE: steryl oleate PE: PE-dipalmitoyl
 TG: TAG/tripentadecanoin PA: PA-diheptadecanoyl
 Sterol: stigmasterol/sitosterol PI: PI-diheptadecanoyl
 SODG: sulfoquinovosyldiacylglycerol PS: PS-diheptadecanoyl
 DHCer: dehydroxycerebroside PC: PC-diheptadecanoyl
 Cer: cerebroside SPH: sphingomyelin
 DGDG: digalactosyldiacylglycerol LPC: lysophosphatidylcholine

Literature: JAOCS, Vol. 80, no. 8 (2003) p. 747-753

YMC-Pack CN (Cyano)

- silica gel chemically bound with cyanopropyl groups
- faster column equilibration than normal silica gel



YMC-Pack CN	Specification	
Particle Size / μm	3; 5	5
Pore Size / nm	12	30
Surface area / m^2g^{-1}	330	100
Carbon content / %	7	3
Recommended pH range	2.0 - 7.5	2.0 - 7.5

General

Cyano packings also provide an alternative to silica material in normal phase chromatography, where bonded normal phase packings have the advantage of faster equilibration, more uniform surface activity and increased resistance to dissolution.

To extend column lifetime continued switching between normal and reversed phase solvents should be avoided. Both reversed and normal phase separations can be carried out on this material.

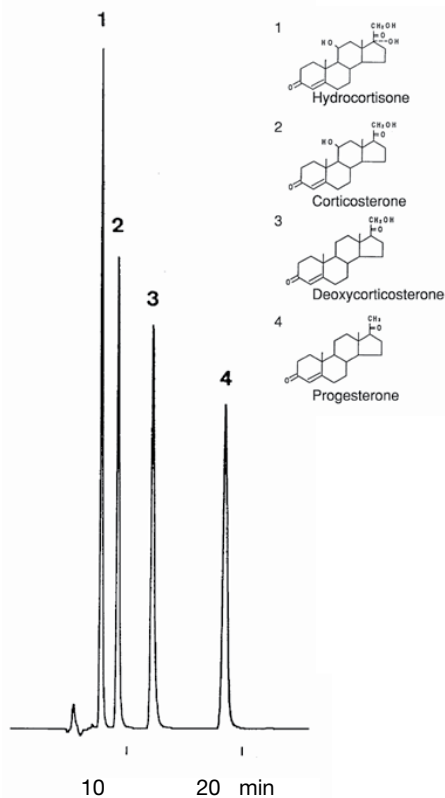
YMC-Pack CN (Cyano) is also available in preparative particle sizes.

YMC-Pack CN (Cyano)

YMC-Pack CN Separation Modes

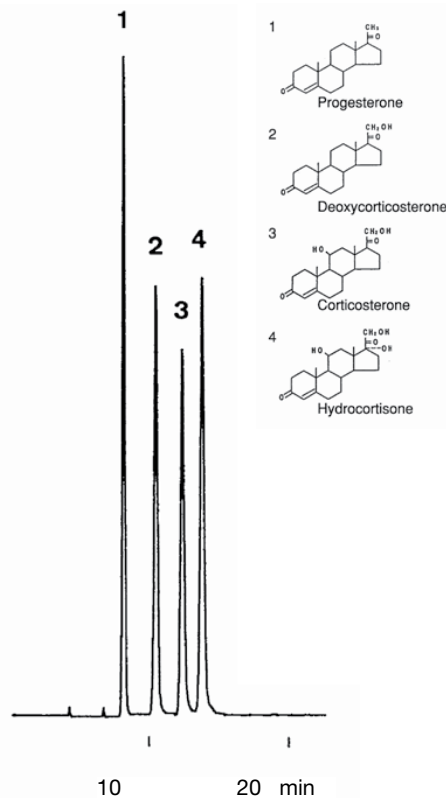
YMC-Pack CN can be used either in reversed phase and normal phase modes since it provides cyanopropyl groups of medium polarity. It can be employed in reversed phase mode with an aqueous mobile phase of higher polarity and in normal phase mode with a lower polarity than the stationary phase. This results in an important phenomenon for large-scale work; the elution order will be inverted by use of the alternate separation mode.

Steroids in reversed phase*



Column: YMC-Pack CN (5 μ m, 12 nm) 250 x 4.6 mm ID
 Part No.: CN12S05-2546WT
 Eluent: acetonitrile / water (40/60)
 Flow: 0.6 mL/min
 Detection: UV at 254 nm, 0.32 AUFS
 Temperature: 30 °C
 Injection: 3 μ L (0.25 mg/mL)

Steroids in normal phase*



Column: YMC-Pack CN (5 μ m, 12 nm) 250 x 4.6 mm ID
 Part No.: CN12S05-2546WT
 Eluent: hexane / methanol / dichloromethane (75/20/5)
 Flow: 0.6 mL/min
 Detection: UV at 254 nm, 0.32 AUFS
 Temperature: 30 °C
 Injection: 3 μ L (0.25 mg/mL)

Column care

YMC-Pack CN is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage.

For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack Diol-NP

- good selectivity without excessive retention
- high product recovery rate
- high preparative loading
- reproducibility
- improved peak shape versus bare silica
- gel filtration on a silica based material for aqueous size separations



YMC-Pack Diol-NP	Specification	
Particle Size / μm	5	5
Pore Size / nm	6	12
Surface area / m^2g^{-1}	450	330
Recommended pH range (NP)	2.0 - 7.5	2.0 - 7.5
(SEC)	5.0 - 7.5	5.0 - 7.5

General

In normal phase mode the YMC-Pack Diol stationary phase is a versatile alternative to silica. The bonded phase's hydroxyl groups provide good selectivity without excessive retention, since hydrogen bonding with the diol layer is not as strong as with the silanols on a bare silica surface. Diol columns also provide improved reproducibility when compared with bare silica.

Diol packings are suitable for separations using reversed phase techniques or molecular weight determination of proteins by gel filtration.

Properties

As with all YMC silica based bonded phases, YMC-Pack Diol starts with a base silica support of exceptional purity. YMC manufacturing and quality control procedures ensure that the silica has a very low residual metal content. The silica purity greatly reduces non-specific sample adsorption, thereby providing excellent sample recovery.

The high surface area, together with the large number of available sites for interaction of the 1,2-dihydroxypropane ligands, provides high preparative loading.

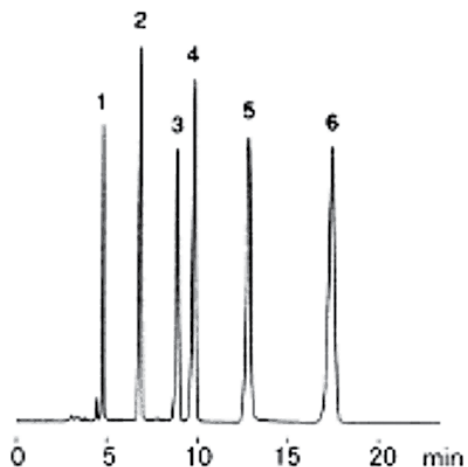
YMC-Pack Diol SEC columns for separation and MW determination of biomolecules may be found on page 203-218.

YMC-Pack Diol packings can be cleaned repeatedly with methanol, or even water. When combined with the high mechanical strength of the pure base silica, this washability means that YMC*Gel Diol packings provide longer column life than underivatized silica.

YMC-Pack Diol is also available in preparative particle sizes.

YMC-Pack Diol-NP

Separations of phenols*



1. Phenol
2. Catechol
3. Resorcinol
4. Hydroquinone
5. Pyrogallol
6. Phloroglucinol

Column: YMC-Pack Diol-NP (DN) (5 μ m, 12 nm) 250 x 4.6 mm ID
Part No.: DN12S05-2546WT
Eluent: hexane / ethanol (80/20)
Flow rate: 1.0 mL/min
Temperature: 30 °C
Detection: UV at 254 nm

Column care

YMC-Pack Diol is stable towards hydrolysis between pH 5.0-7.5 in reversed phase mode (DL) and pH 2.0-7.5 in normal phase mode (DN). Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack Polyamine II

- amino phase with polymeric surface
- exclusively 2° and 3° amino groups
- stable towards hydrolysis and oxidation
- high recovery
- excellent life-time

- saccharides and derivatives
- nucleotides
- tocopherols
- for RP- and NP-mode separations



YMC-Pack Polyamine II	Specification
Particle Size / μm	5
Pore Size / nm	12
Surface area / m^2g^{-1}	n/a
Carbon content / %	n/a
Recommended pH range	2.0 - 7.5

General

The chromatographic separation and the reliable quantitation of saccharides is increasingly important in many areas of food technology, life science and in pharmaceutical industry.

For these particular applications, YMC provides YMC-Pack Polyamine II, a polymer amino phase.

Properties

YMC-Pack Polyamine II is based on ultra-pure YMC silica as a support material. The functionality of the stationary phase is achieved by a covalently bonded polymer layer containing secondary (2°) and tertiary (3°) amino groups. The 2° and 3° amino groups of YMC-Pack Polyamine II are only weakly nucleophilic, exhibiting a significantly reduced reactivity against carbonyl compounds. Therefore, unlike conventional amino phases with primary n-propyl-amino ligands, YMC-Pack Polyamine II does not tend to the formation of Schiff's bases or other stable condensation products. In addition, the 2° and 3° amino groups of the polymer layer are to a large extent resistant to oxidation and hydrolysis (see figure next page).

The low reactivity of the 2° and 3° amino groups preserves the long-term retention characteristics and selectivity of YMC-Pack Polyamine II.

Compared to conventional amino phases, one of their most outstanding benefits is the significantly prolonged lifetime. As the silica matrix is completely polymer coated, even the short-term use of basic eluents up to pH 10.5 is possible.

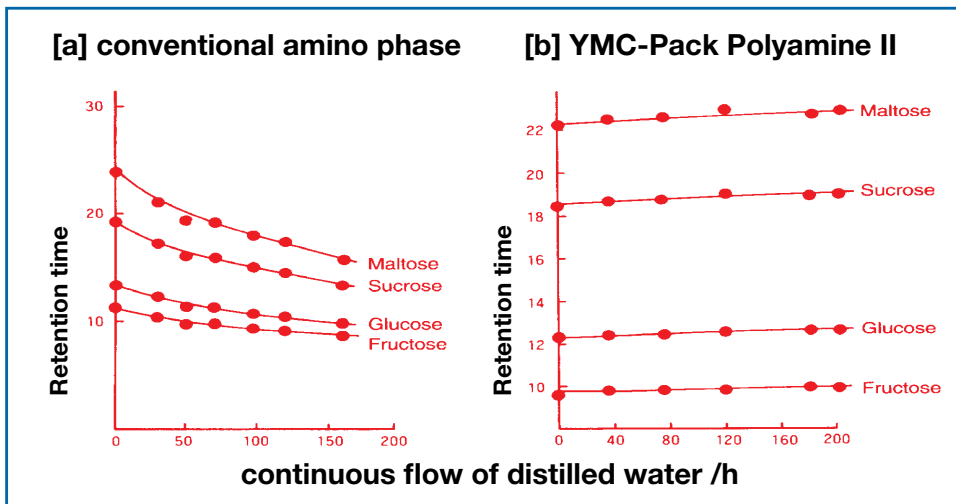
Reducing sugars are often adsorbed irreversibly to conventional amino phases, which causes problems in their recovery and quantitation. In YMC-Pack Polyamine II columns however, the adsorption of reducing sugars plays only a minor role. As a result, a high recovery of these compounds can be obtained which is beneficial for accurate and reliable quantitation.

Column care

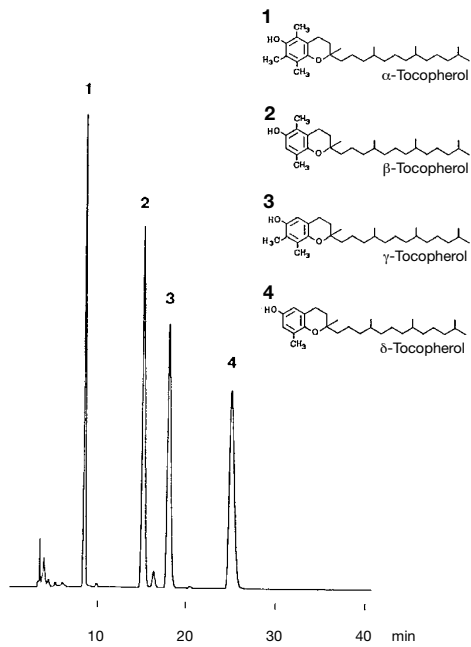
YMC-Pack Polyamine II is stable towards hydrolysis between pH 2.0-9.0. Remove acid and buffer salts before storage. For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack Polyamine II

Stability of amino type packings*



Tocopherols*



Column: YMC-Pack Polyamine II (5 μ m, 12 nm) 250 x 4.6 mm ID
 Part No.: PB12S05-2546WT
 Eluent: hexane / ethylacetate = 70/30
 Flow: 1.0 mL/min
 Detection: UV, 295 nm
 Temperature: 30 $^{\circ}$ C

YMC-Pack NH₂ (Amino)

- primary amine (-NH₂) functionality
- stable, high coverage monomeric bonded chemistry
- available in analytical, semi-prep and preparative column sizes



YMC-Pack NH ₂	Specification
Particle Size / μm	3; 5
Pore Size / nm	12
Surface area / m ² g ⁻¹	330
Recommended pH range	2.0 - 7.5

General

YMC-Pack NH₂ (Amino) packings are specifically useful for the analysis of mono- and polysaccharides under aggressive normal phase elution conditions. They can also be used in place of silica for conventional normal phase chromatography using nonpolar solvents.

Properties

YMC-Pack NH₂ (Amino) is based on a monomeric bonding of a primary propylamine functionality to YMC's spherical, ultra pure, high surface area silica with a mean pore diameter of 12 nm. The amine functionality provides retention and allows the separation of polar compounds under aggressive normal phase elution conditions, e.g. the analysis of mono- and polysaccharides using acetonitrile/water eluents. (Since YMC-Pack NH₂ packings operate under normal phase / HILIC elution conditions, water, which is more polar than acetonitrile, is the stronger solvent.) YMC-Pack NH₂ (Amino) can also be used for the separation of isomers of tocopherols and other organic soluble compounds such as paraffins, olefins and aromatics under conventional normal phase conditions.

In aqueous, low pH buffers the amino phase becomes a weak anion exchanger capable of separating negatively charged molecules.

YMC-Pack NH₂ (Amino) is also available in preparative particle sizes.

Column care

YMC-Pack NH₂ (Amino) is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage.

For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

YMC-Pack TMS (C1)



- intermediate polarity between normal phase silica and other alkyl bonded reversed phases
- operates in either normal phase or reversed phase mode

YMC-Pack TMS	Specification
Particle Size / μm	3; 5
Pore Size / nm	12
Surface area / m^2g^{-1}	330
Carbon content / %	4
Recommended pH range	2.0 - 7.5

General

YMC-Pack TMS (C1) is a bonded phase suitable for samples that exhibit strong retention characteristics and are difficult or impossible to separate on conventional reversed phase or normal phase packings.

Properties

YMC-Pack TMS (C1) is bonded with trimethylmonochlorosilane to create a phase with intermediate polarity for separation of extremely hydrophobic compounds using conventional reversed phase solvents and of highly polar compounds using normal phase solvents.

The chemistry of TMS is also well-suited for the analysis of multifunctional compounds. Selectivity characteristics of a C1 bonded phase can be unique, and samples must be tested to determine the applicability of the phase.

YMC-Pack TMS (C1) is also available in preparative particle sizes.

Column care

YMC-Pack TMS (C1) is stable towards hydrolysis between pH 2.0-7.5. Remove acid and buffer salts before storage. Store the column in methanol / water = 70/30. Clogged inlet frits often can be cleaned by changing the flow direction or replacement.

For detailed information please refer to the "Column Care and Use Instructions" which can be downloaded from www.ymc.de/support-documentation.html.

Ordering Information

YMC-Pack SIL

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
6 nm 3 µm	2.1	SL06S03-H3Q1QT	SL06S03-05Q1QT	SL06S03-10Q1QT	SL06S03-15Q1QT	SL06S03-25Q1QT	SL06S03-01Q1GC
	3.0	SL06S03-H303QT	SL06S03-0503QT	SL06S03-1003QT	SL06S03-1503QT	SL06S03-2503QT	SL06S03-0103GC
	4.0	SL06S03-H304QT	SL06S03-0504QT	SL06S03-1004QT	SL06S03-1504QT	SL06S03-2504QT	SL06S03-0104GC
	4.6	SL06S03-0346WT	SL06S03-0546WT	SL06S03-1046WT	SL06S03-1546WT	SL06S03-2546WT	SL06S03-0104GC
12 nm 3 µm	2.1	SL12S03-H3Q1QT	SL12S03-05Q1QT	SL12S03-10Q1QT	SL12S03-15Q1QT	SL12S03-25Q1QT	SL12S03-01Q1GC
	3.0	SL12S03-H303QT	SL12S03-0503QT	SL12S03-1003QT	SL12S03-1503QT	SL12S03-2503QT	SL12S03-0103GC
	4.0	SL12S03-H304QT	SL12S03-0504QT	SL12S03-1004QT	SL12S03-1504QT	SL12S03-2504QT	SL12S03-0104GC
	4.6	SL12S03-0346WT	SL12S03-0546WT	SL12S03-1046WT	SL12S03-1546WT	SL12S03-2546WT	SL12S03-0104GC
20 nm 3 µm	2.1	SL20S03-H3Q1QT	SL20S03-05Q1QT	SL20S03-10Q1QT	SL20S03-15Q1QT	SL20S03-25Q1QT	SL20S03-01Q1GC
	3.0	SL20S03-H303QT	SL20S03-0503QT	SL20S03-1003QT	SL20S03-1503QT	SL20S03-2503QT	SL20S03-0103GC
	4.0	SL20S03-H304QT	SL20S03-0504QT	SL20S03-1004QT	SL20S03-1504QT	SL20S03-2504QT	SL20S03-0104GC
	4.6	SL20S03-0346WT	SL20S03-0546WT	SL20S03-1046WT	SL20S03-1546WT	SL20S03-2546WT	SL20S03-0104GC
6 nm 5 µm	2.1	SL06S05-H3Q1QT	SL06S05-05Q1QT	SL06S05-10Q1QT	SL06S05-15Q1QT	SL06S05-25Q1QT	SL06S05-01Q1GC
	3.0	SL06S05-H303QT	SL06S05-0503QT	SL06S05-1003QT	SL06S05-1503QT	SL06S05-2503QT	SL06S05-0103GC
	4.0	SL06S05-H304QT	SL06S05-0504QT	SL06S05-1004QT	SL06S05-1504QT	SL06S05-2504QT	SL06S05-0104GC
	4.6	SL06S05-0346WT	SL06S05-0546WT	SL06S05-1046WT	SL06S05-1546WT	SL06S05-2546WT	SL06S05-0104GC
12 nm 5 µm	2.1	SL12S05-H3Q1QT	SL12S05-05Q1QT	SL12S05-10Q1QT	SL12S05-15Q1QT	SL12S05-25Q1QT	SL12S05-01Q1GC
	3.0	SL12S05-H303QT	SL12S05-0503QT	SL12S05-1003QT	SL12S05-1503QT	SL12S05-2503QT	SL12S05-0103GC
	4.0	SL12S05-H304QT	SL12S05-0504QT	SL12S05-1004QT	SL12S05-1504QT	SL12S05-2504QT	SL12S05-0104GC
	4.6	SL12S05-0346WT	SL12S05-0546WT	SL12S05-1046WT	SL12S05-1546WT	SL12S05-2546WT	SL12S05-0104GC
20 nm 5 µm	2.1	SL20S05-H3Q1QT	SL20S05-05Q1QT	SL20S05-10Q1QT	SL20S05-15Q1QT	SL20S05-25Q1QT	SL20S05-01Q1GC
	3.0	SL20S05-H303QT	SL20S05-0503QT	SL20S05-1003QT	SL20S05-1503QT	SL20S05-2503QT	SL20S05-0103GC
	4.0	SL20S05-H304QT	SL20S05-0504QT	SL20S05-1004QT	SL20S05-1504QT	SL20S05-2504QT	SL20S05-0104GC
	4.6	SL20S05-0346WT	SL20S05-0546WT	SL20S05-1046WT	SL20S05-1546WT	SL20S05-2546WT	SL20S05-0104GC
30 nm 5 µm	2.1	SL30S05-H3Q1QT	SL30S05-05Q1QT	SL30S05-10Q1QT	SL30S05-15Q1QT	SL30S05-25Q1QT	SL30S05-01Q1GC
	3.0	SL30S05-H303QT	SL30S05-0503QT	SL30S05-1003QT	SL30S05-1503QT	SL30S05-2503QT	SL30S05-0103GC
	4.0	SL30S05-H304QT	SL30S05-0504QT	SL30S05-1004QT	SL30S05-1504QT	SL30S05-2504QT	SL30S05-0104GC
	4.6	SL30S05-0346WT	SL30S05-0546WT	SL30S05-1046WT	SL30S05-1546WT	SL30S05-2546WT	SL30S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

YMC-Pack PVA-Sil

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 5 µm	2.1	PV12S05-H3Q1QT	PV12S05-05Q1QT	PV12S05-10Q1QT	PV12S05-15Q1QT	PV12S05-25Q1QT	PV12S05-01Q1GC
	3.0	PV12S05-H303QT	PV12S05-0503QT	PV12S05-1003QT	PV12S05-1503QT	PV12S05-2503QT	PV12S05-0103GC
	4.0	PV12S05-H304QT	PV12S05-0504QT	PV12S05-1004QT	PV12S05-1504QT	PV12S05-2504QT	PV12S05-0104GC
	4.6	PV12S05-0346WT	PV12S05-0546WT	PV12S05-1046WT	PV12S05-1546WT	PV12S05-2546WT	PV12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

YMC-Pack CN (Cyano)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	CN12S03-H3Q1QT	CN12S03-05Q1QT	CN12S03-10Q1QT	CN12S03-15Q1QT	CN12S03-25Q1QT	CN12S03-01Q1GC
	3.0	CN12S03-H303QT	CN12S03-0503QT	CN12S03-1003QT	CN12S03-1503QT	CN12S03-2503QT	CN12S03-0103GC
	4.0	CN12S03-H304QT	CN12S03-0504QT	CN12S03-1004QT	CN12S03-1504QT	CN12S03-2504QT	CN12S03-0104GC
	4.6	CN12S03-0346WT	CN12S03-0546WT	CN12S03-1046WT	CN12S03-1546WT	CN12S03-2546WT	CN12S03-0104GC
12 nm 5 µm	2.1	CN12S05-H3Q1QT	CN12S05-05Q1QT	CN12S05-10Q1QT	CN12S05-15Q1QT	CN12S05-25Q1QT	CN12S05-01Q1GC
	3.0	CN12S05-H303QT	CN12S05-0503QT	CN12S05-1003QT	CN12S05-1503QT	CN12S05-2503QT	CN12S05-0103GC
	4.0	CN12S05-H304QT	CN12S05-0504QT	CN12S05-1004QT	CN12S05-1504QT	CN12S05-2504QT	CN12S05-0104GC
	4.6	CN12S05-0346WT	CN12S05-0546WT	CN12S05-1046WT	CN12S05-1546WT	CN12S05-2546WT	CN12S05-0104GC
30 nm 5 µm	2.1	CN30S05-H3Q1QT	CN30S05-05Q1QT	CN30S05-10Q1QT	CN30S05-15Q1QT	CN30S05-25Q1QT	CN30S05-01Q1GC
	3.0	CN30S05-H303QT	CN30S05-0503QT	CN30S05-1003QT	CN30S05-1503QT	CN30S05-2503QT	CN30S05-0103GC
	4.0	CN30S05-H304QT	CN30S05-0504QT	CN30S05-1004QT	CN30S05-1504QT	CN30S05-2504QT	CN30S05-0104GC
	4.6	CN30S05-0346WT	CN30S05-0546WT	CN30S05-1046WT	CN30S05-1546WT	CN30S05-2546WT	CN30S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

Ordering Information

YMC-Pack Diol-NP

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
6 nm 5 µm	2.1	DN06S05-H3Q1QT	DN06S05-05Q1QT	DN06S05-10Q1QT	DN06S05-15Q1QT	DN06S05-25Q1QT	DN06S05-01Q1GC
	3.0	DN06S05-H303QT	DN06S05-0503QT	DN06S05-1003QT	DN06S05-1503QT	DN06S05-2503QT	DN06S05-0103GC
	4.0	DN06S05-H304QT	DN06S05-0504QT	DN06S05-1004QT	DN06S05-1504QT	DN06S05-2504QT	DN06S05-0104GC
	4.6	DN06S05-0346WT	DN06S05-0546WT	DN06S05-1046WT	DN06S05-1546WT	DN06S05-2546WT	DN06S05-0104GC
12 nm 5 µm	2.1	DN12S05-H3Q1QT	DN12S05-05Q1QT	DN12S05-10Q1QT	DN12S05-15Q1QT	DN12S05-25Q1QT	DN12S05-01Q1GC
	3.0	DN12S05-H303QT	DN12S05-0503QT	DN12S05-1003QT	DN12S05-1503QT	DN12S05-2503QT	DN12S05-0103GC
	4.0	DN12S05-H304QT	DN12S05-0504QT	DN12S05-1004QT	DN12S05-1504QT	DN12S05-2504QT	DN12S05-0104GC
	4.6	DN12S05-0346WT	DN12S05-0546WT	DN12S05-1046WT	DN12S05-1546WT	DN12S05-2546WT	DN12S05-0104GC
20 nm 5 µm	2.1	DN20S05-H3Q1QT	DN20S05-05Q1QT	DN20S05-10Q1QT	DN20S05-15Q1QT	DN20S05-25Q1QT	DN20S05-01Q1GC
	3.0	DN20S05-H303QT	DN20S05-0503QT	DN20S05-1003QT	DN20S05-1503QT	DN20S05-2503QT	DN20S05-0103GC
	4.0	DN20S05-H304QT	DN20S05-0504QT	DN20S05-1004QT	DN20S05-1504QT	DN20S05-2504QT	DN20S05-0104GC
	4.6	DN20S05-0346WT	DN20S05-0546WT	DN20S05-1046WT	DN20S05-1546WT	DN20S05-2546WT	DN20S05-0104GC
30 nm 5 µm	2.1	DN30S05-H3Q1QT	DN30S05-05Q1QT	DN30S05-10Q1QT	DN30S05-15Q1QT	DN30S05-25Q1QT	DN30S05-01Q1GC
	3.0	DN30S05-H303QT	DN30S05-0503QT	DN30S05-1003QT	DN30S05-1503QT	DN30S05-2503QT	DN30S05-0103GC
	4.0	DN30S05-H304QT	DN30S05-0504QT	DN30S05-1004QT	DN30S05-1504QT	DN30S05-2504QT	DN30S05-0104GC
	4.6	DN30S05-0346WT	DN30S05-0546WT	DN30S05-1046WT	DN30S05-1546WT	DN30S05-2546WT	DN30S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

YMC-Pack Polyamine II

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 5 µm	2.1	PB12S05-H3Q1QT	PB12S05-05Q1QT	PB12S05-10Q1QT	PB12S05-15Q1QT	PB12S05-25Q1QT	PB12S05-01Q1GC
	3.0	PB12S05-H303QT	PB12S05-0503QT	PB12S05-1003QT	PB12S05-1503QT	PB12S05-2503QT	PB12S05-0103GC
	4.0	PB12S05-H304QT	PB12S05-0504QT	PB12S05-1004QT	PB12S05-1504QT	PB12S05-2504QT	PB12S05-0104GC
	4.6	PB12S05-0346WT	PB12S05-0546WT	PB12S05-1046WT	PB12S05-1546WT	PB12S05-2546WT	PB12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

YMC-Pack NH₂ (Amino)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	NH12S03-H3Q1QT	NH12S03-05Q1QT	NH12S03-10Q1QT	NH12S03-15Q1QT	NH12S03-25Q1QT	NH12S03-01Q1GC
	3.0	NH12S03-H303QT	NH12S03-0503QT	NH12S03-1003QT	NH12S03-1503QT	NH12S03-2503QT	NH12S03-0103GC
	4.0	NH12S03-H304QT	NH12S03-0504QT	NH12S03-1004QT	NH12S03-1504QT	NH12S03-2504QT	NH12S03-0104GC
	4.6	NH12S03-0346WT	NH12S03-0546WT	NH12S03-1046WT	NH12S03-1546WT	NH12S03-2546WT	NH12S03-0104GC
12 nm 5 µm	2.1	NH12S05-H3Q1QT	NH12S05-05Q1QT	NH12S05-10Q1QT	NH12S05-15Q1QT	NH12S05-25Q1QT	NH12S05-01Q1GC
	3.0	NH12S05-H303QT	NH12S05-0503QT	NH12S05-1003QT	NH12S05-1503QT	NH12S05-2503QT	NH12S05-0103GC
	4.0	NH12S05-H304QT	NH12S05-0504QT	NH12S05-1004QT	NH12S05-1504QT	NH12S05-2504QT	NH12S05-0104GC
	4.6	NH12S05-0346WT	NH12S05-0546WT	NH12S05-1046WT	NH12S05-1546WT	NH12S05-2546WT	NH12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

YMC-Pack TMS (C1)

Phase dimension	Column ID [mm]	Column length [mm]					Guard cartridges* with 10 mm length [pack of 5]
		30 (WT) / 33 (QT)	50	100	150	250	
12 nm 3 µm	2.1	TM12S03-H3Q1QT	TM12S03-05Q1QT	TM12S03-10Q1QT	TM12S03-15Q1QT	TM12S03-25Q1QT	TM12S03-01Q1GC
	3.0	TM12S03-H303QT	TM12S03-0503QT	TM12S03-1003QT	TM12S03-1503QT	TM12S03-2503QT	TM12S03-0103GC
	4.0	TM12S03-H304QT	TM12S03-0504QT	TM12S03-1004QT	TM12S03-1504QT	TM12S03-2504QT	TM12S03-0104GC
	4.6	TM12S03-0346WT	TM12S03-0546WT	TM12S03-1046WT	TM12S03-1546WT	TM12S03-2546WT	TM12S03-0104GC
12 nm 5 µm	2.1	TM12S05-H3Q1QT	TM12S05-05Q1QT	TM12S05-10Q1QT	TM12S05-15Q1QT	TM12S05-25Q1QT	TM12S05-01Q1GC
	3.0	TM12S05-H303QT	TM12S05-0503QT	TM12S05-1003QT	TM12S05-1503QT	TM12S05-2503QT	TM12S05-0103GC
	4.0	TM12S05-H304QT	TM12S05-0504QT	TM12S05-1004QT	TM12S05-1504QT	TM12S05-2504QT	TM12S05-0104GC
	4.6	TM12S05-0346WT	TM12S05-0546WT	TM12S05-1046WT	TM12S05-1546WT	TM12S05-2546WT	TM12S05-0104GC

*Guard cartridge holder required, part no. XPGCH-Q1

For other dimensions please refer to page 386-387