Introduction

This catalogue describes the chromatography products and services that CHIRAL TECHNOLOGIES EUROPE offers to our European customers, in support of their activities to develop and manufacture chiral pharmaceuticals.

CHIRAL TECHNOLOGIES EUROPE was established in 1996 by DAICEL CHEMICAL INDUSTRIES, LTD., as a wholly-owned subsidiary with the aim of developing a global business based on chiral chromatography products and preparative separation services.
Since 1996, the demand for chiral columns, bulk chiral stationary phases (CSPs) and outsourcing services to obtain pure enantiomers via chromatography has increased significantly.

To match this growing demand, the sites in the three major world areas, DAICEL CHEMICAL INDUSTRIES, LTD. in Japan (Arai), CHIRAL TECHNOLOGIES INC. in the U.S.A (Exton) and CHIRAL TECHNOLOGIES EUROPE in France (Illkirch), have had to adapt their capacity not only in terms of resources but also in terms of facilities.

Our DAICEL chiral stationary phases for chromatography, based on polysaccharide derivatives as the chiral selector, have now become the industry standard for HPLC and SFC chiral resolution. DAICEL together with CHIRAL TECHNOLOGIES recently expanded this product line to include both coated and immobilized polysaccharides on silica gel.

The range of products and services offered by CHIRAL TECHNOLOGIES EUROPE includes the DAICEL chiral columns, bulk chiral stationary phases products plus three distinct support services :
- Technical assistance for customer applications.
- Development of optimal chromatography methods for both analytical and preparative applications.
- Outsourcing services for isolation and purification of enantiomers using SMB and batch HPLC or SFC chromatography systems, in accordance with current Good Manufacturing Practice where necessary.

CHIRAL TECHNOLOGIES EUROPE will provide the technology and the expertise to give you the fast, reliable and accomplished method to obtain a pure end result.

If you need to analyse or to separate chiral compounds ...

Chromatography Products

CHIRAL TECHNOLOGIES EUROPE markets DAICEL chiral chromatography products, identified by the registered trademarks CHIRALCEL®, CHIRALPAK® and CROWNPAK®. The columns are available directly from us in a range of sizes. They are supplied for applications ranging from analytical methods and quality control to preparative scale separations.
Using DAICEL chiral stationary phases, more than 90% of all racemic samples can be resolved when analysed in our application laboratory. Extensive data collected over many years of application research have shown that our four most versatile columns CHIRALPAK®AD, CHIRALCEL®OD, CHIRALPAK®AS and CHIRALCEL®OJ, are able to resolve more than 80% of chiral compounds. Their outstanding capabilities will provide you with a powerful and unique tool.

Semi-preparative and preparative columns are increasingly being used by the discovery and chemical development groups of our pharmaceutical industry customers. Predominantly with HPLC equipment but also increasingly on SFC systems. Our product line also includes higher pressure rated columns for SFC applications.

Bulk chiral stationary phases for production purposes are also available from CHIRAL TECHNOLOGIES EUROPE. Their excellent batch to batch reproducibility ensures their suitability for routine production.
All DAICEL chromatography phases are based on patented technologies and are manufactured in a cGMP facility.
For a detailed description of the products sold by CHIRAL TECHNOLOGIES EUROPE please refer to this catalogue.

DAICEL chiral columns are the most widely used and referenced chiral chromatography products in the world. Due to their broad selectivity, good durability and especially high loading capacity, DAICEL chiral stationary phases have become the leading chromatography products for enantiomeric analysis and chiral separations.

Technical Support

Our Technical Support Team will assist you with your questions related to the use of our analytical columns, preparative separations using semi-preparative and preparative columns and issues associated with bulk CSPs for large scale applications.

- Send an e-mail to support@chiral.fr for rapid response in all areas of chiral chromatography.
- Call us at 00 33 (0)3 88 79 52 00 for emergency requests for Technical Support.
- Look at our Frequently Asked Questions (FAQs) session on our website at www.chiral.fr to reflect the most immediate concerns of our users.
- Ask for our upgradable Application Guide which contains over 400 applications carried out mainly on the most recent DAICEL columns. This can be obtained by addressing your request to support@chiral.fr.
- Seminars and training adapted to each customer's needs can also be organized.

Technical Support is an integral component of the mission of CHIRAL TECHNOLOGIES EUROPE.

Custom Preparative Separation Services

CHIRAL TECHNOLOGIES EUROPE provides a Custom Separation Service for companies involved in the development of chiral pharmaceutical compounds. This service can assist in the rapid preparation and purification of chiral compounds from milligram to tonne scale.
Our facility is equipped with Preparative HPLC, Preparative SFC and SMB systems, and our staff provides high yield and high purity resolutions of single enantiomers.
Production scale methods are developed in our facility at CHIRAL TECHNOLOGIES EUROPE. Method development begins with a complete screening on the DAICEL preparative chiral stationary phases, followed by scale-up studies.

Customers will have access to the combined strengths of chiral chromatography and DAICEL polysaccharide-derived supports.
These chiral supports are the most widely used in preparative applications for the resolution of enantiomers by chromatography. In addition, chiral chromatography is the fastest, most expedient process to obtain individual enantiomers of chiral compounds.

The chiral stationary phase is the key to achieving lower cost in a chiral separation at a large scale.

DAICEL CHEMICAL INDUSTRIES, LTD.

DAICEL CHEMICAL INDUSTRIES, LTD. is a speciality chemical company with its headquarters in Japan. DAICEL's major products include organic chemicals, cellulose derivatives, functional products, plastics, aerospace and defence systems.
The business unit, at DAICEL, responsible for the production of the chiral chromatography products and related services is the Chiral Pharmaceuticals Ingredients Company (CPI Company).
In addition, this unit offers extensive capabilities in biotransformation and a complementary range of specialized pharmaceutical chemicals from the DAICEL portfolio that brings value to our customers.

CHIRAL TECHNOLOGIES EUROPE in France and CHIRAL TECHNOLOGIES INC. in the U.S.A are wholly-owned subsidiaries of DAICEL.

… you need to talk to
CHIRAL TECHNOLOGIES EUROPE

CHIRALPAK® IA and CHIRALPAK® IB
DAICEL Immobilized Polysaccharide-derived Chiral Stationary Phases

Product description

These chiral stationary phases are made with a silica support onto which the polymeric chiral selector (polysaccharide derivatives) has been immobilized.

The immobilization of polysaccharide derivatives on a matrix has been considered as an evolutionary approach to implement universal solvent compatibility on these highly selective chiral stationary phases for enantioseparations.
This broadens the range of solvents to be used as mobile phases, thereby introducing new selectivity profiles and beneficial CSP characteristics.
In this context, DAICEL CHEMICAL INDUSTRIES, LTD. has expended its product line from the originally coated CSPs to the immobilized ones using proprietary immobilization technologies.

CHIRALPAK® IA and CHIRALPAK® IB are the first immobilized CSPs from DAICEL to become commercially available. Their unique solvent flexibility and excellent chiral recognition ability make CHIRALPAK® IA and CHIRALPAK® IB an ideal choice for chiral separations.

CHIRALPAK® IA and CHIRALPAK® IB offer:

- High solvent versatility in the selection of the mobile phase composition.
- Solvent flexibility for the resolution of compounds with limited solubility.
- High selectivity and broad application domain in the resolution of enantiomers.
- Robustness and extended durability.
- Excellent column efficiency.
- Easy use of the column.

Mobile phase recommendation

The major advantage of an immobilized polysaccharide CSP is that it can be used with any organic miscible solvent combination in the mobile phase.
This flexibility not only broadens the choice of mobile phase compositions, but also the type of solvents that can be used for sample injection in order to enhance the solubility.

Based on our extensive experience the most commonly used chromatographic solvents and their mixtures can be classified in two groups in terms of enantioselectivity.
The mixtures containing solvents of the first group usually lead to better enantioselectivities, although the separation ability of the chiral support may be different depending on the sample.
The solvent that gives the highest solubility of your sample should be the first choice when this is a limiting factor.

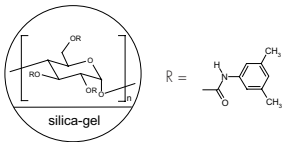
	Group - 1	Group - 2
CHIRALPAK® IA	Alcohols THF MtBE CH_2Cl_2	Ethyl acetate Acetonitrile $CHCl_3$ 1,4-Dioxane Acetone Toluene
CHIRALPAK® IB	$CHCl_3$ Ethyl acetate THF MtBE Alcohols in alkane	Toluene CH_2Cl_2 Acetone 1,4-Dioxane Acetonitrile

For basic or acidic samples, it is necessary to incorporate an additive into the mobile phase in order to optimize the chiral separation. Extreme pH values must be avoided as they can damage the silica gel used in these columns.
Please refer to the column instruction manual **specific to each stationary phase** for mobile phase additives, method development and optimization.

Analytical and Semi-Preparative Columns for HPLC

CHIRALPAK® IA

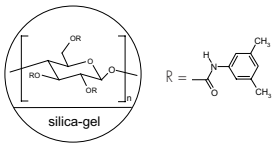
Amylose tris (3,5-dimethylphenylcarbamate) immobilized on a 5µm silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
80311	CHIRALPAK® IA	Guard cartridge (x3)	4.0	10	5
80324	CHIRALPAK® IA	Analytical	4.6	150	5
80325	CHIRALPAK® IA	Analytical	4.6	250	5
80394	CHIRALPAK® IA	Microbore	2.1	150	5
80337	CHIRALPAK® IA	Semi-Prep. Guard	10	20	5
80335	CHIRALPAK® IA	Semi-Prep.	10	250	5
80345	CHIRALPAK® IA	Semi-Prep.	20	250	5

CHIRALPAK® IB

Cellulose tris (3,5-dimethylphenylcarbamate) immobilized on a 5µm silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
81311	CHIRALPAK® IB	Guard cartridge (x3)	4.0	10	5
81324	CHIRALPAK® IB	Analytical	4.6	150	5
81325	CHIRALPAK® IB	Analytical	4.6	250	5
81394	CHIRALPAK® IB	Microbore	2.1	150	5
81337	CHIRALPAK® IB	Semi-Prep. Guard	10	20	5
81335	CHIRALPAK® IB	Semi-Prep.	10	250	5
81345	CHIRALPAK® IB	Semi-Prep.	20	250	5

CHIRALPAK® IA and CHIRALPAK® IB, the revolutionary generation of Immobilized chiral stationary phases compatible with all ranges of organic miscible solvents.

Give your chiral separations a new dimension.

Our Application guide offers a selection of applications carried out mainly on the more recent DAICEL columns.
Further applications may be added in the future by down-loading from our website www.chiral.fr.

CHIRALPAK® and CHIRALCEL®
DAICEL Polysaccharide-derived Normal Phase Chiral Stationary Phases

Product description

DAICEL coated polysaccharide chiral stationary phases are made with a spherical high quality silica support(*) onto which the polymeric chiral selector (amylose or cellulose derivatives) is physically coated. Due to the coated nature of these chiral supports, solvents should be carefully selected.

(*) except for CHIRALCEL® CA-1 CSP.

Analytical and Semi-preparative columns are available with 5 and 10 micron particle sizes. The 5 micron columns (-H series) offer higher resolution for use in more demanding applications than the traditional 10 micron columns.

Mobile phase recommendation :

Standard conditions for DAICEL coated polysaccharide CSPs are Hexane (Heptane)/Alcohol solvent mixtures. However polar solvents like Ethanol, Methanol and Acetonitrile are tolerated by some of them (see table below). The use of these CSPs in such solvents **requires cautious handling :**

- All transitions from one solvent system to another should be made **via 2-Propanol** to avoid any dangerous solvent mixtures which may damage the chiral support.
- Nevertheless, once the column is transferred to a polar mode, we highly recommend to dedicate it to this specific application to avoid any reproducibility problems between standard and polar modes.

Standard solvent mixtures

Hexane / 2-propanol	Columns	Hexane / Ethanol	Columns
100 : 0 to 0 : 100	CHIRALPAK® AD(-H), AS(-H) CHIRALCEL® OA, OB(-H), OC, OD(-H), OJ(-H), OK	100 : 0 to 0 : 100	CHIRALPAK® AD-H, AS(-H) CHIRALCEL® OA, OB(-H), OC, OD(-H), OJ(-H), OK
100 : 0 to 50 : 50	CHIRALCEL® OF, OG	100 : 0 to 80 : 20	CHIRALCEL® OF, OG
		100 : 0 to 85 : 15 and 40 : 60 to 0 : 100	CHIRALPAK® AD

Polar solvents

Methanol Ethanol Pure or combined	CHIRALPAK® AD(-H), AS(-H) CHIRALCEL® OD(-H), OJ(-H),	Acetonitrile Pure or combined with alcohols	CHIRALPAK® AD(-H), AS(-H) CHIRALCEL® OD(-H), OJ(-H),

For basic or acidic samples, it is necessary to incorporate an additive into the mobile phase in order to optimize the chiral separation.
Please refer to the column instruction manual **specific to each stationary phase for mobile phase additives and solvent compatibility.**

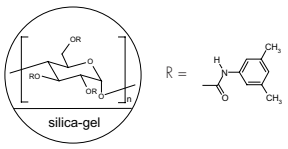
The following solvents should **NEVER** be used even for sample preparation :
DMF, DMSO, Dioxane, Toluene, THF, chloroform, methylene chloride, acetone, ethyl acetate.
These solvents are known to modify or remove the chiral selector from the column damaging irreversibly the chiral stationary phase.

Amylose-derived Chiral Stationary Phases
Analytical and Semi-Preparative Columns for HPLC and SFC

CHIRALPAK® AD-H / High Performance
CHIRALPAK® AD

Amylose tris (3,5-dimethylphenylcarbamate) coated on a silica support

CHIRALPAK® analytical columns can be used with HPLC and SFC systems.
In semi-prep, the high system pressure required to keep CO_2 liquid dictates the use of more robust column hardware.



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
19311	CHIRALPAK® AD-H	Guard cartridge (x3)	4.0	10	5
19324	CHIRALPAK® AD-H	Analytical	4.6	150	5
19325	CHIRALPAK® AD-H	Analytical	4.6	250	5
19394	CHIRALPAK® AD-H	Microbore	2.1	150	5
19337	CHIRALPAK® AD-H	Semi-Prep. Guard	10	20	5
19335	CHIRALPAK® AD-H	Semi-Prep.	10	250	5
19345	CHIRALPAK® AD-H	Semi-Prep.	20	250	5
19025	CHIRALPAK® AD	Analytical	4.6	250	10
19094	CHIRALPAK® AD	Microbore	2.1	150	10
19032	CHIRALPAK® AD	Semi-Prep. Guard	10	50	10
19035	CHIRALPAK® AD	Semi-Prep.	10	250	10
19042	CHIRALPAK® AD	Semi-Prep. Guard	20	50	10
19045	CHIRALPAK® AD	Semi-Prep.	20	250	10

Supercritical Fluid Chromatography
Semi-Preparative Columns

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
19435	CHIRALPAK® AD-H / SFC	SFC Semi-Prep.	10	250	5
19445	CHIRALPAK® AD-H / SFC	SFC Semi-Prep.	20	250	5
19475	CHIRALPAK® AD-H / SFC	SFC Semi-Prep.	30	250	5
19145	CHIRALPAK® AD / SFC	SFC Semi-Prep.	20	250	10

CHIRALPAK® AD, CHIRALCEL® OD, CHIRALPAK® AS and CHIRALCEL® OJ, the four global market leader chiral stationary phases able to resolve 80% of all racemic samples.

Their outstanding capabilities will provide you with a powerful and unique tool.

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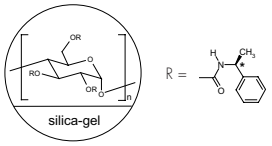
CHIRALPAK® AS-H / High Performance CHIRALPAK® AS

Amylose tris [(S)- -methylbenzylcarbamate] coated on a silica support

CHIRALPAK® analytical columns can be used with HPLC and SFC systems.
In semi-prep, the high system pressure required to keep CO_2 liquid dictates the use of more robust column hardware.



*: (S) configuration; Chiral side chain

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
20311	CHIRALPAK® AS-H	Guard cartridge (x3)	4.0	10	5
20324	CHIRALPAK® AS-H	Analytical	4.6	150	5
20325	CHIRALPAK® AS-H	Analytical	4.6	250	5
20394	CHIRALPAK® AS-H	Microbore	2.1	150	5
20337	CHIRALPAK® AS-H	Semi-Prep. Guard	10	20	5
20335	CHIRALPAK® AS-H	Semi-Prep.	10	250	5
20345	CHIRALPAK® AS-H	Semi-Prep.	20	250	5
20025	CHIRALPAK® AS	Analytical	4.6	250	10
20094	CHIRALPAK® AS	Microbore	2.1	150	10
20032	CHIRALPAK® AS	Semi-Prep. Guard	10	50	10
20035	CHIRALPAK® AS	Semi-Prep.	10	250	10
20042	CHIRALPAK® AS	Semi-Prep. Guard	20	50	10
20045	CHIRALPAK® AS	Semi-Prep.	20	250	10

Supercritical Fluid Chromatography
Semi-Preparative Columns

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
20435	CHIRALPAK® AS-H / SFC	SFC Semi-Prep.	10	250	5
20445	CHIRALPAK® AS-H / SFC	SFC Semi-Prep.	20	250	5
20475	CHIRALPAK® AS-H / SFC	SFC Semi-Prep.	30	250	5
20145	CHIRALPAK® AS / SFC	SFC Semi-Prep.	20	250	10

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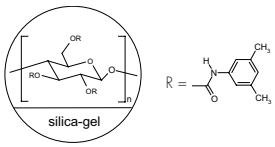
Cellulose-derived Chiral Stationary Phases
Analytical and Semi-Preparative Columns for HPLC and SFC

CHIRALCEL® OD-H / High Performance
CHIRALCEL® OD

Cellulose tris (3,5-dimethylphenylcarbamate) coated on a silica support

CHIRALCEL® analytical columns can be used with HPLC and SFC systems.
In semi-prep, the high system pressure required to keep CO_2 liquid dictates the use of more robust column hardware.



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
14311	CHIRALCEL® OD-H	Guard cartridge (x3)	4.0	10	5
14324	CHIRALCEL® OD-H	Analytical	4.6	150	5
14325	CHIRALCEL® OD-H	Analytical	4.6	250	5
14394	CHIRALCEL® OD-H	Microbore	2.1	150	5
14337	CHIRALCEL® OD-H	Semi-Prep. Guard	10	20	5
14335	CHIRALCEL® OD-H	Semi-Prep.	10	250	5
14345	CHIRALCEL® OD-H	Semi-Prep.	20	250	5
14025	CHIRALCEL® OD	Analytical	4.6	250	10
14032	CHIRALCEL® OD	Semi-Prep. Guard	10	50	10
14035	CHIRALCEL® OD	Semi-Prep.	10	250	10
14042	CHIRALCEL® OD	Semi-Prep. Guard	20	50	10
14045	CHIRALCEL® OD	Semi-Prep.	20	250	10

Supercritical Fluid Chromatography
Semi-Preparative Columns

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
14435	CHIRALCEL® OD-H / SFC	SFC Semi-Prep.	10	250	5
14445	CHIRALCEL® OD-H / SFC	SFC Semi-Prep.	20	250	5
14475	CHIRALCEL® OD-H / SFC	SFC Semi-Prep.	30	250	5
14145	CHIRALCEL® OD / SFC	SFC Semi-Prep.	20	250	10

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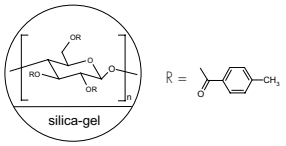
CHIRALCEL® OJ-H / High Performance CHIRALCEL® OJ

Cellulose tris (4-methylbenzoate) coated on a silica support

CHIRALCEL® analytical columns can be used with HPLC and SFC systems.
In semi-prep, the high system pressure required to keep CO_2 liquid dictates the use of more robust column hardware.



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
17311	CHIRALCEL® OJ-H	Guard cartridge (x3)	4.0	10	5
17324	CHIRALCEL® OJ-H	Analytical	4.6	150	5
17325	CHIRALCEL® OJ-H	Analytical	4.6	250	5
17394	CHIRALCEL® OJ-H	Microbore	2.1	150	5
17337	CHIRALCEL® OJ-H	Semi-Prep. Guard	10	20	5
17335	CHIRALCEL® OJ-H	Semi-Prep.	10	250	5
17345	CHIRALCEL® OJ-H	Semi-Prep.	20	250	5
17025	CHIRALCEL® OJ	Analytical	4.6	250	10
17032	CHIRALCEL® OJ	Semi-Prep. Guard	10	50	10
17035	CHIRALCEL® OJ	Semi-Prep.	10	250	10
17042	CHIRALCEL® OJ	Semi-Prep. Guard	20	50	10
17045	CHIRALCEL® OJ	Semi-Prep.	20	250	10

Supercritical Fluid Chromatography Semi-Preparative Columns

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
17435	CHIRALCEL® OJ-H / SFC	SFC Semi-Prep.	10	250	5
17445	CHIRALCEL® OJ-H / SFC	SFC Semi-Prep.	20	250	5
17475	CHIRALCEL® OJ-H / SFC	SFC Semi-Prep.	30	250	5
17145	CHIRALCEL® OJ / SFC	SFC Semi-Prep.	20	250	10

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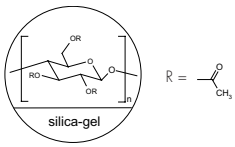
CHIRALCEL® OA

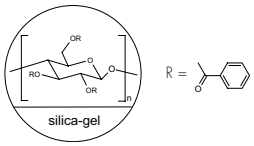
Cellulose triacetate coated on a silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
11022	CHIRALCEL® OA	Guard column	4.6	50	10
11025	CHIRALCEL® OA	Analytical	4.6	250	10

CHIRALCEL® OB-H / High Performance CHIRALCEL® OB

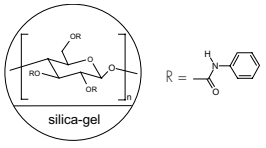
Cellulose tribenzoate coated on a silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
12311	CHIRALCEL® OB-H	Guard cartridge (x3)	4.0	10	5
12324	CHIRALCEL® OB-H	Analytical	4.6	150	5
12325	CHIRALCEL® OB-H	Analytical	4.6	250	5
12022	CHIRALCEL® OB	Guard column	4.6	50	10
12025	CHIRALCEL® OB	Analytical	4.6	250	10

CHIRALCEL® OC

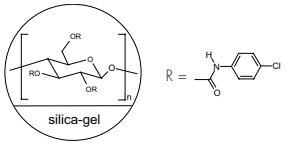
Cellulose tris (phenylcarbanate) coated on a silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
13022	CHIRALCEL® OC	Guard column	4.6	50	10
13025	CHIRALCEL® OC	Analytical	4.6	250	10

CHIRALCEL® OF

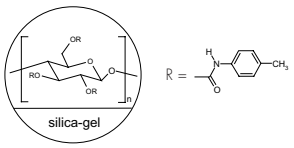
Cellulose tris (4-chlorophenylcarbamate) coated on a silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
15022	CHIRALCEL® OF	Guard column	4.6	50	10
15025	CHIRALCEL® OF	Analytical	4.6	250	10

CHIRALCEL® OG

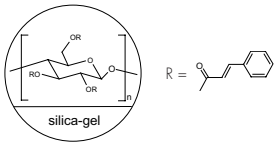
Cellulose tris (4-methylphenylcarbamate) coated on a silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
16022	CHIRALCEL® OG	Guard column	4.6	50	10
16025	CHIRALCEL® OG	Analytical	4.6	250	10

CHIRALCEL® OK

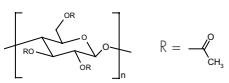
Cellulose tricinnamate coated on a silica support



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
18022	CHIRALCEL® OK	Guard column	4.6	50	10
18025	CHIRALCEL® OK	Analytical	4.6	250	10

CHIRALCEL® CA-1

Fine powder of microcrystalline Cellulose triacetate



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
10022	CHIRALCEL® CA-1	Guard column	4.6	50	NA
10025	CHIRALCEL® CA-1	Analytical	4.6	250	NA

CHIRAL
TECHNOLOGIES EUROPE

CHIRALPAK® and CHIRALCEL® [-RH series]
DAICEL Polysaccharide-derived Reverse Phase Chiral Stationary Phases

Product description

CHIRALPAK® AD-H, AS-H and CHIRALCEL® OD-H, OJ-H offer the widest application domain in normal phase mode and hence reverse phase versions have been developed by DAICEL :
CHIRALPAK® AD-RH, AS-RH and CHIRALCEL® OD-RH, OJ-RH.

These have the same coated chiral selector as found in the normal phase stationary phases, however in comparison, they use a different bounded silica as the base material which stabilises the CSP.

Reverse-phase analytical columns were developed specifically for aqueous-organic mobile phases.
They are suited for applications where the sample is presented in aqueous media (e.g. biological samples) or for samples that require flexibility in term of pH range. Extreme pH values must be avoided as they can damage the silica gel used in these columns.
These columns are also frequently used in LC/MS applications.

Mobile phase recommendation

CHIRALPAK® AD-RH / AS-RH

Neutral compounds	Acidic compounds	Basic compounds
Aqueous solution (90% to 0%)	Aqueous solution (85% to 0%)	Aqueous solution (85% to 0%)
Water	50mM pH 2 phosphate buffer	20mM pH 8 phosphate buffer or 20mM pH 9 borate buffer
Organic modifier (10% to 100%)	Organic modifier (15% to 100%)	Organic modifier (15% to 100%)
CH_3CN/MeOH/EtOH or 2-Propanol	CH_3CN/MeOH/EtOH or 2-Propanol	CH_3CN/MeOH/EtOH or 2-Propanol

Typical starting mobile phase composition
50% aqueous - 50% organic

CHIRALCEL® OD-RH / OD-R / OJ-RH

Neutral compounds	Acidic compounds	Basic compounds
Aqueous solution (90% to 0%)	Aqueous solution (85% to 0%)	Aqueous solution (85% to 0%)
Water	50mM pH 2 phosphate buffer or pH 2 phosphoric acid aqueous solution	50mM $NaPF_6$ or KPF_6 aq. (pH adjusted at 2.0 with H_3PO_4)
Organic modifier (10% to 100%)	Organic modifier (15% to 100%)	Organic modifier (15% to 100%)
CH_3CN/MeOH/EtOH or 2-Propanol	CH_3CN/MeOH/EtOH or 2-Propanol	CH_3CN/MeOH/EtOH or 2-Propanol

Typical starting mobile phase composition
60% aqueous - 40% organic

After use of buffer solutions it is recommended to wash the column before storage.

For maximum lifetime, analytical columns should be used in a series with an appropriate guard cartridge **especially when basic conditions are required.** Guard cartridges are available with the packing material to match the protected column.

Amylose and Cellulose-derived Chiral Stationary Phases
Analytical and Semi-Preparative columns for Reverse Phase HPLC

CHIRALPAK® AD-RH

Reverse Phase type of CHIRALPAK® AD-H

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
19711	CHIRALPAK® AD-RH	Guard cartridge (x3)	4	10	5
19724	CHIRALPAK® AD-RH	Analytical	4.6	150	5
19794	CHIRALPAK® AD-RH	Microbore	2.1	150	5
19744	CHIRALPAK® AD-RH	Semi-Prep.	20	150	5

CHIRALPAK® AS-RH

Reverse Phase type of CHIRALPAK® AS-H

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
20711	CHIRALPAK® AS-RH	Guard cartridge (x3)	4	10	5
20724	CHIRALPAK® AS-RH	Analytical	4.6	150	5
20794	CHIRALPAK® AS-RH	Microbore	2.1	150	5
20744	CHIRALPAK® AS-RH	Semi-Prep.	20	150	5

CHIRALCEL® OD-RH
CHIRALCEL® OD-R

Reverse Phase type of CHIRALCEL® OD-H / OD

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
14711	CHIRALCEL® OD-RH	Guard cartridge (x3)	4	10	5
14724	CHIRALCEL® OD-RH	Analytical	4.6	150	5
14794	CHIRALCEL® OD-RH	Microbore	2.1	150	5
14744	CHIRALCEL® OD-RH	Semi-Prep	20	150	5
14011	CHIRALCEL® OD-R	Guard cartridge (x3)	4	10	10
14625	CHIRALCEL® OD-R	Analytical	4.6	250	10

CHIRALCEL® OJ-RH

Reverse Phase type of CHIRALCEL® OJ-H

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
17711	CHIRALCEL® OJ-RH	Guard cartridge (x3)	4	10	5
17724	CHIRALCEL® OJ-RH	Analytical	4.6	150	5
17794	CHIRALCEL® OJ-RH	Microbore	2.1	150	5
17744	CHIRALCEL® OJ-RH	Semi-Prep.	20	150	5

DAICEL Chiral HPLC Columns for Special Applications

Anion Exchange Chiral Stationary Phases

CHIRALPAK® QD-AX and CHIRALPAK® QN-AX columns

CHIRALPAK® QN-AX and CHIRALPAK® QD-AX are enantioselective weak anion-exchange (AX) HPLC columns. They were developed by Prof. W. Lindner's group in Vienna and are designed specifically for enantioselective HPLC of chiral acids and possess exceptional enantiomer separation capabilities for acidic chiral compounds containing carboxylic, phosphonic, phosphinic, phosphoric or sulfonic acid groups.
In some cases, weakly acidic compounds such as phenols can also be separated.

These two columns are based on two complementary stereoisomeric quinine (QN) and quinidine (QD) derivatives. Owing to their pseudo enantiomeric character they usually reveal reversed elution order for opposite enantiomers.

They can be used in reversed phase (RP) mode or in polar organic mode (non-aqueous, polar organic solvents containing organic acids and bases as buffer constituents).
In addition the separation of chiral basic and neutral compounds may also be possible, but usually under normal phase (NP) conditions. In this mobile phase mode, CHIRALPAK® QN-AX and CHIRALPAK® QD-AX behave like a standard Pirkle type chiral stationary phase.

They are compatible with all common HPLC solvents (e.g. methanol, acetonitrile, tetrahydrofuran, 1,4-dioxane or chloroform) as well as in a wide pH range spanning from pH 2 to 8.
Typical buffers used in hydro-organic mode are acetate, formate, citrate and phosphate.

Crown Ether Chiral Stationary Phases

CROWNPAK® CR (+) / CR (-) columns

These columns contain a chiral crown ether as a chiral selector which is coated onto a 5µm silica support.
Acidic mobile phases such as Perchloric acid pH 1 to 2, are used to operate these columns under standard conditions. Note that to shorten the retention time of hydrophobic samples, the addition of Methanol (**15% maximum** v/v) has been shown to be effective.

These columns are the reference columns for achieving amino acid separations, with the advantage that the elution order of the enantiomers can be reversed when necessary (CR(-) column gives the reversed elution order compared to CR(+) column).

Ligand Exchange Chiral Stationary Phases

CHIRALPAK® WH and MA(+) columns

The chiral stationary phases in these columns are made of amino acids and its derivatives coated or bonded to silica supports (with a particle size of 10µm for WH and 3µm for MA(+)).
Since these columns are ligand-exchange type columns, the standard mobile phase to use is an aqueous solution of $CuSO_4$ (0.1 to 2mM).
These columns can tolerate organic modifiers such as Methanol and Acetonitrile according to the specifications in the instruction manual.

Polymethacrylate Chiral Stationary Phases

CHIRALPAK® OT(+) and OP(+) columns

These were the first CSPs invented by Professor Okamoto of Nagoya University (Japan).
The chiral selector is a chiral synthetic methacrylate polymer coated onto a 10µm silica support.
The best chromatographic results are obtained using 100% Methanol as mobile phase.
The polymer used for the CHIRALPAK® OT(+) column is very delicate and is slowly degraded by alcohols. To avoid this phenomenon, we recommend to run the analyses at low temperatures (0 ~ 5°C).

Anion Exchange Chiral Stationary Phases
Analytical and Semi-Preparative Columns for HPLC

CHIRALPAK® QD-AX

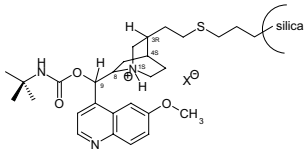
O-9-(tert-butylcarbamoyl) quinidine immobilized on a 5µm silica support

CHIRALPAK® QN-AX

O-9-(tert-butylcarbamoyl) quinine immobilized on a 5µm silica support

For acidic chiral compounds containing carboxylic, phosphonic, phosphinic, phosphoric or sulfonic acid groups. In some cases, weakly acidic compounds such as phenols can also be separated.

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
31324	CHIRALPAK® QD-AX	Analytical	4.6	150	5
31394	CHIRALPAK® QD-AX	Microbore	2.1	150	5
31344	CHIRALPAK® QD-AX	Semi-Prep.	20	150	5
32324	CHIRALPAK® QN-AX	Analytical	4.6	150	5
32394	CHIRALPAK® QN-AX	Microbore	2.1	150	5
32344	CHIRALPAK® QN-AX	Semi-Prep.	20	150	5



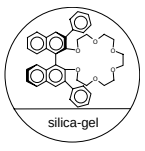
CHIRALPAK® QD-AX: (8R,9S)
CHIRALPAK® QN-AX: (8S,9R)

Crown Ether Chiral Stationary Phases
Analytical Columns for HPLC

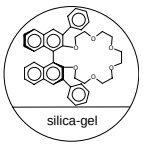
CROWNPAK® CR(+)
CROWNPAK® CR(-)

For amino acids and compounds with a primary amino group near the asymmetric center, including dipeptides.
Note that the CROWNPAK® CR(-) provides reversed order of elution relative to CROWNPAK® CR(+).

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
27711	CROWNPAK® CR	Guard column	4	10	5
27714	CROWNPAK® CR(+)	Analytical	4	150	5
28714	CROWNPAK® CR(-)	Analytical	4	150	5



CR (+)

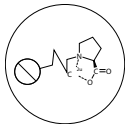


CR (-)

Ligand Exchange Chiral Stationary Phases
Analytical Columns for HPLC

CHIRALPAK® WH

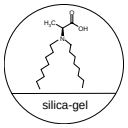
For -amino acids and their derivatives.



Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
25622	CHIRALPAK® WH	Guard column	4.6	50	10
25625	CHIRALPAK® WH	Analytical	4.6	250	10

CHIRALPAK® MA(+)

For hydroxycarboxylic acids, amino acids (including their derivatives), dipeptides.

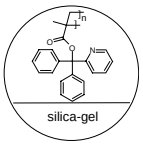


Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
21822	CHIRALPAK® MA(+)	Analytical	4.6	50	3

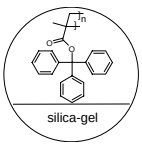
Polymethacrylate Chiral Stationary Phases
Analytical Columns for HPLC

CHIRALPAK® OP(+)
CHIRALPAK® OT(+)

Special columns to resolve compounds by the chiral polymers' helicity.



OP (+)



OT (+)

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
22022	CHIRALPAK® OP(+)	Guard column	4.6	50	10
22025	CHIRALPAK® OP(+)	Analytical	4.6	250	10
23022	CHIRALPAK® OT(+)	Guard column	4.6	50	10
23025	CHIRALPAK® OT(+)	Analytical	4.6	250	10

Accessories for Analytical Chromatography

Cartridge Holder

The HPLC analytical guard cartridges (package of three) need to be mounted in a cartridge holder to be connected to the analytical column.

Column Jacket

The column jackets allow operating temperature of analytical columns to be controlled with a circulating water bath.

ACCESSORIES

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
00021	Cartridge Holder	Hardware	4.0	10	NA
00024	Column Jacket, 15cm	Hardware	4.6	150	NA
00025	Column Jacket, 25cm	Hardware	4.6	250	NA

CHIRALPAK® and CHIRALCEL®
Preparative columns and Bulk Chiral Stationary Phases

CHIRAL TECHNOLOGIES EUROPE develops chromatography processes utilizing both continuous processes (e.g. SMB) and single-column equipments.
For the first step, our Application Department provides a free of charge customer service to identify the optimum chiral stationary phase and mobile phase for the analysis of a specific compound.
The same method developed for analytical separations can be directly scaled up for preparative scale separations (milligrams to tens of grams) on 1 cm, 2 cm, and 5 cm I.D. columns. If greater quantities are required, larger columns (10 cm I.D.) are also available, again using the same methodology as initially developed.

Bulk chiral stationary phases (20 micron particle size) with excellent batch-to-batch reproducibility for production purposes are available from CHIRAL TECHNOLOGIES EUROPE. To date, several multi-ton production units for drugs have been installed in Europe, using our CSPs.
The wide selectivity and high loading capacity of the DAICEL CSPs have made CHIRAL TECHNOLOGIES, and the entire DAICEL group, the worldwide market leader in chiral chromatography products and services.

To support preparative scale applications, analytical size columns packed with 20 micron CSPs are available **on request.**
These columns are used specifically for developing and optimizing methods for preparative processes before scaling up in a linear fashion to full-size production, as they closely match the performance of large preparative columns.
The loading data on these columns yield accurate projections of the preparative separations.

HPLC Preparative Columns Packed with 20µm Stationary Phases

CHIRALPAK® AD

Amylose tris (3,5-dimethylphenylcarbamate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
19242 A	CHIRALPAK® AD	Semi-Prep. Guard	21	50	20
19245 A	CHIRALPAK® AD	Semi-Prep.	21	250	20
19256	CHIRALPAK® AD	Preparative Column	50	500	20
19266	CHIRALPAK® AD	Preparative Column	100	500	20

CHIRALPAK® AS-V

Amylose tris [(S)- -methylbenzylcarbamate] coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
20242 A	CHIRALPAK® AS-V	Semi-Prep. Guard	21	50	20
20245 A	CHIRALPAK® AS-V	Semi-Prep.	21	250	20
20256	CHIRALPAK® AS-V	Preparative Column	50	500	20
20266	CHIRALPAK® AS-V	Preparative Column	100	500	20

CHIRALCEL® OD

Cellulose tris (3,5-dimethylphenylcarbamate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
14242 A	CHIRALCEL® OD	Semi-Prep. Guard	21	50	20
14245 A	CHIRALCEL® OD	Semi-Prep.	21	250	20
14256	CHIRALCEL® OD	Preparative Column	50	500	20
14266	CHIRALCEL® OD	Preparative Column	100	500	20

CHIRALCEL® OJ

Cellulose tris (4-methylbenzoate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
17242 A	CHIRALCEL® OJ	Semi-Prep. Guard	21	50	20
17245 A	CHIRALCEL® OJ	Semi-Prep.	21	250	20
17256	CHIRALCEL® OJ	Preparative Column	50	500	20
17266	CHIRALCEL® OJ	Preparative Column	100	500	20

Bulk Chiral Stationary Phases

Please contact us for details regarding bulk quantities. Further bulk CSPs are also available.

To support your preparative method development, we pack upon request, analytical columns (4.6 mm I.D.) in various lengths using 20µm CSPs.

Please contact CHIRAL TECHNOLOGIES EUROPE for questions associated with bulk CSPs.

CHIRALPAK® AD

Amylose tris (3,5-dimethylphenylcarbamate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
19020	CHIRALPAK® AD	Bulk CSP (1 Kg)	NA	NA	20
19021	CHIRALPAK® AD	Bulk CSP (100 g)	NA	NA	20

CHIRALPAK® AS-V

Amylose tris [(S)- -methylbenzylcarbamate] coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
20020	CHIRALPAK® AS-V	Bulk CSP (1 Kg)	NA	NA	20
20021	CHIRALPAK® AS-V	Bulk CSP (100 g)	NA	NA	20

CHIRALCEL® OD

Cellulose tris (3,5-dimethylphenylcarbamate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
14020	CHIRALCEL® OD	Bulk CSP (1 Kg)	NA	NA	20
14021	CHIRALCEL® OD	Bulk CSP (100 g)	NA	NA	20

CHIRALCEL® OJ

Cellulose tris (4-methylbenzoate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
17020	CHIRALCEL® OJ	Bulk CSP (1 Kg)	NA	NA	20
17021	CHIRALCEL® OJ	Bulk CSP (100 g)	NA	NA	20

CHIRALPAK® IA

Amylose tris (3,5-dimethylphenylcarbamate) immobilized on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
80020	CHIRALPAK® IA	Bulk CSP (1 Kg)	NA	NA	20
80021	CHIRALPAK® IA	Bulk CSP (100 g)	NA	NA	20

CHIRALCEL® OD-I

Cellulose tris (3,5-dimethylphenylcarbamate) immobilized on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
50020	CHIRALCEL® OD-I	Bulk CSP (1 Kg)	NA	NA	20
50021	CHIRALCEL® OD-I	Bulk CSP (100 g)	NA	NA	20

CHIRALCEL® OF

Cellulose tris (4-chlorophenylcarbamate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
15020	CHIRALCEL® OF	Bulk CSP (1 Kg)	NA	NA	20
15021	CHIRALCEL® OF	Bulk CSP (100 g)	NA	NA	20

CHIRALCEL® OG

Cellulose tris (4-methylphenylcarbamate) coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
16020	CHIRALCEL® OG	Bulk CSP (1 Kg)	NA	NA	20
16021	CHIRALCEL® OG	Bulk CSP (100 g)	NA	NA	20

CHIRALCEL® OK

Cellulose tricinnamate coated on a 20µm silica support

Ref.	Column Name	Product Type	Internal Diameter (mm)	Column Length (mm)	Particle Size (µm)
18020	CHIRALCEL® OK	Bulk CSP (1 Kg)	NA	NA	20
18021	CHIRALCEL® OK	Bulk CSP (100 g)	NA	NA	20