Dr. Maisch GmbH

High Performance LC • HPLC-Columns and more

CONTENT

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chiraPedia

The free chiral database by Dr. Maisch

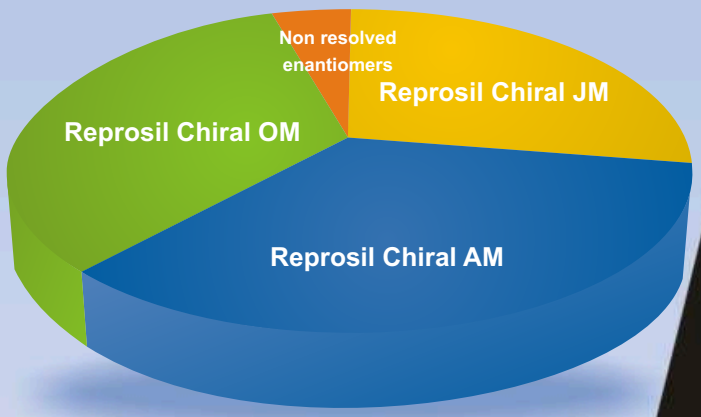
CHIRAL COLUMNS MADE BY DR. MAISCH

MORE THAN 90% OF SEPARATIONS

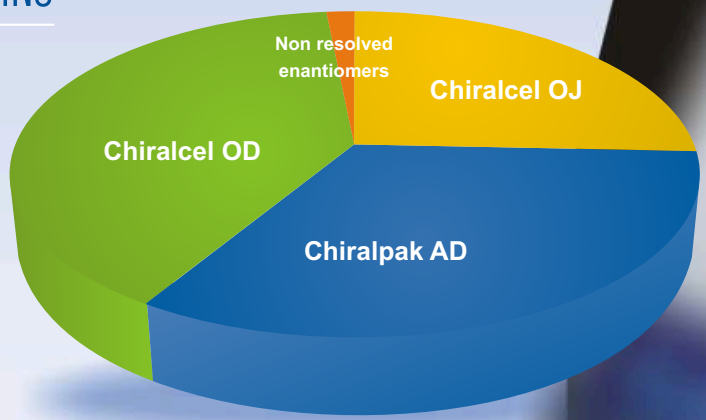
Reprosil chiral columns are complementary and successful in achieving more than 90% of separations of the solute set.

Reprosil Chiral JM and OM allow performing rather equivalent performances compared to their original homologous CSP's.
Only Reprosil Chiral AM shows a lower number of successful separations than Chiralpak AD (similarly to all other AD clones). Reprosil Chiral CM does not resolve the 8% of non - separated enantiomers but is rather redundant to the other three for this particular solute set.

REPROSIL CHIRAL COLUMNS



DAICEL CHIRAL COLUMNS



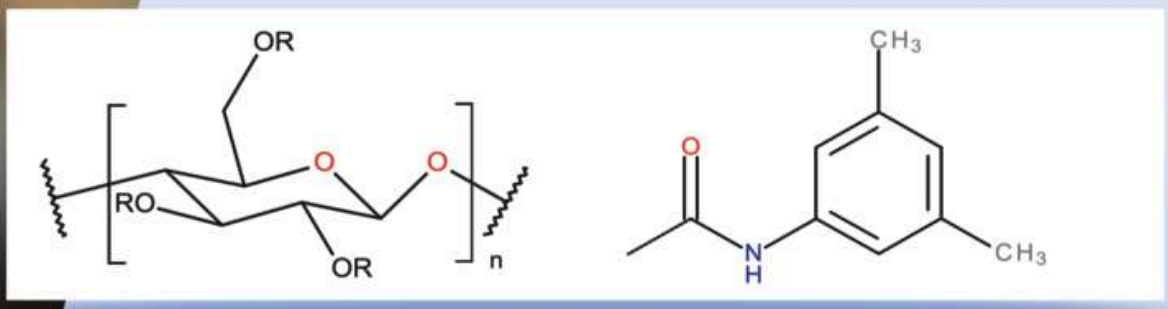
EVALUATION OF REPROSIL CHIRAL OM vs. OD

Evaluation of a silica phase modified with cellulose tris-(3,5-dimethylphenyl-carbamate) "Reprosil Chiral-OM" in supercritical fluid chromatography.
Syame Khater and Caroline West, University of Orleans, CNRS UMR 7311, ICOA

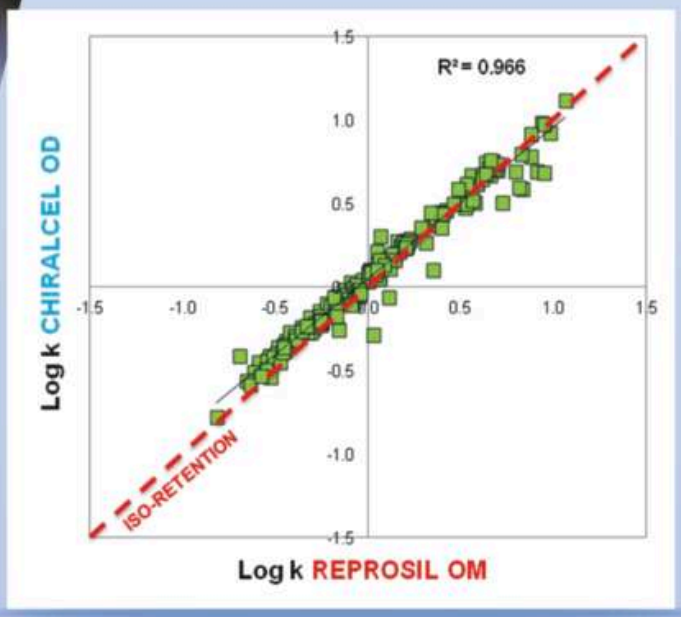
EXPERIMENTAL

All experiments were performed on a Jasco SFC system and an Acquity UPC² system. Reprosil Chiral-OM is based on silica coated with tris-(3,5-dimethylphenylcarbamate) of cellulose. Two hundred and thirty achiral compounds and one hundred and thirty chiral racemic compounds were screened on different polysaccharide-type chiral stationary phases in SFC in the following operating conditions:
CO_2/MeOH (90:10), flow rate 3 ml/min, oven temperature 25°C, outlet pressure 150 bars.

NON-SPECIFIC INTERACTIONS AND RETENTION

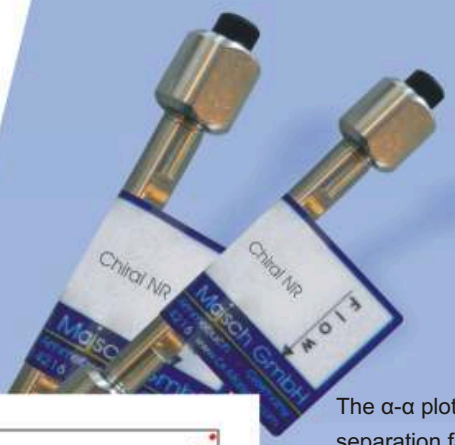


Retention on cellulose tris-(3,5-dimethylphenylcarbamate) could be explained by non-specific interactions such as π-π interactions, hydrogen bonding and stereo-induced interactions.

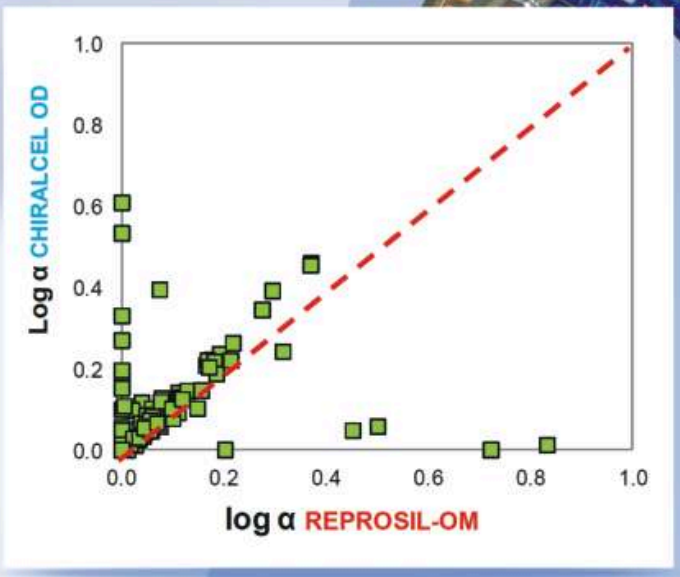


The investigation on non-specific interactions that control retention is based on the analysis of 230 achiral compounds.
The κ-κ plot on the left compares the logarithms of retention factors of 168 achiral species on Chiralcel OD vs. Reprosil Chiral-OM. The phases are expected to be similar since they possess the same chiral selector (R^2 =0.966). They would provide similar non-specific interactions.

Independent Chiral-SFC study by Syame Khater and Caroline West, University of Orleans



PERFORMANCE

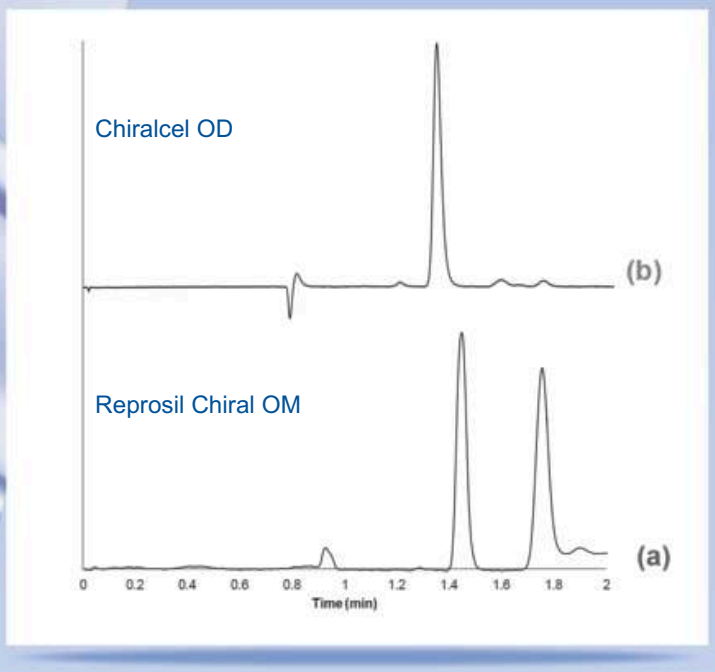


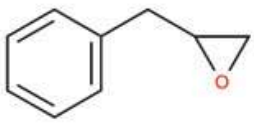
The α-α plot below compares the logarithm of separation factors measured for 130 racemates on Reprosil Chiral-OM vs. Chiralcel OD.
The major part of the compounds is located on the dotted line, indicating similar separation behaviour of the two columns.
Chiralcel OD provides a higher number of unique hits. Indeed, 81% of the tested chiral species are resolved on Reprosil Chiral-OM against 86% on Chiralcel OD. However, some racemates are well separated on Reprosil chiral-OM with little or no separation on Chiralcel OD.

APPLICATIONS

The following chromatograms illustrate the complementary of the generic phases having cellulose tris-(3,5-dimethylphenyl-carbamate) as chiral selector in the course of method development
a) Focus on Reprosil Chiral-OM versus Chiralcel OD

The chromatograms illustrate the chiral compounds that are well resolved on Reprosil Chiral-OM (a) but have no separation on Chiralcel OD.

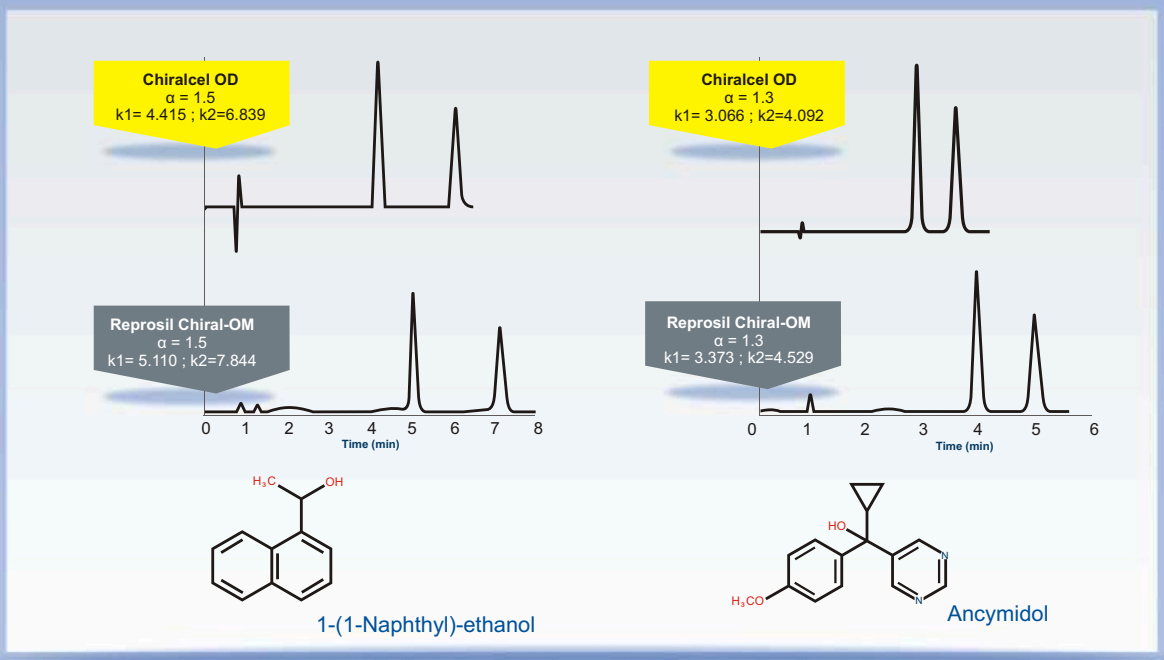


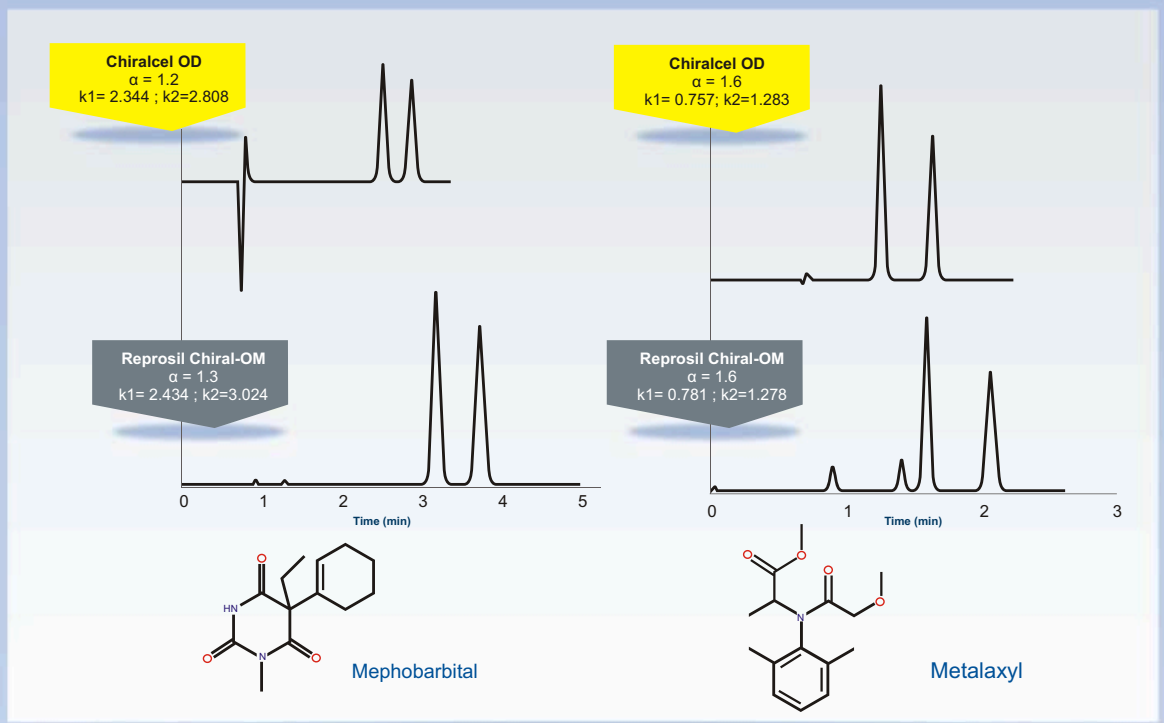


(2,3-epoxypropyl)-benzene

IDENTICAL SELECTIVITY

COMPARISON OF REPROSIL CHIRAL OM AND CHIRACEL ODH





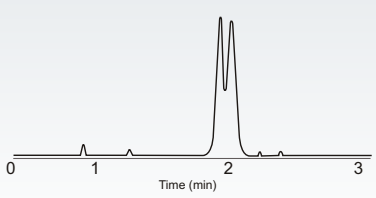
Independent Chiral-SFC study by Syame Khater and Caroline West, University of Orleans

COMPARISON OF USP-L40 CHIRAL COLUMNS

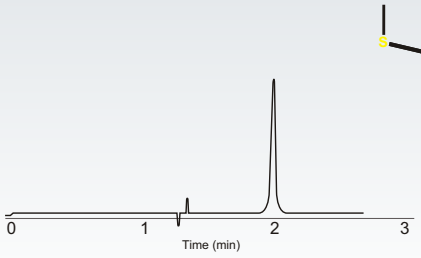
The analysis of fenamiphos, gluthetimide and 5-methyl-5-phenylhydantoin on Reprosil Chiral-OM (left-hand chromatogram) provide a better starting point for a method development than those on RegisCell, Lux Cellulose-1 or Cellucoat, respectively (right-hand chromatogram).

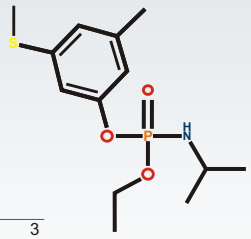
› SEPARATION

› NO SEPARATION

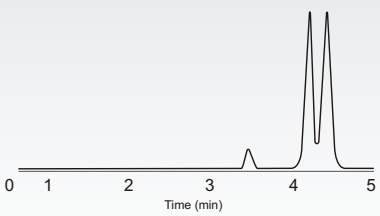


Reprosil Chiral-OM vs. RegisCell

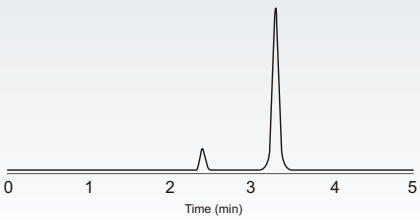


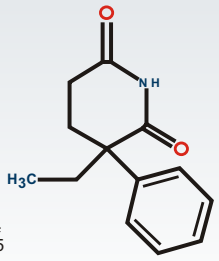


Fenamiphos

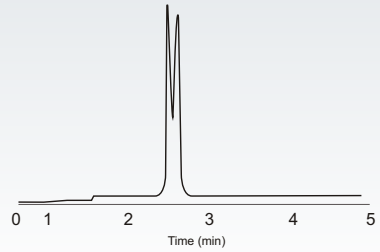


Reprosil Chiral-OM vs. Lux Cellulose-1

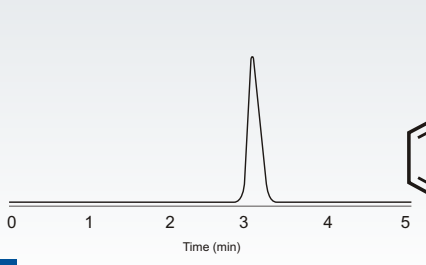


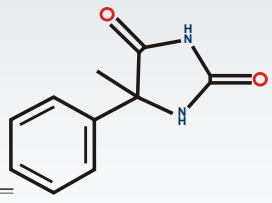


Gluthetimide



Reprosil Chiral-OM vs. CelluCoat





5-Methyl-5-phenylhydantoin

REPROSIL CHIRAL-AM (USP-L51)

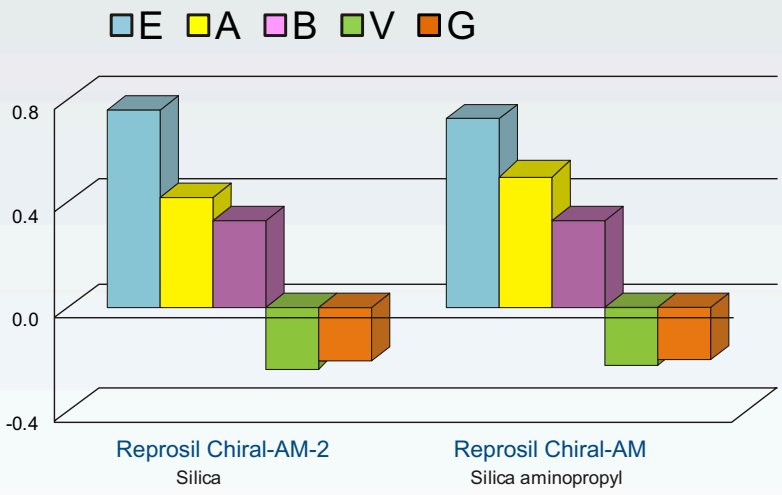
QUESTION:

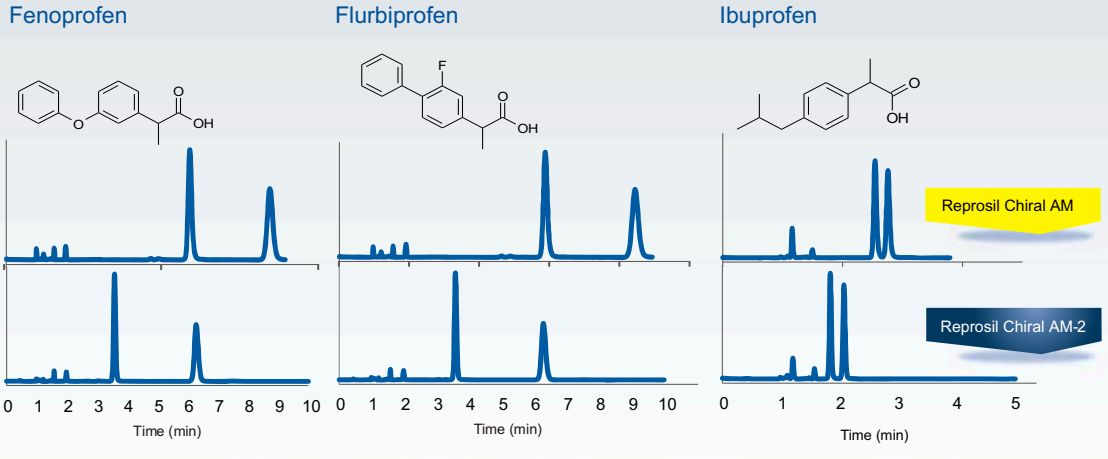
Does the nature of silica treatment affect the retention ability?

ANSWER:

The interactions with hydrogen donor (a coefficient in yellow) are significantly lower on AM-2. Interactions with acids are thus lower.

The analysis of 3 nonsteroidal anti-inflammatory drugs (Fenoprofen, Flurbiprofen and Ibuprofen) on AM (upper chromatograms) thus provides higher retention than that on AM-2 (bottom chromatograms)

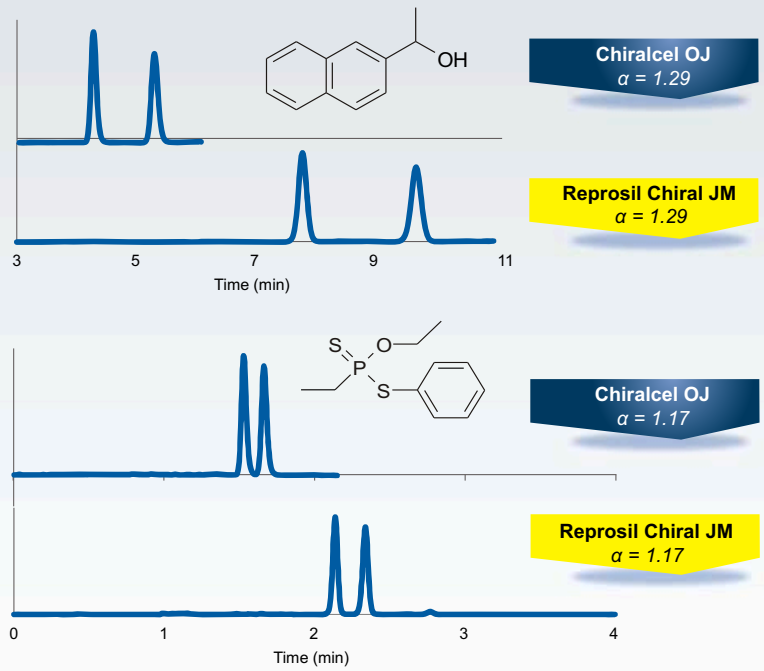


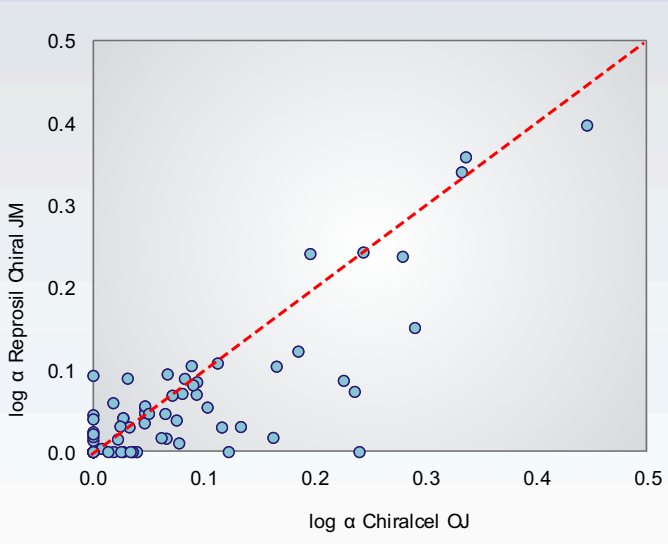


Independent Chiral-SFC study by Syame Khater and Caroline West, University of Orleans

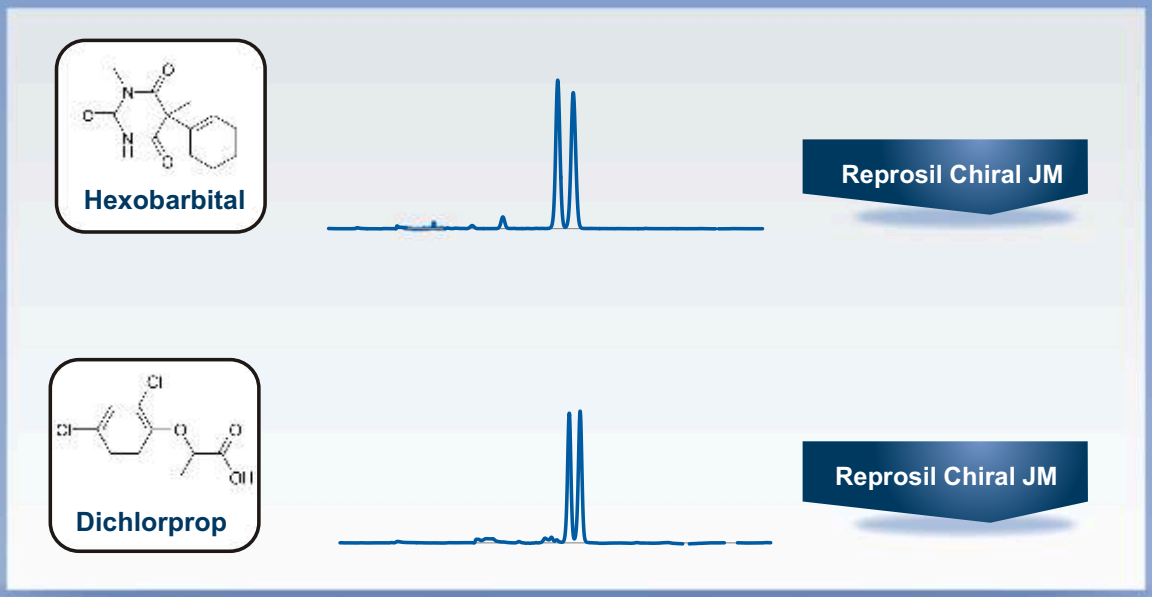
SEPARATION ABILITY OF JM AND OJ (USP-L80)

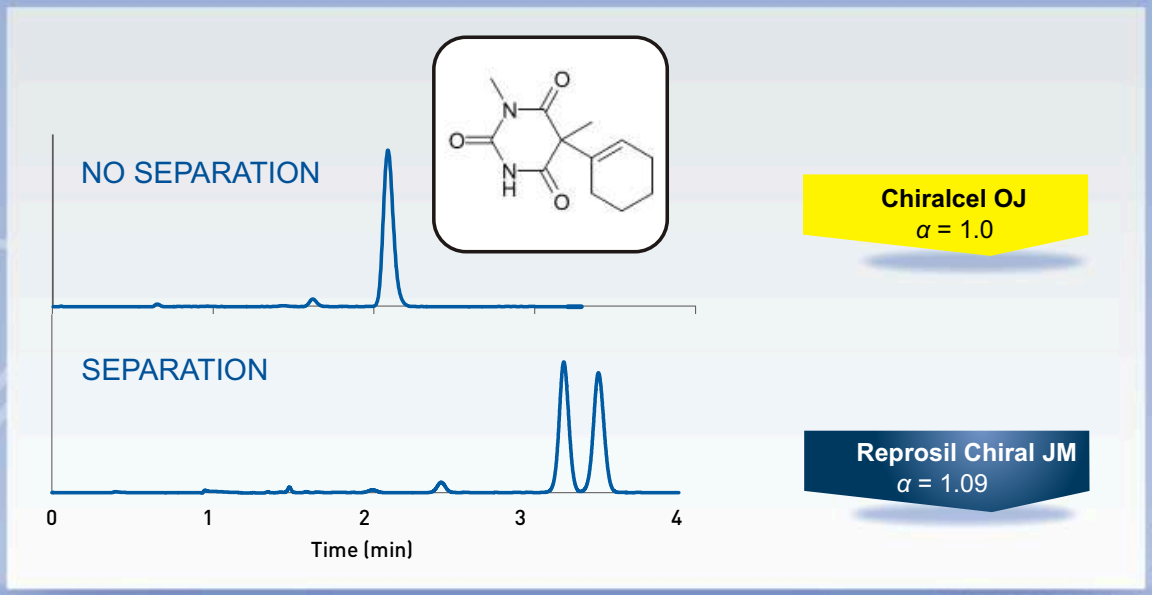
The log α - log α plot compares the separation ability of JM and OJ.
The data points located on the first bisector (red dotted line) show similar separation profiles. The chromatograms of 1-(2-Naphthyl)-ethanol and Fonofos illustrate chiral compounds with identical separation factors on both columns.





The analysis of Hexobarbital on **Reprosil Chiral-JM** provides a better starting point for a method development than those on **Chiral-AM** or **Chiral-OM**.





Independent Chiral-SFC study by Syame Khater and Caroline West, University of Orleans

COMPARISON OF REPROSIL CHIRAL-AM / OM / NR WITH HPLC

Reprosil Chiral-AM and Reprosil Chiral-OM
are new polysaccharide Chiral Stationary Phases. The chiral selectors are Amylose-tris-(3,5-dimethylphenyl-carbamate) for Chiral-AM or Cellulose-tris-(3,5-dimethylphenyl-carbamate) for Chiral-OM. Both selectors are coated with an ultra pure silica with 1000 A° pores.
Reprosil Chiral-AM is equivalent to Chiralpak AD, and Reprosil Chiral-OM is equivalent to Chiralcel OD from Daicel.
Dr. Maisch's company offers them in 2 different CPS versions: Reprosil Chiral-AM and Chiral-OM are designed for separations in normal phase mode, Reprosil Chiral-AM-RP and Chiral-OM-RP for separations in reversed phase mode.
Both Reprosil Chiral-AM and Chiral-OM columns are able to separate neutral, acidic and basic racemates.

Reprosil Chiral-NR
is an immobilized brush-type phase with very broad generality and complementary selectivity to Reprosil Chiral-AM and OM. In many cases it is similar to Reprosil Chiral-AM or Chiral-OM, but much more stable. The Chiral-NR selector is covalently bound, so that you can use all HPLC-eluents. This is similar to the immobilized IA, IB and IC columns.
It is a perfect column for preparative separations.

Eluents:
In Normal Phase mode typical eluents are hexane / IPA or heptane / IPA mixtures.
Basic samples: To prevent peak tailing of basic compounds please add 0.1 – 0.5 % Diethylamine or Triethylamine.
Acidic samples: To prevent peak tailing of acidic compounds please add 0.1 – 0.5 % TFA or acetic acid.
In Reversed phase mode typical eluents are Acetonitrile / Water mixtures. You can use also MeOH or Ethanol instead of Acetonitrile. The water content must be below 85 %.
For basic compounds please use 0,5 – 1 N Perchlorate or 0.1 % TFA. For acidic compounds please use $HClO_4$ / $NaClO_4$ buffers together with ACN
.

Sample preparation / Temperature / Pressure / Guard:
Please dissolve the samples in the eluent. The samples should be filtered. For a longer life span a guard column is recommended. Best temperature range: 0-40 C°. Max. pressure is 150 bar.

Attention:
Please never use with coated (not immobilized) chiral phases the following eluents, which may destroy the columns: Ethers, THF, Dioxane, Dichlormethane, Chloroform, Ketones, Ethylacetate, DMSO, Dimethylformamide (DMF), Dimethylacetamide and 50-100 % IPA.

Comparison of 3 most important chiral columns by Dr. Maisch:

Table 1. Chromatographic properties of the neutral racemates.
Eluent: Heptane / IPA (90/10), Flow: 1 ml/min, Column dimension: 250 x 4.6 mm

Column	ReproSil Chiral-NR	Reprosil Chiral-OM	Reprosil Chiral-AM
Benzoin	a = 2,6 k'1 =2,4 N =7500	a = 1,5 k'1 =2,7 N =6800	a = 1,4 k1 =5,5 N =14000
1,1-Binaphtol	a = n.s. k'1 = 1,2	a =1,2 k'1 = 3,7 N = 2600	a = 1,3 k'1 = 10,0 N = 6200
Trans-Stilbenoxide	a = 3,3 k'1 = 0,78 N = 8900	a = 2,1 k'1 = 0,81 N = 11000	a = 3,0 k'1 = 0,79 N = 12000
1,1-Binaphtol	a = n.s. k'1 = 1,2	a =1,2 k'1 = 3,7 N = 2600	a = 1,3 k'1 = 10,0 N = 6200

Table 2. Chromatographic properties of the basic racemates.
Eluent: Heptane / IPA (90/10) + 0,1 DEA, Flow: 1 ml/min, Column dimension: 250 x 4.6 mm

Column	ReproSil Chiral-NR	Reprosil Chiral-OM	Reprosil Chiral-AM
Bupivacine	a = 1,5 k'1 =5,7 N = 5800	a = 1,15 k'1 =0,6 N = 4600	
Carbinoxamine	a = 1,2 k'1 = 5.0 N = 400	a =1,4 k'1 = 0,7 N = 7500	a = 1,4 k'1 = 1,3 N = 10000
Clenbuterol	a = 1,4 k'1 = 2,1 N = 3800	a = no separation k'1 = 0,7	a = no separation k'1 = 1,9
Ketamine	a = 1,1 k'1 =2.0 N =6200	a = 1,2 k'1 =1,1 N = 6500	a = 1,0 k'1 =1,2
Oxamniquine	a = 1,1 k'1 = 10,6 N = 3100	a = 1,1 k'1 =3,8 N =3100	a = 1,2 k'1 =5,6 N = 10400
Oxprenolol	a = 1,3 k'1 = 2,3 N = 3000	a = 6,3 k'1 = 1,9 N = 3200	a = 1,7 k'1 = 1,1 N = 9000
1-(1-Phenyl)-ethylamine	a = no separation k'1 = 2,2	a = 1,3 k'1 = 1,1 N = 7500	a = no separation k'1 = 0,5
Troeger's base	a = 1,9 k'1 = 1,1 N = 5900	a = 1,3 k'1 = 1,0 N = 6000	a = 1,8 k'1 = 0,8 N = 9000

Table 3. Chromatographic properties of the acidic racemates.
Eluent: Heptane / IPA (90/10) + 0,1 TFA , Flow: 1 ml/min, Column dimension: 250 x 4.6 mm

Column	ReproSil Chiral-NR	Reprosil Chiral-OM	Reprosil Chiral-AM
CBZ-Alanine (210 nm)	a = 1,3 k'1 = 3,2 N = 5700	a = 2,9 k'1 = 2,0 N = 3100	a = 2,1 k'1 = 3,7 N = 9200
Flurbiprofen	a = 1,3 k'1 = 1.0 N = 6900	a =1,1 k'1 = 0,7 N = 6000	a = 1,7 k'1 = 1,2 N = 11600
Sulindac	a = no separation k'1 = 3,0		a = 1,4 k'1 = 1,9 N = 10200
Proglumide Eluent: Heptane/EtOH (9/1)+ 0,1 TFA	a = 1,6 k'1 = 4,3 N = 5900	a = 2,2 k'1 = 0,7 N = 3800	a = 1,8 k'1 = 2,4 N = 5000

Rules of thumb for chiral separation

Reprosil Chiral-NR:

-Sample needs an oxygen at or near the chiral centre + an aromatic ring.
-More predictable.
-Inversion of elution order possible.
-Very high prep. capacity
-Stable in all HPLC-eluents.

Reprosil Chiral-OM:

-High versatile chiral phase.
-No aromatic ring necessary.
-No inversion of elution order possible
-Scale up possible
-Caution: Not stable in all eluents.

Reprosil Chiral-AM:

-Highest generality of all chiral phases.
-No aromatic ring necessary.
-No inversion of elution order possible
-Scale up possible
-Caution: Not stable in all eluents.

(Same prices for 4.6 mm, 4.0 mm, 3.0 mm and 2.0 mm id columns)

Reprosil Chiral-NR
Immobilized brush-type phases, Dinitro-compounds.
π-electron acceptor / π-electron donor phase. Particularly for aromatic compounds with O or N near chiral-centre.
Chiral separations in NP and RP-Modus

with: **5 µm** (PN:r15.nr)	250 x 4.6 mm 150 x 4.6 mm 100 x 4.6 mm
with: **8 µm** (PN:r18.nr), **12 µm** (PN:r112.nr), **15 µm** (PN:r115.nr)	250 x 4.6 mm 150 x 4.6 mm 100 x 4.6 mm 250 x 10 mm 250 x 20 mm

Reprosil Chiral-NR-R Reversed Elution order compared to Reprosil Chiral-NR / Antipode of Chiral-NR

with: **8 µm** (PN:r18.nr), **12 µm,** (PN:r112.nr),	250 x 4.6 mm 150 x 4.6 mm 100 x 4.6 mm 250 x 10 mm 250 x 20 mm

Reprosil Chiral-OM (USP-L40, Cellulose tris-(3.5-dimethylphenyl-carbamate) mod. Silica)

Reprosil Chiral-OM, 3 µm / Reprosil Chiral-OM-R, 3 µm Alternatives to Daicel OD-3 / OD-3R

Reprosil Chiral-OM, 5 µm / Reprosil Chiral-OM-R, 5 µm Alternative to Daicel OD-H / OD-RH

Reprosil Chiral-OM, 10 µm / Reprosil Chiral-OM-R, 10 µm Alternatives to Daicel OD / OD-R

Reprosil Chiral-OM, 20 µm / Reprosil Chiral-OMR, 20 µm Alternative to Daicel OD / OD-R

Reprosil Chiral-AM (USP-L51, Amylose tris-3,5-dimethylphenylcarbamate mod. Silica)

Reprosil Chiral-AM, 3 µm / Reprosil Chiral-AM-R, 3 µm Alternative to Daicel AD-3 / AD-3R

Reprosil Chiral-AM, 5 µm / Reprosil Chiral-AM-R, 5 µm Alternatives to Daicel AD-H / AD-RH

Reprosil Chiral-AM, 10 µm / Reprosil Chiral-AM-R, 10 µm Alternatives to Daicel AD / AD-R

Reprosil Chiral-AM, 20 µm / Reprosil Chiral-AM-R, 20 µm Alternatives to Daicel AD / AD-R

Reprosil Chiral-AMS	**(**Amylose tris-(S)-α-Methylbenzyl-Carbamate mod. Silica)	
Reprosil Chiral-AMS, 3 µm / Reprosil Chiral-AMS-R, 3 µm		Alternatives to Daicel AS-3 / AS-3R
Reprosil Chiral-AMS, 5 µm / Reprosil Chiral-AMS-R, 5 µm		Alternatives to Daicel AS-H / AS-RH
Reprosil Chiral-AMS, 10 µm / Reprosil Chiral-AMS-R, 10 µm		Alternatives to Daicel AS / AS-R

Reprosil Chiral-CM	USP-L70 (Tris-(Phenylcarbamate)-Cellulose mod. Silica)	
Reprosil Chiral-CM, 3 µm,	(Alternative to Daicel OC-3)	(PN:r63.cm)
Reprosil Chiral-CM, 5 µm,	Alternative to Daicel OC-H	(PN:r65.cm)
Reprosil Chiral-CM, 10 µm,	(Alternative to Daicel OC)	(PN:r60.cm)

Reprosil Chiral-JM	USP-L80 (Tris-(4-Methylbenzoyl)-Cellulose mod. Silica)	
Reprosil Chiral-JM, 3 µm, (or Reprosil Chiral-JM-R)	Alternative to Daicel OJ-3 / OJ-3R	(PN:r63.jm)
Reprosil Chiral-JM, 5 µm, (or Reprosil Chiral-JM-R)	Alternative to Daicel OJ-H / OJ-HR	(PN:r65.jm)
Reprosil Chiral-JM, 10 µm, (or Reprosil Chiral-JM-R)	Alternative to Daicel OJ / OJR	(PN:r60.jm)

Reprosil Chiral- ZM	(Cellulose tris-3-Chloro-4-Methylphenylcarbamate mod. Silica)	
Reprosil Chiral-ZM, 3 µm, (or Reprosil Chiral-ZM-R)	Alternative to Daicel OZ-3 / OZ-3H	(PN:r63.zm)
Reprosil Chiral-ZM, 5 µm, (or Reprosil Chiral-ZM-R)	Alternative to Daicel OZ-H	(PN:r65.zm)

Reprosil Chiral-ZA	(Amylose tris-3-Chloro-4-Methylphenylcarbamate mod. Silica)	
Reprosil Chiral-ZA, 3 µm, (or Reprosil Chiral-ZA-R)	Alternative to Daicel AZ-3 / AZ-3R	(PN:r63.za)
Reprosil Chiral-ZA, 5 µm, (or Reprosil Chiral-ZA-R)	Alternative to Daicel AZ-H /AZ-HR	(PN:r65.za)

Reprosil Chiral-YM	(Amylose tris-5-Chloro-2-Methylphenylcarbamate mod. Silica)	
Reprosil Chiral-YM, 3 µm, (or Reprosil Chiral-YM-R)	Alternatives to Daicel AY-3 / AY-3R	(PN:r63.ym)

REPROSIL-CHIRAL

Reprosil Chiral-BM (Tris-(Benzoyl)-Cellulose mod. Silica)

Reprosil Chiral-BM, 5 µm / Reprosil Chiral-BM-R Alternatives to Daicel OB-H / OB-RH

Reprosil Chiral-BM, 10 µm / Reprosil Chiral-BM-R Alternatives to Daicel OB / OB-R

Other Chiral Phases

Reprosil Chiral-PS, 8 µm, Chiral separations in NP and RP-Modus
(for aromatic compounds with S or P, for example: Sulfoxides, Phosphine Oxides, Phosphonates, Thiophosphine Oxides, Phosphine Selenides, Phosphine Boranes)
(PN:r18.ps) 250 x 4.0 mm

Reprosil Chiral-OH, 8 µm, Chiral separations in NP-Modus
(Aromatic Alcohols with OH near chiral centre, Aryl Carbinols)
(PN:r18.oh) 250 x 4.0 mm

Reprosil Chiral-AA, 8 µm, Chiral separations in NP and RP-Modus
(for all amino acids, L-form elutes first)
(PN:r18.aa) 250 x 4.0 mm

Reprosil Chiral-TAG, 8 µm Chiral separations in NP and RP-Modus
(Teicoplanin Aglycon: for Aminoalkohols, N-blocked amino acids, a-Hydroxy Acids, Oxazolidinons, Hydantoins, Imides, Amino Acids) USP-L63
(PN:r18.tag) 250 x 4.0 mm

Reprosil Chiral-Beta-CD, 5 µm USP-L45 (Dansyl-Aminoacids, Barbiturates, Propranolol Sulfonamide, Prostaglandines) (r15.bcd.s2504)
(PN:r15.bcd.s2504) 250 x 4 mm

Reprosil Chiral-Gamma-CD, 5 µm (PN:r15.gcd.s2504) 250 x 4 mm

Reprosil Chiral-D-PhenylGlycin, 5µm USP-L36, N-(3,5-Dinitrobenzoyl)-D-Phenylglycin.
(Herbicides + Pharmaca (Alcohols, Carbon. acids , Esters, Sulfoxides) Fenoprop-Methyl, Mecoprop-Methyl, Supidimid)
(PN:r15.DPG.s2504) 250 x 4 mm:
250 x 10 mm:
250 x 20 mm:

Reprosil Chiral-L-PhenylGlycin, 5µm USP-L36, N-(3,5-Dinitrobenzoyl)-L-Phenylglycin.
Antipode to D-PhenylGlycin
(Herbicides + Pharmaca (Alkohols, Carbon. Acids , Esters, Sulfoxides) Fenoprop-Methyl, Mecoprop-Methyl, Supidimid)
(PN:r15.LPG.s2504) 250 x 4 mm

Reprosil Chiral-L-Leucin, 5 µm N-(3,5-Dinitrobenzoyl)-L-Leucin,
(PN:r15.LL.s2546) 250 x 4.6 mm

Reprosil Chiral-L-Prolin, 5 µm Davankov-Ligand exchange, Aminoacids, Hydantoine, Succinimide, Gluthetimide, Barbiturate, Sulfoxide
(PN:r15.pr.s2504) 250 x 4 mm

Reprosil L-Hydroxy-Prolin, 5 µm	Alternative to Nucleosil Chiral-1, USP-L32 Ligand exchange, Eluent: 2-10 mM Coppersulfate , 20-60 C° (For DL-Atrolactinacid, DL-Mandelic acids, DL-Lactic acid, DL-Asparagin, DL-Serin, DL-Phenylalanin, DL-Threonin, DL-Prolin, DL-Histidin, DL-Valin, DL-Tyrosin, DL-Tryptophan), (PN:r15.hp.s2504) 250 x 4mm

Reprosil Chiral-AGP, 5 µm (300 A° Silicagel with chiral AGP–Protein, USP-L41)

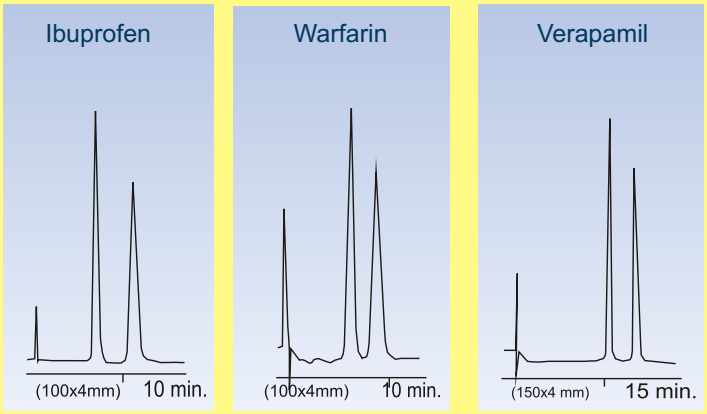
100 x 4 mm (PN: r35.agp.s1004)
150 x 3 mm (PN: r35.agp.s1503)
Guards: 5 x 3 mm: 2 pieces (PN:r35.agp.v0003)
Guard-holder, direct (PN:81.00)

100 x 3 mm (PN: r35.agp.s1003)
50 x 3 mm (PN: r35.agp.s0503)

150 x 2 mm (PN:r35.agp.s1502)
50 x 2 mm (PN:r35.agp.s0502
Guards: 5 x 2 mm: 2 pieces (PN:r35.agp.v0002)
Guard-holder, direct (PN:91.00)

100 x 2 mm (PN:r35.agp.s1002)

Chiral separation of Ibuprofen, Warfarin and Verapamil



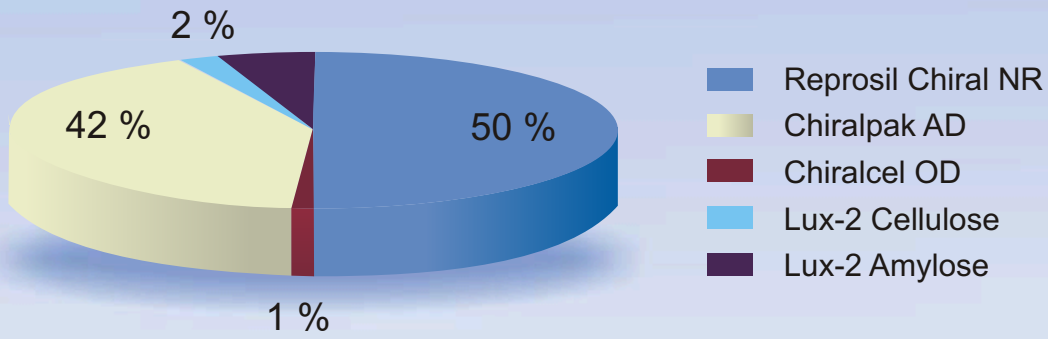
Reprosil Chiral-AGP, 5 µm

Eluents:
Ibuprofen
100 mM Na-phosphate buffer, pH7

Warfarin
10% -Propanol in 10 mM Na-phosphate buffer, pH7

Verapamil
12% ACN in 10 mM Na-phosphate buffer, pH7

CHIRAL PREPARATIVE SEPARATIONS WITH HPLC BY HOFFMANN-LA ROCHE, BASEL IN 2014.



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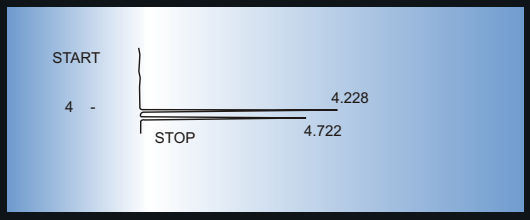
High Performance LC • HPLC-Columns and more

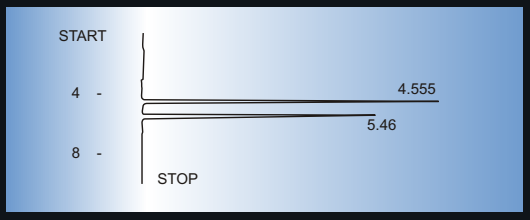
Comparison of chiral phases:

Column dimensions: 250 x 4.6 mm, Flow: 1 ml / min, Temperature: ambient, Eluent: n-Heptane / Isopropanol (85/15), Sample: Trans-Stilbene-Oxide

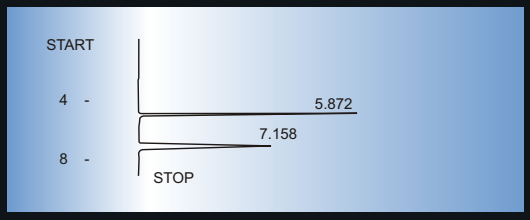
Reprosil Chiral-AMS, 5 µm
Alfa-value: 1.35
Typ. N/m: 70 – 80 000



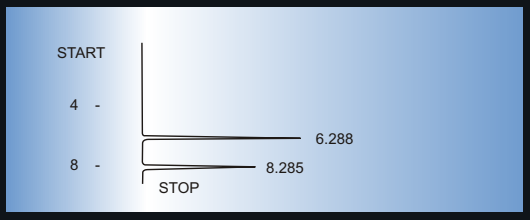
Reprosil Chiral-ZA, 5 µm
Alfa-value: 1.5
Typ. N/m: 70 - 80 000



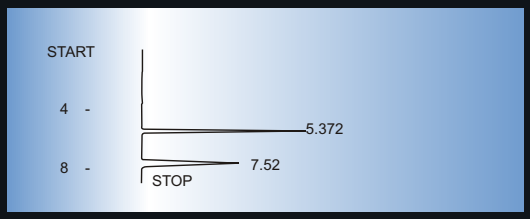
Reprosil Chiral-OM, 5 µm
Alfa-value: 2.0
Typ. N/m: 60 -80 000



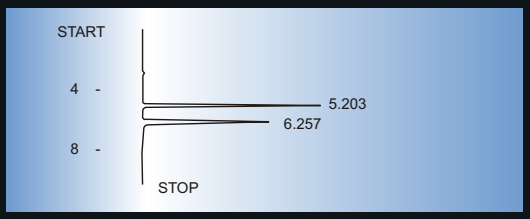
Reprosil Chiral-JM, 5 µm
Alfa-value: 1.6
Typ. N/m: 70 -80 000



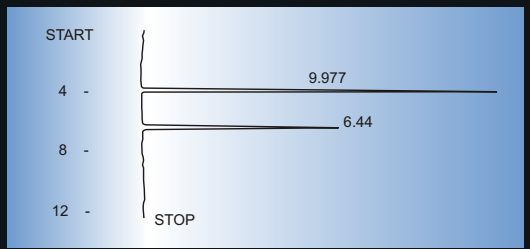
Reprosil Chiral-YM, 5 µm
Alfa-value: 1.8
Typ. N/m: 40 - 55 000



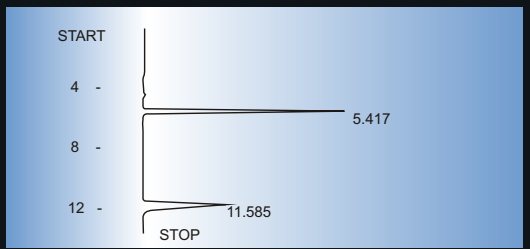
Reprosil Chiral-CM, 5 µm
Alfa-value: 1.4
Typ. N/m: 40 – 55 000



Reprosil Chiral-ZM, 5 µm
Alfa-value: 3.0
Typ. N/m: 50 - 70 000



Reprosil Chiral-NR, 8 µm
Alfa-value: 3.3
Typ. N/m: 25 - 35 000



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