



Chiral Application Handbook

A Comprehensive Guide on Chiral HPLC Separations

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Application and reference Index

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Substance	Column	Application page	Reference
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Phenprocoumon	AGP		A94, A99
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Phenylethanolamine	CBH	36	
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Rosmarinic acid	AGP	28	A135
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Salmeterol	CBH	37	A201
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Sotalol	CBH, AGP	37	C10, A148
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Suprofen	AGP	28	
Synephrine	CBH	37	
Talinolol	CBH	37	
TCP-D,L-methionine	AGP	28	
Terbutaline	AGP	28	A7, A8, A9, A12, A13, A22
Terfenadine acid metabolite	AGP		A114
Terodiline	AGP	28	A29
1,2,3,4-tetrahydro-1-naphthol	AGP	28	
Tetrahydropapaveroline	CBH	37	
Tetrahydrozoline	AGP	29	A8, A12, A13, A101
4,5,6,7-tetrahydro(3,2-c)-thienopyridinyl-5-chlorophenylacetate	AGP	29	
Tetramisole	CBH	37	
Thalidomide	CBH	37	
1,3,4-Thiadiazine	AGP		A116
Thiamylal	AGP		A182
Thiopental=Thiopentone=Penthiobarbital	AGP	29	A28, A128, A136
Thioridazine sulfoxide	AGP	29	
Tiaprofenic acid	AGP	29	A32, A100, A137
Timolol	AGP, CBH	37	
Tiprenolol	AGP	29	A101
Tofisopam	AGP	29	A125
Tolamolol	CBH	37	
Toliprolol	CBH	37	
Tolperisone	AGP	29	A101
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Uxepam	AGP	30	A125
Vamicamide	AGP	30	A104
Valsartan	AGP	30	
Verapamil	AGP	30	A8, A12, A13, A24, A50, A68, A86, A90, A139, A157, A180, A185, A194
Vinca alkaloids	AGP, HSA		A60, H1
Vinpocetin	AGP		A70
Warfarin	AGP	30	A27, A74, A94, A99
Warfarin alcohol	AGP		A99
Zopiclone	AGP	30	

Column selection guide

The chiral columns described in this handbook are all reversed-phase columns, giving many possibilities to affect both the retention and the enantioselectivity. The solutes are retained by three types of forces; ionic bonding (charged solutes), hydrophobic interaction and hydrogen bonding. The relative contribution of the different forces to the retention of the solutes, depend of the nature of the analyte. Analytes containing charged groups, hydrogen bonding groups and hydrophobic parts can be retained by interaction with corresponding groups on the chiral selector.

CHIRAL-AGP™

Extremely broad applicability. Most likely the column with the broadest applicability of all chiral columns available. Separates all types of compounds:

- amines (primary, secondary, tertiary and quarternary ammonium compounds)
- acids (strong and weak)
- non-protolytes (amides, esters, alcohols, sulphoxides, etc.)

CHIRAL-CBH

More narrow applicability than CHIRAL-AGP. Separates preferably **primary and secondary amines** containing an aromatic ring structure. Hydrogen bonding groups not necessary. However, if the molecule contains hydrogen bonding groups like carbonyl, alcohol, amide, sulphoxide etc. , it may give very high enantioselectivity.

CHIRAL-HSA

More narrow applicability than CHIRAL-AGP. Separates preferably **weak and strong acids, zwitter-ionic and non-protolytic compounds.**

Application area for the different columns

	Amines	Non-protolytes	Acids
CHIRAL-AGP™	[Bar spanning all three categories]		
CHIRAL-CBH	[Bar]		
CHIRAL-HSA		[Bar]	

As can be seen the columns overlap for some types of compounds; basic compounds can be separated on both **CHIRAL-AGP** and **CHIRAL-CBH**, acidic compounds and non-protolytes can be separated on both **CHIRAL-AGP** and **CHIRAL-HSA**. However, as **CHIRAL-AGP** is a column with an extremely broad applicability, this column should be the first choice, if an application can not be found in the handbook on any of the other two columns. There are, however, some types of compounds where one of the other columns might be the first choice:

CHIRAL-HSA: very hydrophilic acids

CHIRAL-CBH: very hydrophilic amines/amino alcohols

The CHIRAL-AGP™ column

α_1 -acid glycoprotein (AGP) is a very stable protein, which tolerates pure organic solvents, high temperatures and high and low pH. AGP, the chiral selector in the CHIRAL-AGP column, has been immobilized on spherical 5 μm silica particles. CHIRAL-AGP is a reversed-phase column which is used for the resolution of an extremely broad range of chiral compounds, such as amines (primary, secondary, tertiary and quaternary ammonium compounds), acids (strong and weak) and nonprotolytes (esters, sulphoxides, amides,

alcohols etc.). The very broad applicability is demonstrated in the application section (with chromatograms and chromatographic conditions) and in the list of publications in this handbook.

The enantioselectivity and the retention can easily be regulated by the pH of the mobile phase, the nature and the concentration of the organic modifier and the buffer concentration.

Method Development Strategies

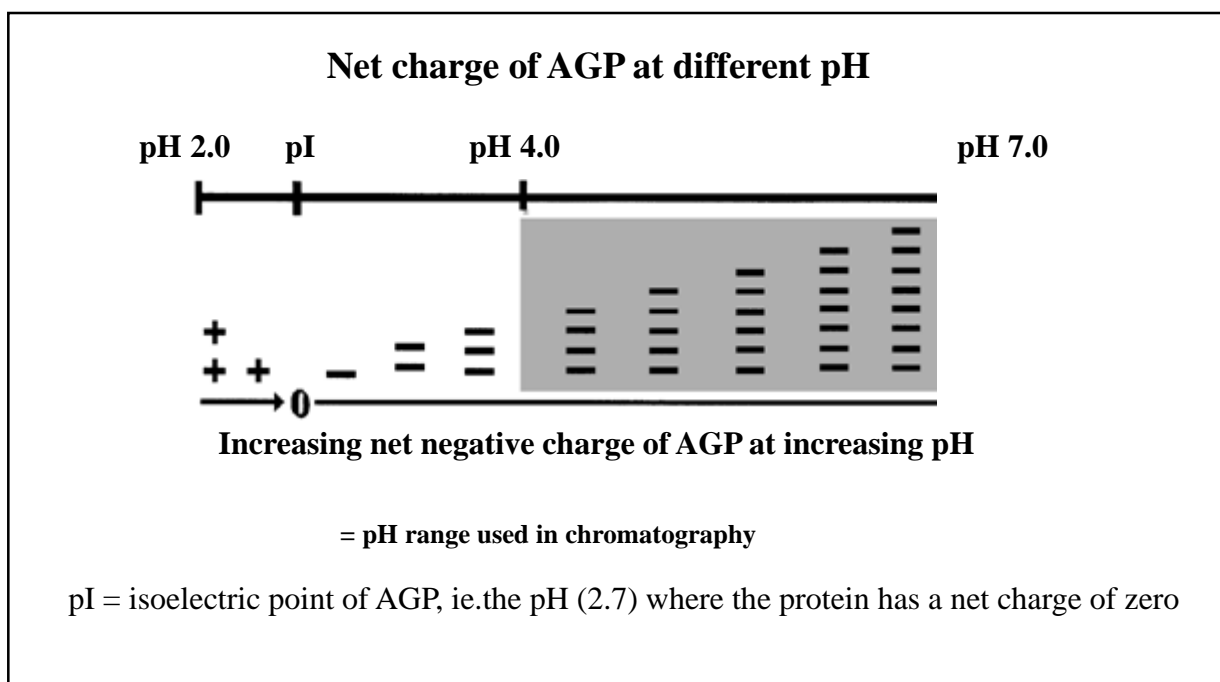
1. pH

The most important tool in method development on this column is the **pH**. The reason is that by changing the pH, the net charge of the chiral selector as well as the charge of the solute can be changed, which affects the way the analyte interacts with the chiral selector (see Fig. below).

AGP has a low isoelectric point (pI) of 2.7. This means that using the column at pH 2.7 gives a net charge of zero of the chiral stationary phase. Increasing the pH from 2.7 up to 7 means that the degree of net negative charge of the chiral selector increases. This gives the prerequisites for ionic binding of positively charged solutes (amines), resulting in a high affinity and a high retention of the solute.

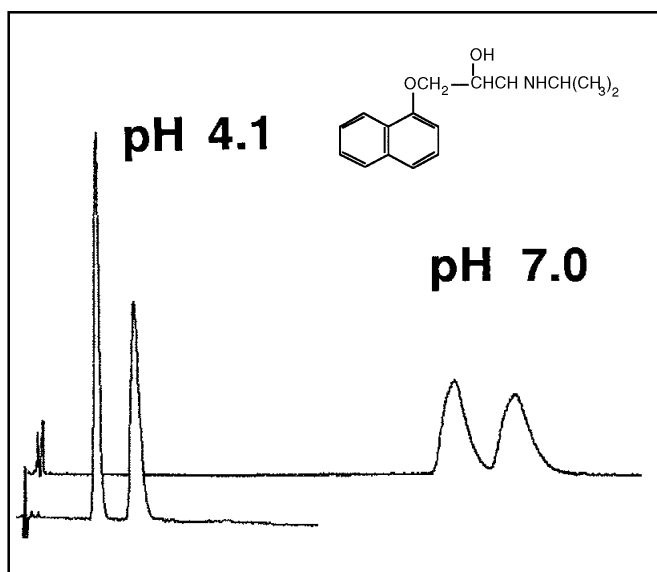
Reducing the pH towards the isoelectric point reduces the negative charge of the stationary phase, resulting in lower retention of the solute (amine). A change of the net charge of the chiral selector strongly affects the interaction between the solute and the chiral stationary phase.

It has been demonstrated that ionic binding of amines to the AGP column is a very important type of interaction for retention of this category of compounds. The solutes are also retained by hydrophobic interaction and hydrogen bonding. The relative influence of the different types of binding forces depends of the nature of the solute, i.e. what kind of structure elements are present in the analyte.

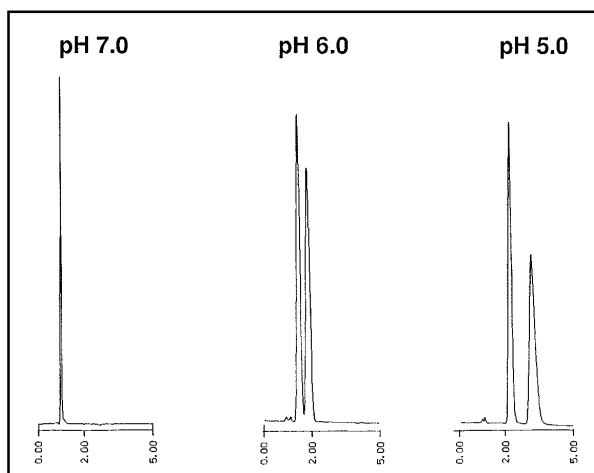


The CHIRAL-AGP™ column

When chromatographing hydrophobic amines, a pH of 4-5 is preferred compared to a pH of 7 (see Fig. below). The explanation to this is that at pH 7, the protein has a strong degree of net negative charge and the analyte is positively charged if the pK_a value is ≥ 9 , which gives a strong ionic binding of the analyte. However, reducing the pH to the range 4-5, reduces the degree of net negative charge of the protein (the analyte is still fully ionized) which gives a reduction of the ionic bonding of the analyte and the retention is strongly reduced. For some compounds even a decrease to pH 6 might give large improvements compared to pH 7. The pH effects are demonstrated below for **propriolol**, chromatographed at pH 4 and 7. Note the very strong reduction of the retention and the improvement of the chromatographic performance at pH 4.



The pH can also be an effective tool for affecting the resolution of acids, which is demonstrated below for **2-phenoxypropionic acid**. The compound has been chromatographed at three different pH; 5, 6 and 7. The analyte is totally ionized (negatively charged) at pH 7, but the charge is reduced at lower pH since the pK_a -value is about 4. Furthermore, a decrease in pH reduces the degree of net negative charge of the protein, resulting in higher retention due to reduction of the repulsion between the analyte and the chiral stationary phase. The solute is retained by hydrophobic interaction and hydrogen bonding.



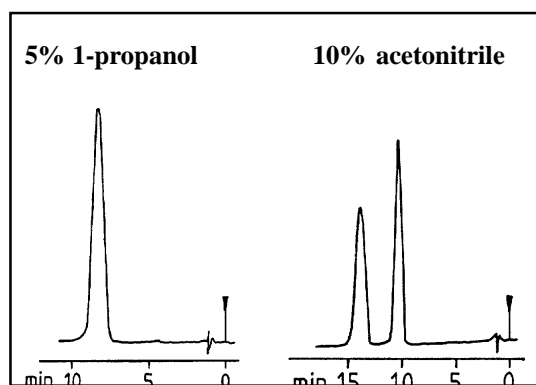
2. Organic modifier (solvent)

2-propanol, acetonitrile, methanol, ethanol and 1-propanol are the most frequently used organic modifiers. Higher modifier concentration reduces the retention and the enantioselectivity for both amines and acids. However, for certain types of acids the enantioselectivity can be strongly improved by increasing the modifier concentration, as is demonstrated for **warfarin** below.

Conc. 2-propanol (%)	k'_1	α
8	4.73	1.33
10	2.45	1.42
12	1.19	1.53
14	0.76	1.57

Mobile phase: 2-propanol in 0.01 M phosphate buffer, pH 7.0

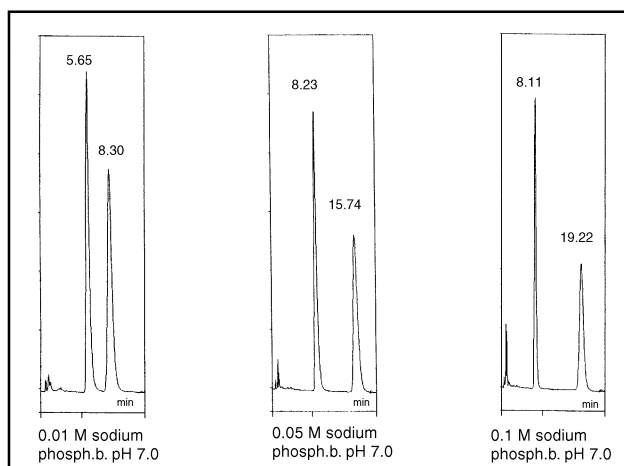
By changing from one organic modifier to another with different hydrogen bonding properties, i.e. from acetonitrile (hydrogen accepting properties) to 2-propanol (hydrogen accepting and donating properties), it is possible to strongly affect the enantioselectivity as demonstrated below for **pindolol**. Using 1-propanol results in no chiral selectivity, while acetonitrile gives a complete base-line resolution.



The CHIRAL-AGP™ column

3. Buffer

By changing the buffer concentration, it is possible to affect both the retention and the enantioselectivity. Such effects have been observed for acids and for certain amines. One example is the acidic drug **naproxen**, shown in the chromatograms below.

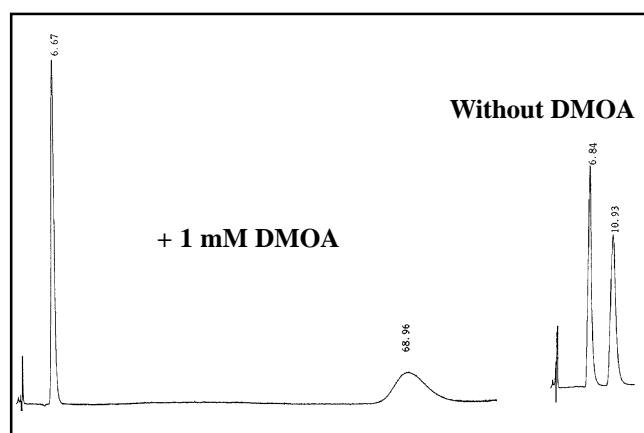


Also when chromatographing basic compounds the buffer concentration can be used to affect the resolution. Below is a table, demonstrating the effect of increasing the buffer concentration when chromatographing propranolol in a mobile phase of 0.5 % 2-propanol in acetate buffer pH 4.1.

Acetate mM	k'_1	k'_2	α
12	5.73	7.29	1.27
25	6.54	8.79	1.34
96	7.04	10.7	1.52

4. Charged modifiers

The majority of all separations performed on the CHIRAL-AGP column have been performed using simple mobile phases consisting of a buffer and an uncharged organic modifier (as 2-propanol). However, for some compounds the addition of a charged modifier may induce or improve the enantioselectivity. The charged modifiers that have been used are octanoic, hexanoic and heptanoic acid, DMOA (N,N-dimethyloctylamine), tetraethyl- and tetrapropyl-ammonium bromide. The chromatograms to the right show naproxen chromatographed with and without DMOA.

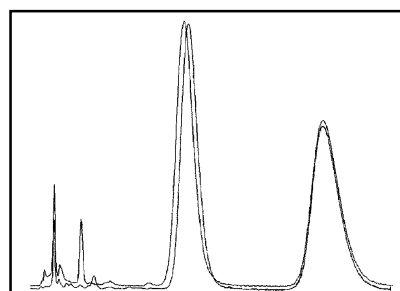


Please note!

If a column has been used with a mobile phase containing a **charged modifier**, it should **not** be used afterwards with mobile phases consisting of a pure buffer or a buffer containing an uncharged modifier. Different types of charged modifiers should not be used on the same column.

Stability of the CHIRAL-AGP column

The stability of the AGP column has been tested using bumadizon, an acidic drug, as test compound. In total **30.5 liters** of mobile phase (10% isopropanol in phosph. buffer pH 6.0) was pumped through the column. **During the test 2030 samples of bumadizon were injected.** The two chromatograms below are the first and the last obtained in the test. No significant changes were observed.



The CHIRAL-AGP™ column

The tools used for regulation of retention and selectivity on the CHIRAL-AGP™ column are exactly the same as those used in ordinary reversed phase chromatography.

In order to use the CHIRAL-AGP™ column and develop methods on it, there is no need to learn and adopt to special techniques. Use the knowledge from reversed phase chromatography and it will be very easy to develop methods. The table beside can be used as a starting point. Look at the structure of the compound of interest, characterize it and choose the corresponding starting mobile phase. Start the work and then use the Method Development Scheme, that is shipped with each column, to optimize the method.

Compound type	Starting mobile phase
Hydrophobic amine	10 mM ammonium or sodium acetate buffer pH 4.5
Hydrophilic amine Weak acid (phenol etc) Nonprotolyte (amide, ester, alcohol etc)	5% 2-propanol in 10 mM sodium phosphate buffer pH 7.0
Strong acid (carboxylic acid)	10 mM sodium phosphate buffer pH 7.0

CHIRAL-AGP™ method optimization for LC/MS

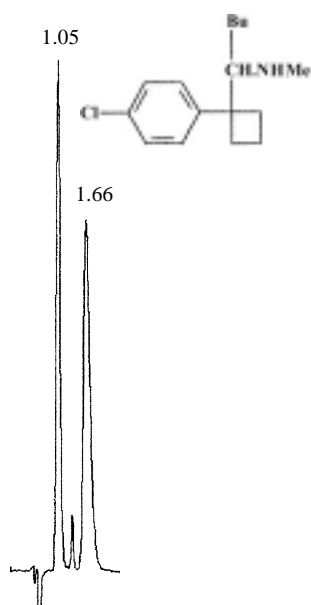
If a method on the CHIRAL-AGP™ column is optimized for UV or fluorescence detection it can easily be converted to a method compatible with MS-detection using the guidelines given here. MS-detectors require other buffers in the mobile phase. Shorter columns are also preferred, as the MS-detector generates high detection selectivity.

Conversion from UV-method to LC/MS method

The type and concentration of buffer is important when developing methods for MS-detection. Methods based on phosphate buffers or other nonvolatile buffers can easily be transformed to MS compatible methods, by changing to ammonium acetate or ammonium formate buffers. Pindolol is used as an example. In the UV-method the mobile phase is 10 % acetonitrile in 10 mM sod.ph.b. pH 7.0 and the column dimension 100x4.0 mm with a flow rate of 0.9 ml/min. To make it suitable for MS the phosphate buffer was replaced by 10 mM ammonium acetate which has a pH of ca. 6.6. To optimize selectivity the acetonitrile concentration was decreased to 7%. Column dimension was 50x2.0 mm and flow rate 0.22 ml/min.

Rapid chiral separations suitable for MS-detection

Desmetylsibutramine



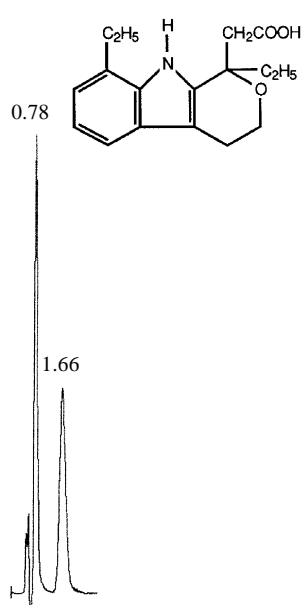
CHIRAL-AGP™

50x4.0 mm

Mobile phase:

5% acetonitrile in 10 mM ammonium acetate buffer pH 4.1

Etodolac



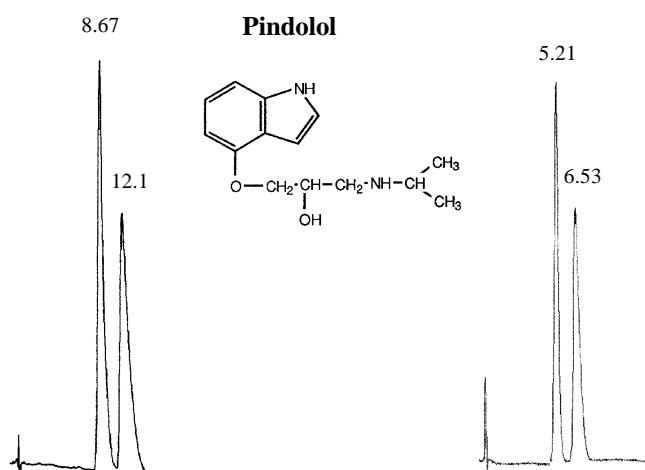
CHIRAL-AGP™

50x2.0 mm

Mobile phase:

15% acetonitrile in 10 mM ammonium acetate

Pindolol



CHIRAL-AGP™

100x4.0 mm

Mobile phase:

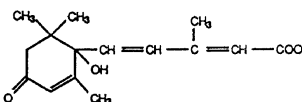
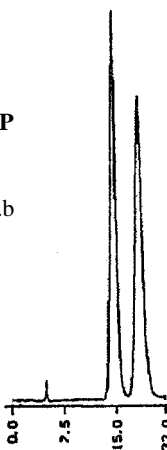
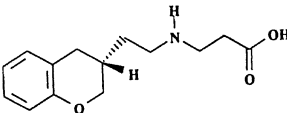
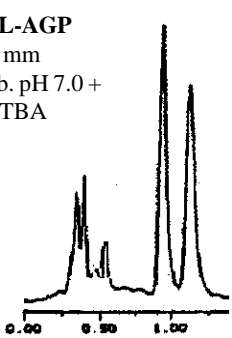
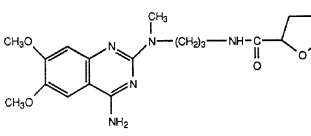
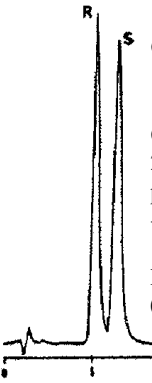
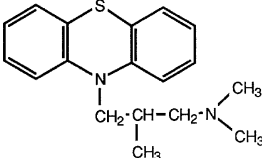
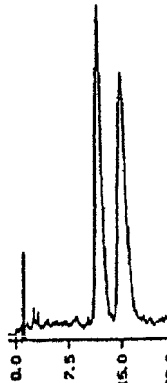
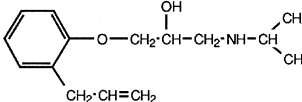
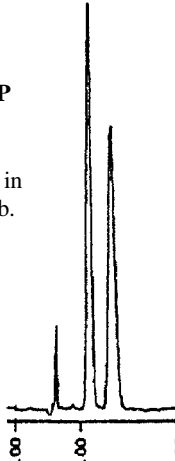
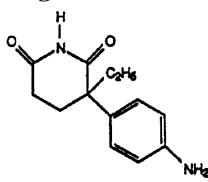
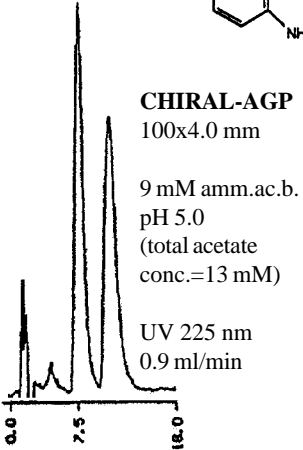
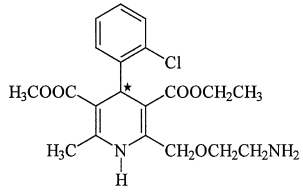
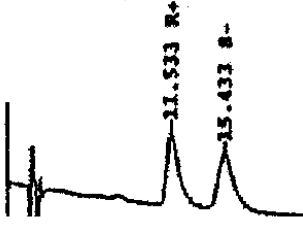
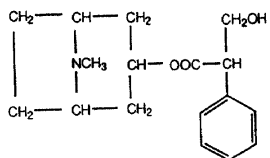
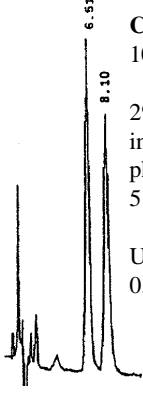
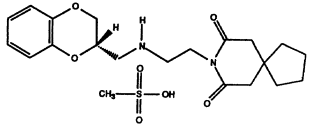
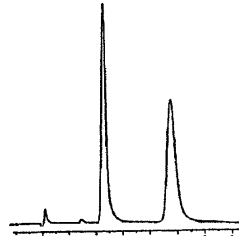
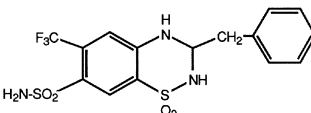
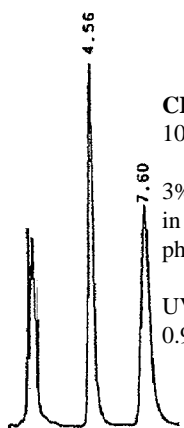
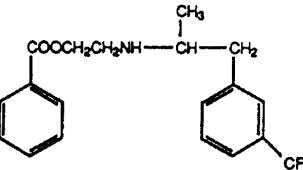
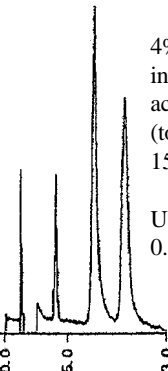
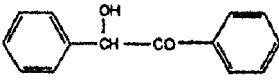
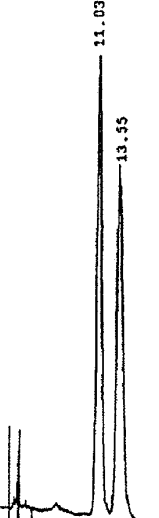
10% acetonitrile in 10 mM sodium phosphate buffer pH 7.0

CHIRAL-AGP™

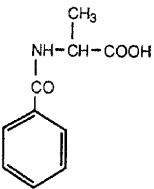
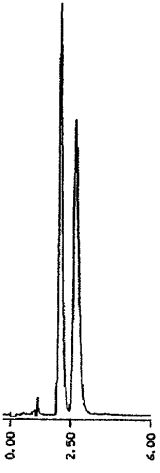
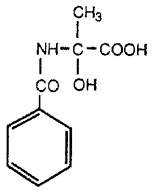
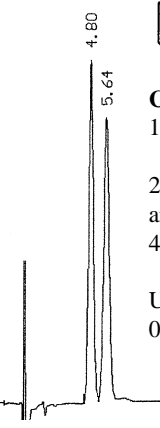
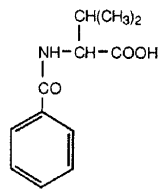
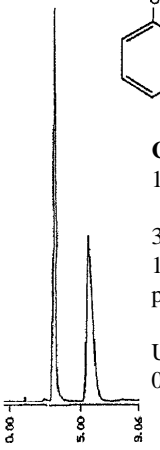
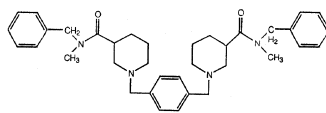
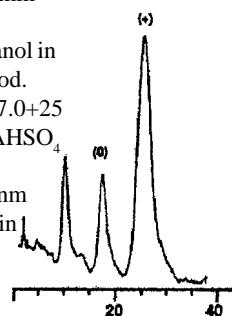
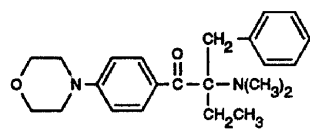
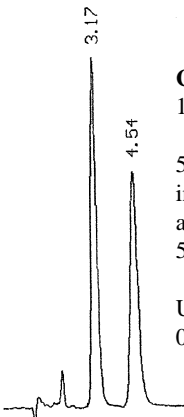
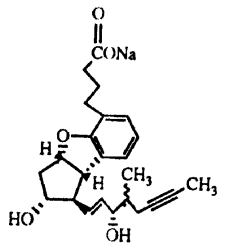
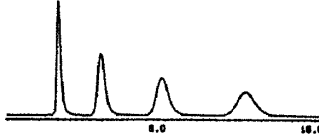
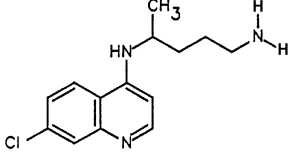
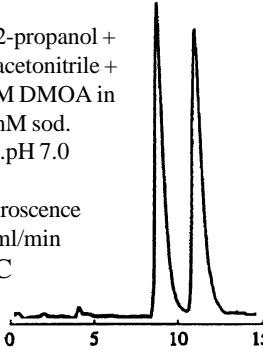
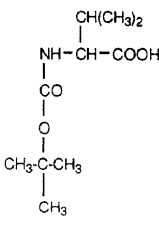

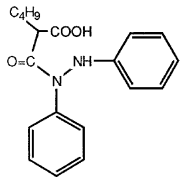
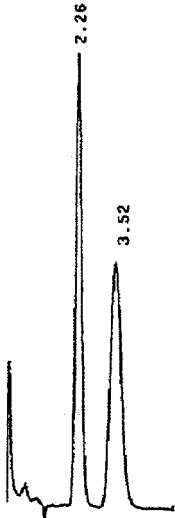
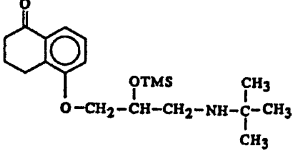
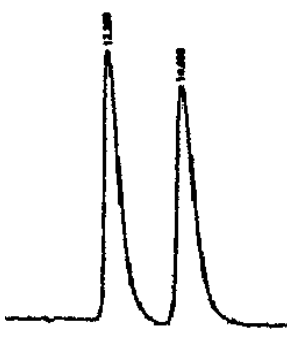
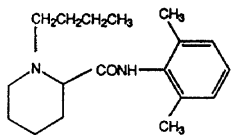
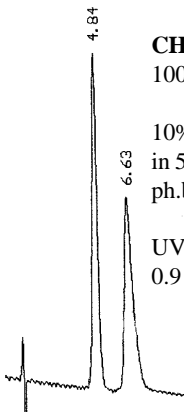
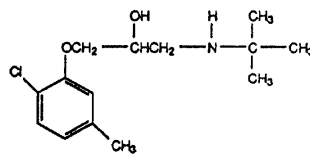
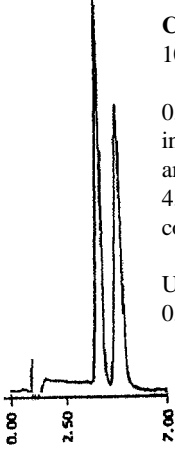
50x2.0 mm

Mobile phase:

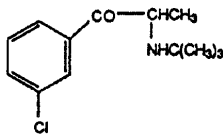
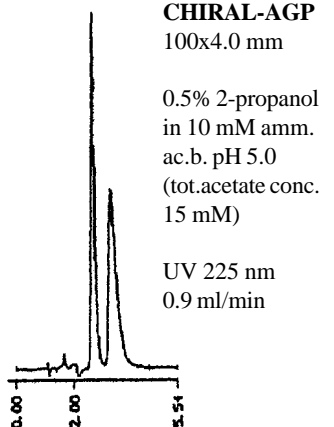
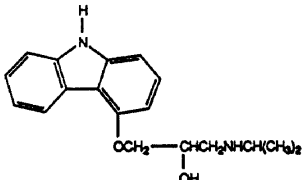
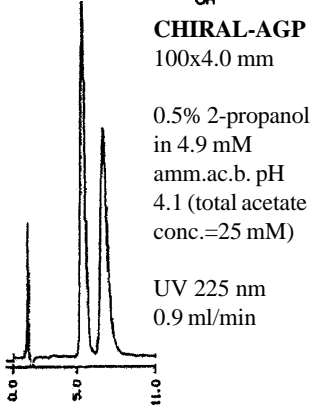
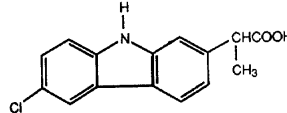
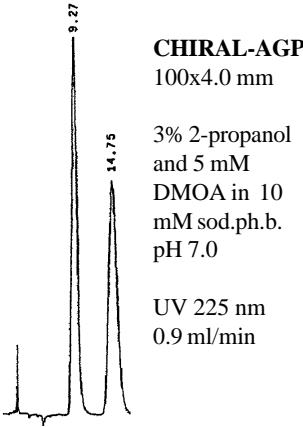
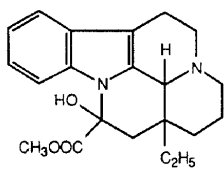
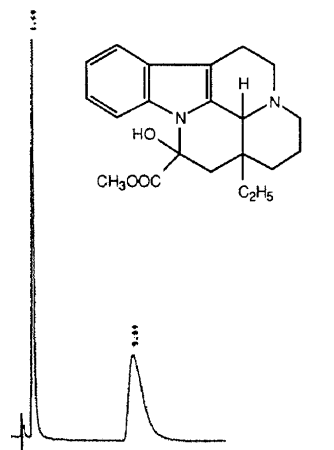
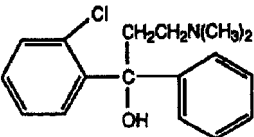
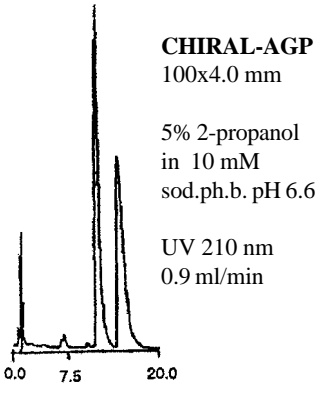
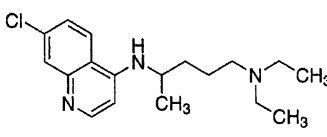
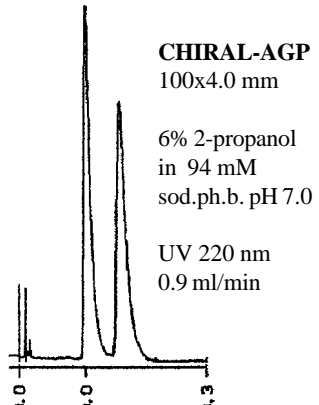
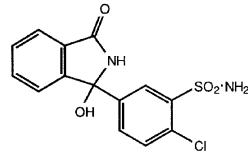
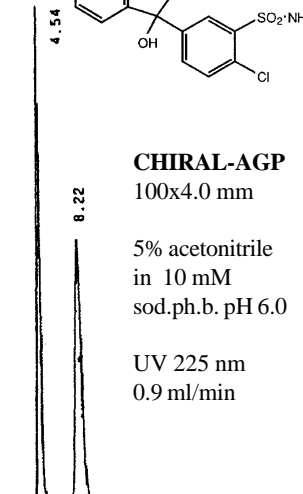
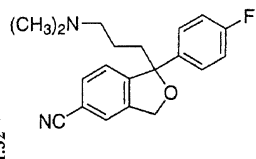
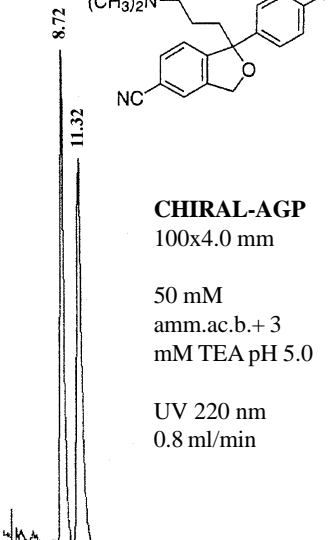
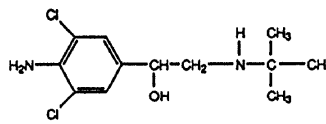
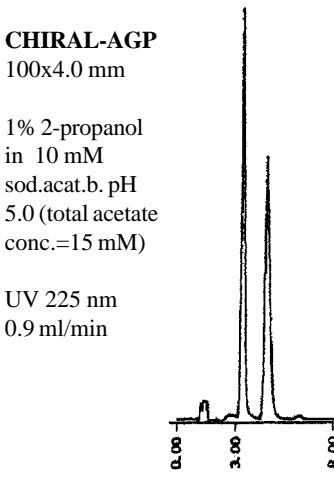
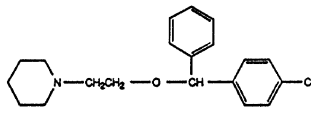
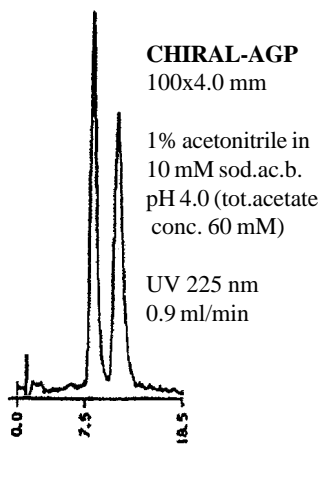
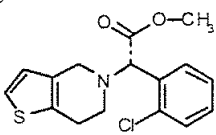
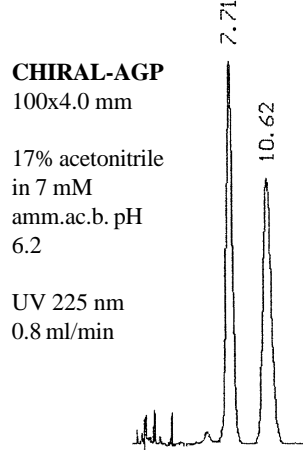
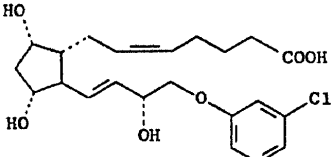
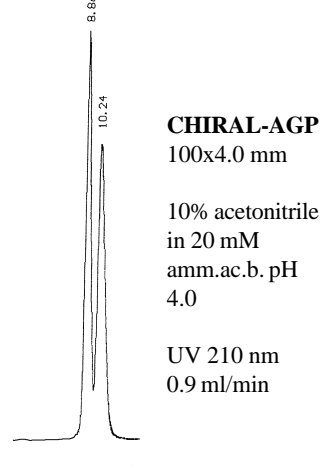
7% acetonitrile in 10 mM ammonium acetate

<p>Abscisic acid</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>75 mM sod.ph.b pH 5.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>β-alanin-N-[2-(3,4-dihydro-2H-1-benzopyran-3-yl)-ethyl] carboxylic acid</p>  <p>CHIRAL-AGP 150x4.0 mm Phosph.b. pH 7.0 + 2.5 mM TBA</p> 	<p>Alfuzosin</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>6% acetonitrile in 25 mM pot.ph.b. pH 7.4 + 25 mM TBaBr</p> <p>Flourescence 0.9 ml/min</p> 	<p>Aliememazine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% acetonitrile in 10 mM sod. ac.b. pH 4.0 (total acetate conc.=60 mM)</p> <p>UV 210 nm 0.9 ml/min</p> 
<p>Alprenolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% acetonitrile in 10 mM sod.ac.b. pH 4.0 (total acetate conc.=60 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Aminoglutethimide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>9 mM amm.ac.b. pH 5.0 (total acetate conc.=13 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Amlodipine</p>  <p>CHIRAL-AGP 150x4.0 mm 1% 1-propanol in 10 mM acet.b. pH 4.5</p> 	<p>Atropine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>2% 2-propanol in 10 mM sod. ph.b pH 7.0 + 5 mM octanoic acid</p> <p>UV 265 nm 0.9 ml/min</p> 
<p>8-Azaspino[4,5]decane-7,9-dione-8-(2-[(2,3-dihydro-1,4-benzodioxin-2-yl)-methyl]-amino)ethyl) mono-methane-sulfonate</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>27.5% methanol in 50 mM phosph.b pH 5.0, UV 210 nm, 1.0 ml/min</p> 	<p>Bendroflumethiazide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 1-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Benflourex</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>4% 2-propanol in 10 mM amm. ac.b. pH 5.0 (tot.acetate conc. 15 mM)</p> <p>UV 225 nm, 0.9 ml/min</p> 	<p>Benzoin</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% methanol in 10 mM sod. ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 

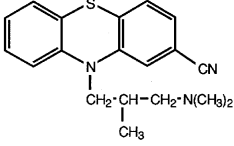
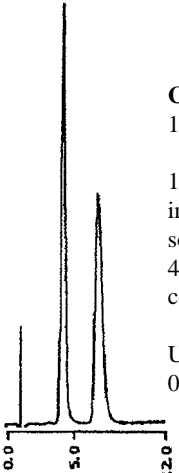
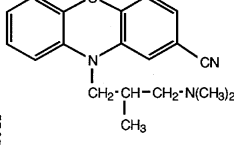
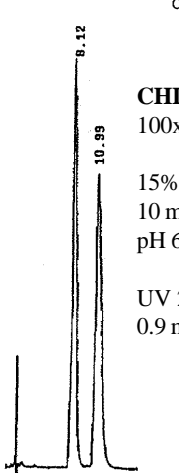
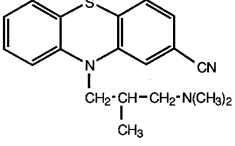
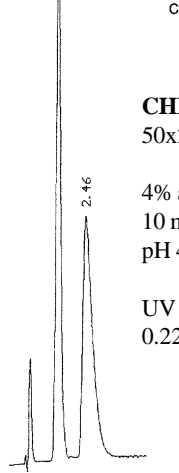
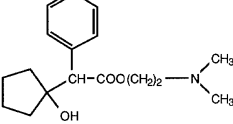
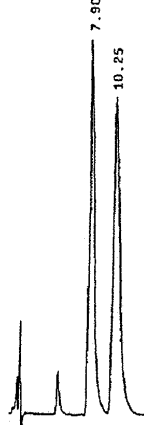
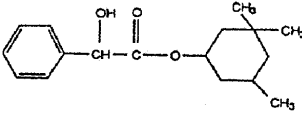
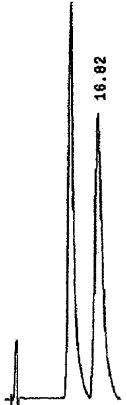
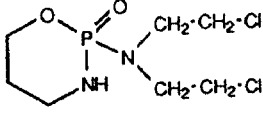
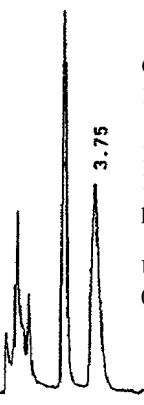
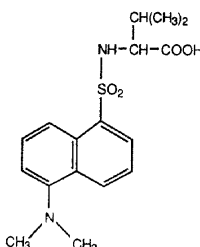
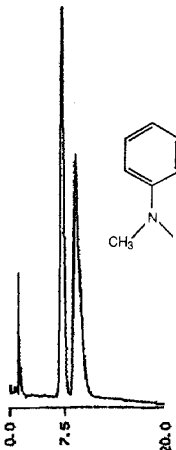
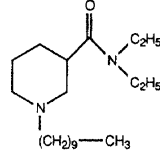
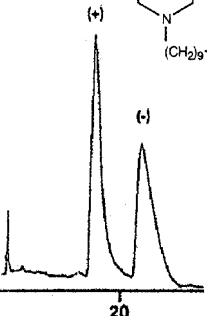
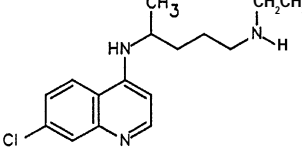
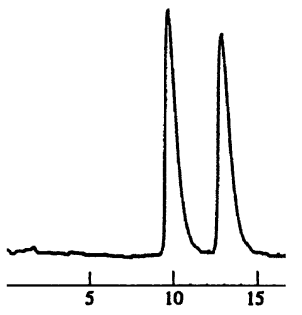
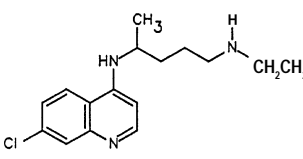
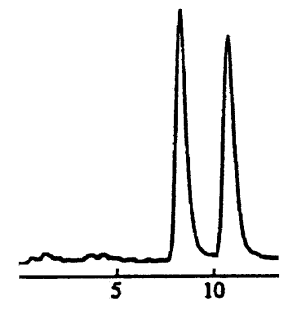
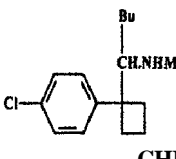
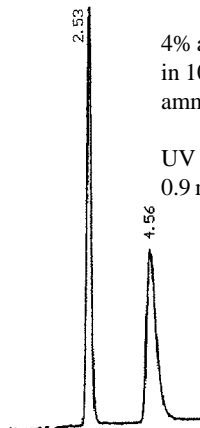
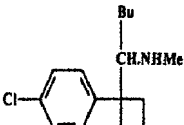

Applications on CHIRAL-AGP

<p>N-benzoyl-DL-alanine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM sod. ph.b.pH 5.5</p> <p>UV 210 nm 0.9 ml/min</p>	<p>N-benzoyl-2-methylserine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>20 mM amm.acet.b.pH 4.1</p> <p>UV 225 nm 0.8 ml/min</p>	<p>N-benzoyl-DL-valine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 2-propanol in 10 mM sod. ph.b.pH 5.0</p> <p>UV 200 nm 0.9 ml/min</p>	<p>α,α'-bis(3-(N-benzyl-N-methylcarbamoyl)-piperidino)-p-xylene dihydrobromide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% ethanol in 25 mM sod. ph.b.pH 7.0+25 mM TBAHSO₄</p> <p>UV 225 nm 1.0 ml/min</p> 
<p>2-Benzyl-2-(dimethylamino)-4'-morpholinobutyrophenone</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% acetonitrile in 20 mM amm.ac.b. pH 5.0</p> <p>UV 225 nm 0.8 ml/min</p>	<p>Beraprost sodium</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% acetonitrile in 20 mM Na₂HPO₄ pH 7.0 Fluorescence Ex=282 nm Em=304 nm, 1.0 ml/min</p>	<p>Bisdesethyl-chloroquine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol + 1% acetonitrile + 5 mM DMOA in 50 mM sod. ph.b.pH 7.0</p> <p>Fluorescence 1.0 ml/min 35°C</p>	<p>N-t-BOC-DL-valine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% acetonitrile in 10 mM sod. ph.b.pH 5.0</p> <p>UV 200 nm 0.9 ml/min</p>
<p>Bumadizon</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% acetonitrile in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Bunolol</p>   <p>CHIRAL-AGP 150x4.0 mm</p> <p>2% 2-propanol in 10 mM ph.b. pH 7.0 + 1 mM DMOA UV 223 nm, 0.9 ml/min</p>	<p>Bupivacaine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 50 mM pot. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Bupranolol</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% 2-propanol in 40 mM amm.ac.b. pH 4.1 (total acetate conc.=190 mM)</p> <p>UV 225 nm 0.9 ml/min</p>

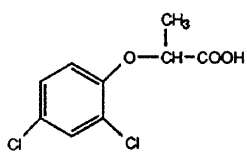
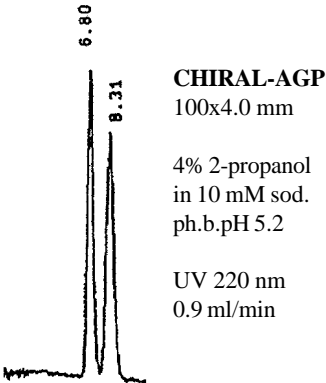
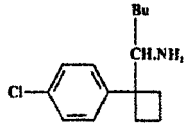
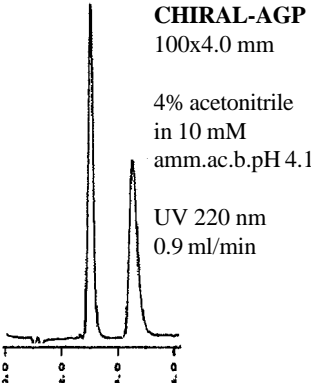
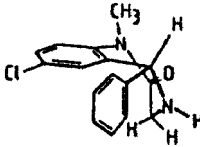
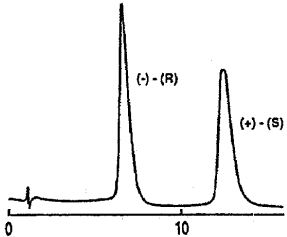
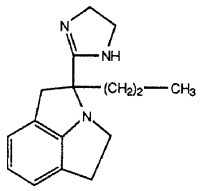
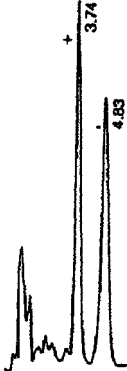
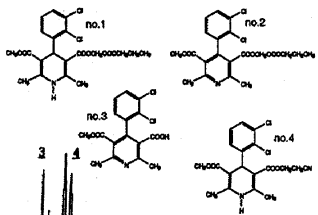
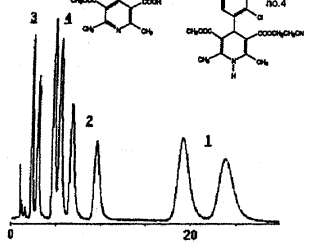
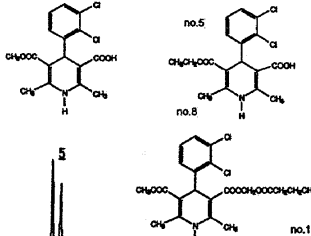
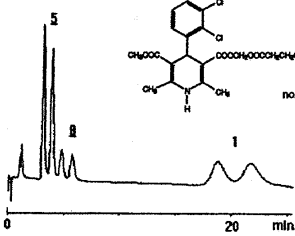
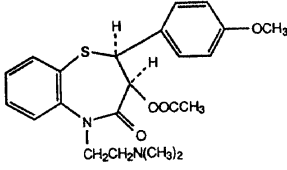
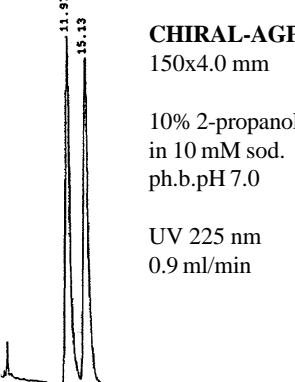
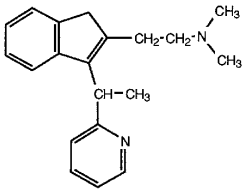
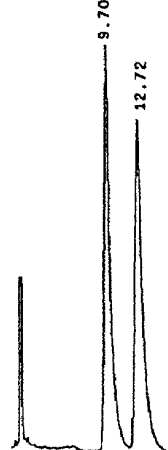
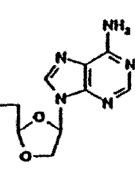
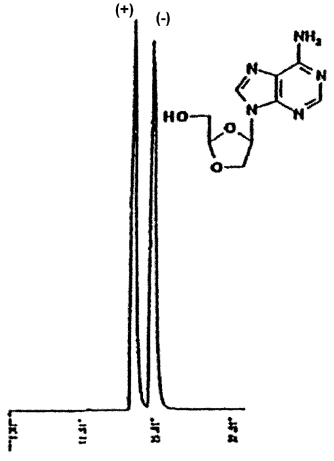
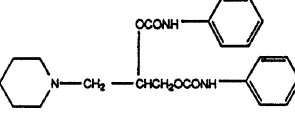
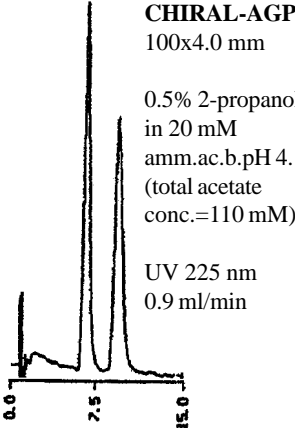
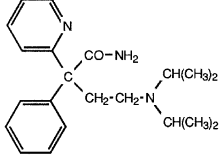
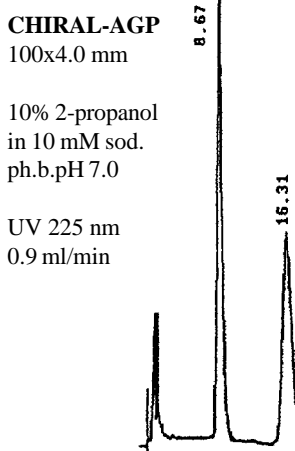
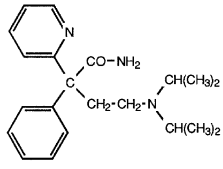
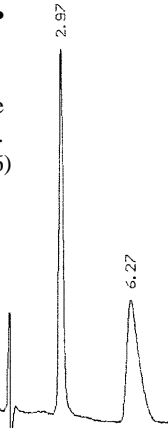
Applications on CHIRAL-AGP

<p>Bupropion</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% 2-propanol in 10 mM amm. ac.b. pH 5.0 (tot. acetate conc. 15 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Carazolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% 2-propanol in 4.9 mM amm.ac.b. pH 4.1 (total acetate conc.=25 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Carprofen</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 2-propanol and 5 mM DMOA in 10 mM sod.ph.b. pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>cis-trans-Cavinton</p>  <p>CHIRAL-AGP 50x4.0 mm 35% acetonitrile in 10 mM sod.ph.b. pH 6.0 UV 225 nm, 0.9 ml/min</p> 
<p>Chlophedianol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod.ph.b. pH 6.6</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Chloroquine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>6% 2-propanol in 94 mM sod.ph.b. pH 7.0</p> <p>UV 220 nm 0.9 ml/min</p> 	<p>Chlortalidone</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% acetonitrile in 10 mM sod.ph.b. pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Citalopram</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>50 mM amm.ac.b.+ 3 mM TEA pH 5.0</p> <p>UV 220 nm 0.8 ml/min</p> 
<p>Clenbuterol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.acat.b. pH 5.0 (total acetate conc.=15 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Cloperastine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% acetonitrile in 10 mM sod.ac.b. pH 4.0 (tot. acetate conc. 60 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Clopidogrel hydrogen sulphate</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>17% acetonitrile in 7 mM amm.ac.b. pH 6.2</p> <p>UV 225 nm 0.8 ml/min</p> 	<p>Cloprostenoil</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% acetonitrile in 20 mM amm.ac.b. pH 4.0</p> <p>UV 210 nm 0.9 ml/min</p> 

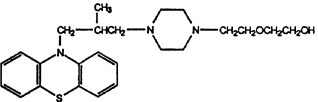
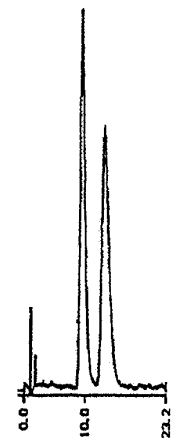
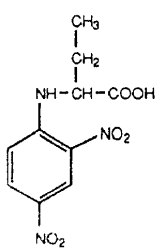
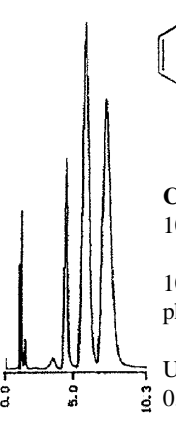
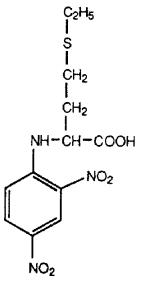
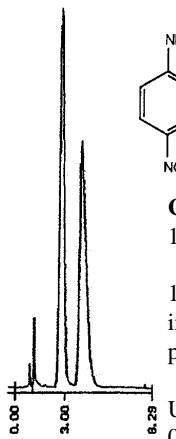
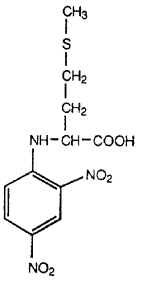
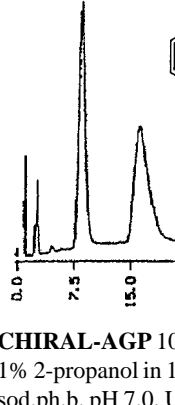
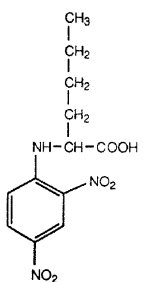

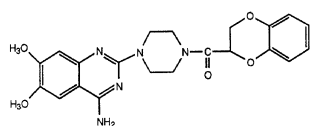
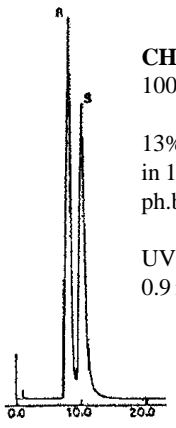
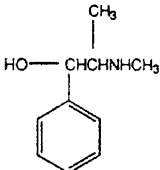
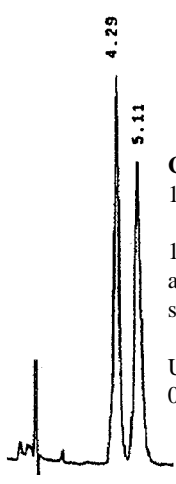
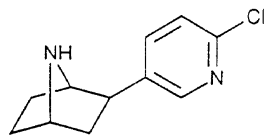
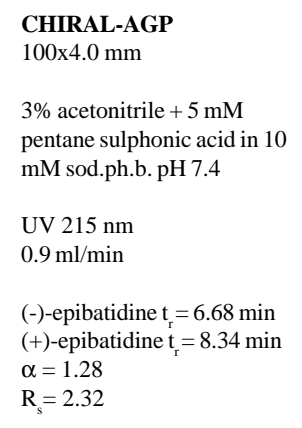
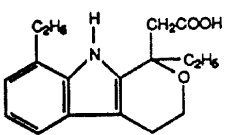
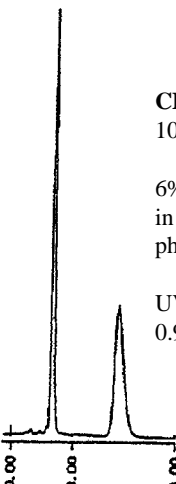
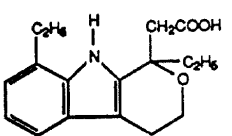
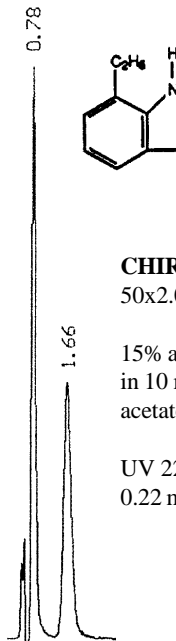
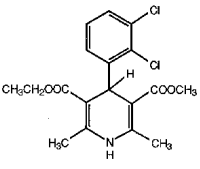
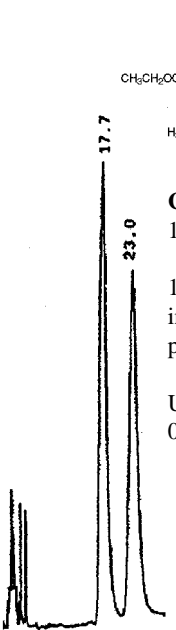
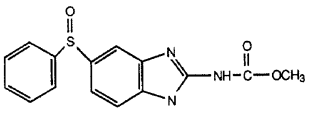
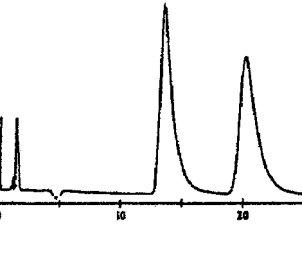
Applications on CHIRAL-AGP

<p>Cyamemazine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.acat.b. pH 4.0 (total acetate conc.=60 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Cyamemazine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>15% acetonitrile in 10 mM sod.ph.b. pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Cyamemazine</p>  <p>CHIRAL-AGP 50x2.0 mm</p> <p>4% acetonitrile in 10 mM amm.ac.b. pH 4.0</p> <p>UV 225 nm 0.22 ml/min</p> 	<p>Cyclopentolate</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>4% 1-propanol in 10 mM sod.ph.b. pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>Cyclandelate</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>15% 2-propanol in 10 mM sod.ph.b. pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Cyclophosphamide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM phosph.b pH 7.0</p> <p>UV 195 nm 0.9 ml/min</p> 	<p>Dansyl-D,L-valine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod.ph.b.pH 5.0, UV 200 nm, 0.9 ml/min</p> 	<p>1-Decyl-3-(N,N-diethyl-carbamoyl)-piperidine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% ethanol in 25 mM sod.ph.b. pH 7.0 + 25 mM TBAHSO₄ UV 225 nm, 1.0 ml/min</p> 
<p>Desethylchloroquine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol + 1% acetonitrile + 5 mM DMOA in 50 mM sod. ph.b.pH 7.0 Fluorescence, 1.0 ml/min, 35°C</p> 	<p>Desethylhydroxychloroquine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol + 1% acetonitrile + 5 mM DMOA in 50 mM sod. ph.b.pH 7.0 Fluorescence, 1.0 ml/min, 35°C</p> 	<p>Desmethylsibutramine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>4% acetonitrile in 10 mM amm.ac.b.pH 4.1</p> <p>UV 220 nm 0.9 ml/min</p> 	<p>Desmethylsibutramine</p>  <p>CHIRAL-AGP 50x4.0 mm</p> <p>5% acetonitrile in 10 mM amm.ac.b.pH 4.1</p> <p>UV 220 nm 0.51 ml/min</p> 

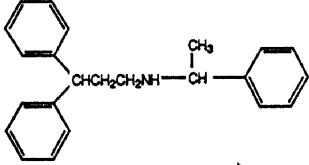
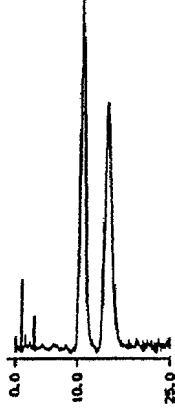
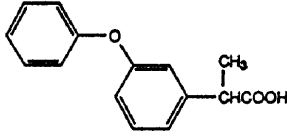
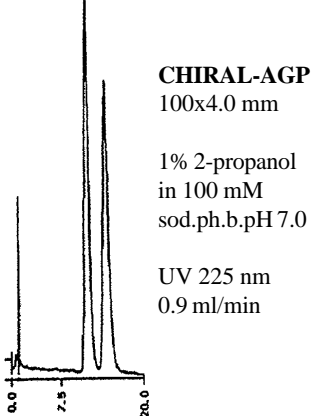
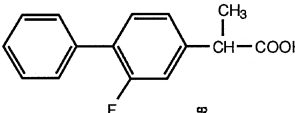
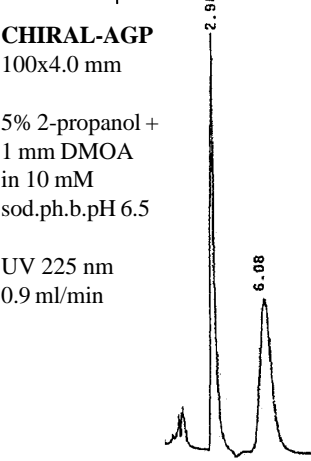
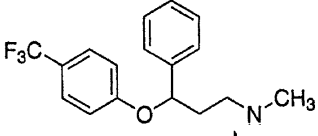
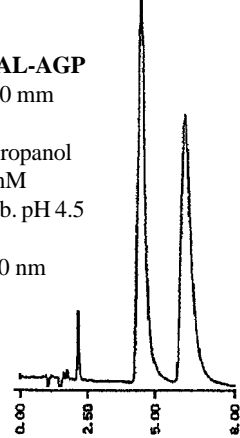
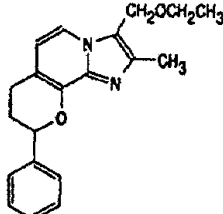
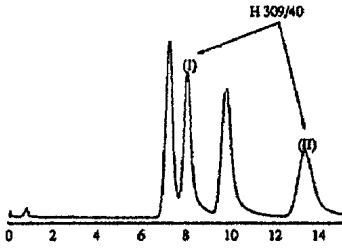
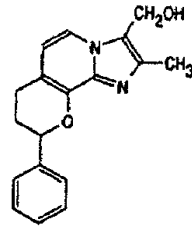
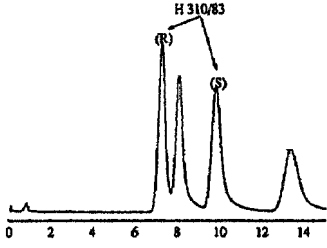
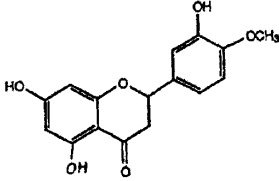
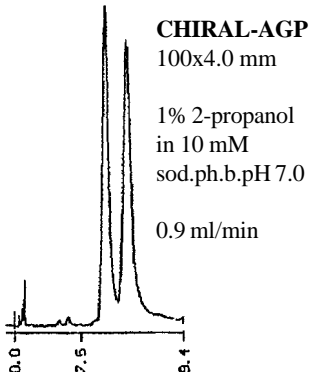
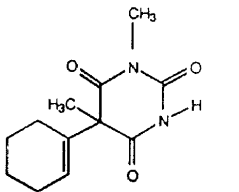
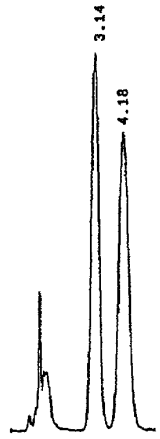
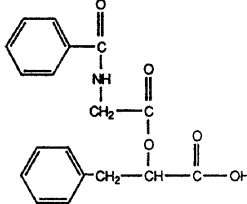
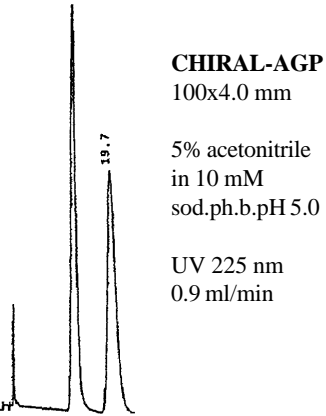
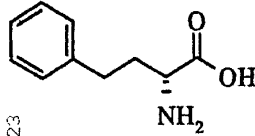
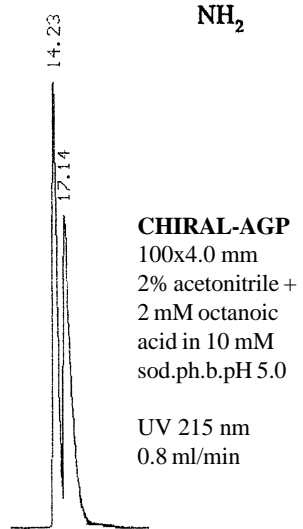
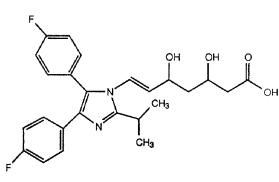
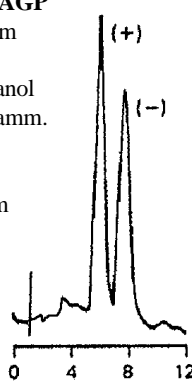
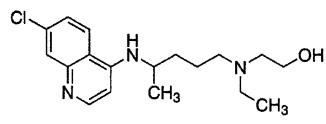
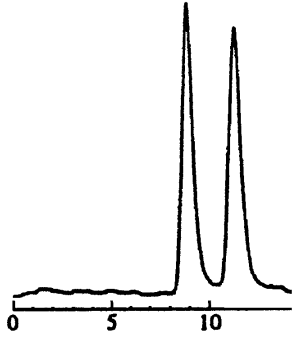
Applications on CHIRAL-AGP

<p>2-(2,4-Dichlorophenoxy)-propionic acid</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>4% 2-propanol in 10 mM sod. ph.b.pH 5.2</p> <p>UV 220 nm 0.9 ml/min</p>	<p>Didesmethyisbutramine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>4% acetonitrile in 10 mM amm.ac.b.pH 4.1</p> <p>UV 220 nm 0.9 ml/min</p>	<p>Dihydrodiazepam</p>   <p>CHIRAL-AGP 100x4.0 mm 10% acetonitrile in 10 mM phosph.b. pH 7.0</p>	<p>2-(4,5-Dihydro-1H-imidazol-2-yl)-2-propyl-1, 2,3,4-tetrahydropyrrolo-(3,2,1-hi)-indole</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% acetonitrile in 50 mM KH₂PO₄ pH 6.1</p> <p>UV 240 nm 0.9 ml/min</p>
<p>Dihydropyridines</p>   <p>CHIRAL-AGP 100x4.0 mm 25% methanol in 10 mM phosph.b. pH 4.51 UV 242 nm, 1 ml/min</p>	<p>Dihydropyridines</p>   <p>CHIRAL-AGP 100x4.0 mm 4% acetonitrile and 18% methanol in 10 mM phosph.b. pH 5.5, UV 242 nm</p>	<p>Diltiazem</p>   <p>CHIRAL-AGP 150x4.0 mm</p> <p>10% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Dimethindene</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>8% 2-propanol in 10 mM sod. ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p>
<p>Dioxolone nucleoside</p>   <p>CHIRAL-AGP 200x4.0 mm (2 100x4.0 mm columns) 20 mM sod.ph.b. pH 7.0</p>	<p>Diperodone</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% 2-propanol in 20 mM amm.ac.b.pH 4.1 (total acetate conc.=110 mM)</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Disopyramide</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Disopyramide</p>   <p>CHIRAL-AGP 50x2.0 mm</p> <p>15% acetonitrile in 10 mM amm. acetate (pH 6.6)</p> <p>UV 225 nm 0.22 ml/min</p>

Applications on CHIRAL-AGP

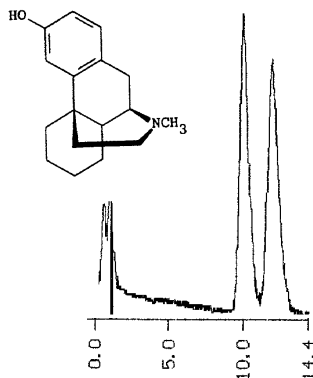
<p>Dixyrazine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% acetonitrile in 10 mM sod.ac.b.pH 4.0 (total acetate conc.=60 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>N-2,4-DNP-D,L-α-amino-n-butyrac acid</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>100 mM sod. ph.b.pH 6.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>N-2,4-DNP-D,L-ethionine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>N-2,4-DNP-D,L-methionine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.ph.b. pH 7.0, UV 210 nm</p> 
<p>N-2,4-DNP-D,L-norleucine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Doxazosine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>13% acetonitrile in 10 mM sod. ph.b.pH 7.25</p> <p>UV 254 nm 0.9 ml/min</p> 	<p>Ephedrine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1 mM octanoic acid in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Epibatidine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% acetonitrile + 5 mM pentane sulphonic acid in 10 mM sod.ph.b. pH 7.4</p> <p>UV 215 nm 0.9 ml/min</p> <p>(-)-epibatidine $t_r = 6.68$ min (+)-epibatidine $t_r = 8.34$ min $\alpha = 1.28$ $R_s = 2.32$</p> 
<p>Etodolac</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>6% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Etodolac</p>  <p>CHIRAL-AGP 50x2.0 mm</p> <p>15% acetonitrile in 10 mM amm. acetate.(pH 6.6)</p> <p>UV 225 nm 0.22 ml/min</p> 	<p>Felodipine</p>  <p>CHIRAL-AGP 150x4.0 mm</p> <p>12% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Fenbendazole sulphoxide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>8 mM sod.ph.b. pH 7.0 UV 210 nm, 0.9 ml/min</p> 

Applications on CHIRAL-AGP

<p>Fendiline</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% acetonitrile in 10 mM sod.ac.b.pH 4.1 (total acetate conc.= 60 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Fenopropfen</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 100 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Flurbiprofen</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol + 1 mm DMOA in 10 mM sod.ph.b.pH 6.5</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Fluoxetine (Prozac)</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.ac.b. pH 4.5</p> <p>UV 220 nm</p> 
<p>H309/40</p>   <p>CHIRAL-AGP 100x4.0 mm 10% acetonitrile in phosph.b. pH 7.5 (ionic strength = 0.01), 40°C</p>	<p>H310/83</p>   <p>CHIRAL-AGP 100x4.0 mm 10% acetonitrile in phosph.b. pH 7.5 (ionic strength = 0.01), 40°C</p>	<p>Hesperitin</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>0.9 ml/min</p>	<p>Hexobarbital</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>2% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>
<p>Hippuryl-phenyllactic acid</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% acetonitrile in 10 mM sod.ph.b.pH 5.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Homophenylalanine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>2% acetonitrile + 2 mM octanoic acid in 10 mM sod.ph.b.pH 5.0</p> <p>UV 215 nm 0.8 ml/min</p>	<p>HMG-CoA reductase inhibitor</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>2% 2-propanol in 20 mM amm. ac.b</p> <p>UV 285 nm</p>	<p>Hydroxychloroquine</p>   <p>CHIRAL-AGP 100x4.0 mm 5% 2-propanol + 1% acetonitrile + 5 mM DMOA in 50 mM sod. ph.b.pH 7.0</p> <p>Fluorescence, 1.0 ml/min, 35°C</p>

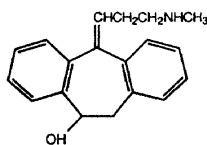
Applications on CHIRAL-AGP

3-Hydroxy-N-methylmorphinan (Levorphanol + Dextrorphanol)



CHIRAL-AGP 100x4.0 mm
4% acetonitrile in 100 mM
sod.ph.b. pH 7.0
UV 220 nm, 0.9 ml/min

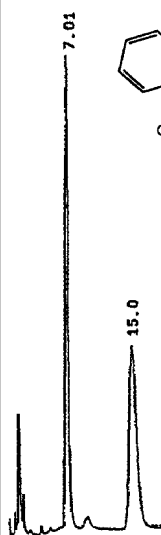
E-10--Hydroxy-nortriptyline



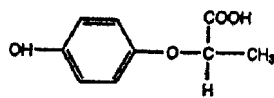
CHIRAL-AGP
100x4.0 mm

7.5% 2-propanol
in 10 mM
sod.ph.b. pH 6.0

UV 225 nm
0.9 ml/min



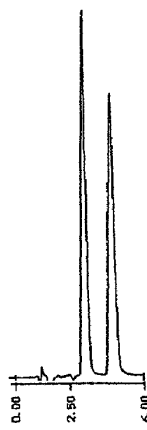
2-(p-Hydroxy-phenoxy)-propionic acid



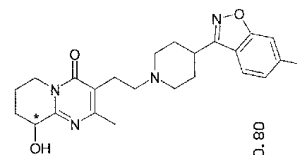
CHIRAL-AGP
100x4.0 mm

10 mM sod.ac.b.
pH 4.5

UV 225 nm
0.9 ml/min



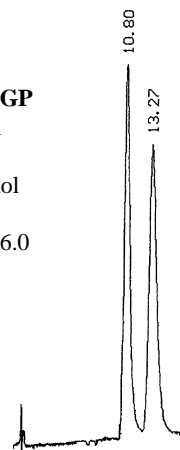
9-Hydroxyrisperidone



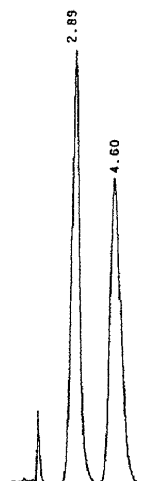
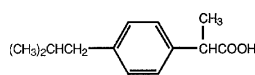
CHIRAL-AGP
100x4.0 mm

2% 2-propanol
in 10 mM
sod.ph.b. pH 6.0

UV 275 nm
0.8 ml/min



Ibuprofen

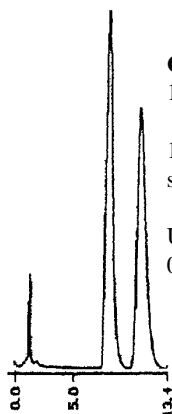
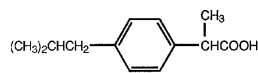


CHIRAL-AGP
100x4.0 mm

1 mM DMOA
in 10 mM
sod.ph.b. pH 7.0

UV 225 nm
0.9 ml/min

Ibuprofen

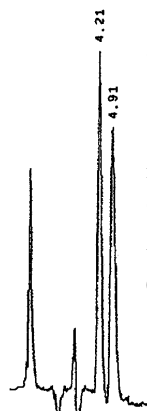
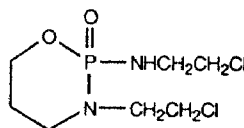


CHIRAL-AGP
100x4.0 mm

100 mM
sod.ph.b. pH 7.0

UV 225 nm
0.9 ml/min

Ifosfamide

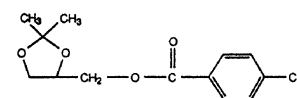


CHIRAL-AGP
100x4.0 mm

1% 2-propanol
in 10 mM
sod.ph.b. pH 7.0

UV 195 nm
0.9 ml/min

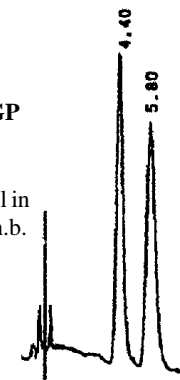
Isopropylidenglycerol-4-methylester



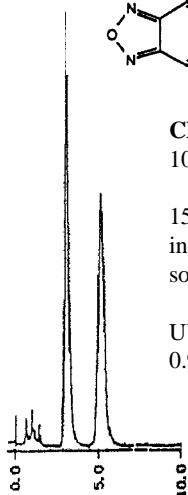
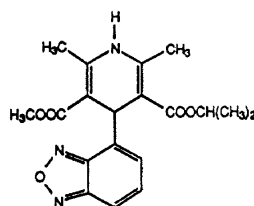
CHIRAL-AGP
100x4.0 mm

6% 2-propanol in
10 mM sod.ph.b.
pH 7.0

UV 225 nm
0.9 ml/min



Isradipine

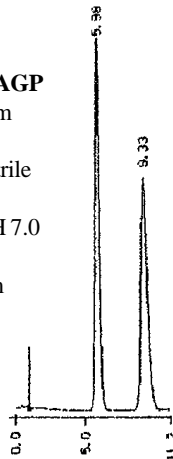
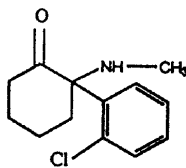


CHIRAL-AGP
100x4.0 mm

15% 2-propanol
in 30 mM
sod.ph.b. pH 6.8

UV 225 nm
0.9 ml/min

Ketamine

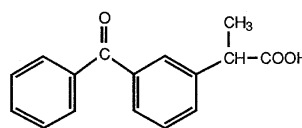


CHIRAL-AGP
100x4.0 mm

7% acetonitrile
in 100 mM
sod.ph.b. pH 7.0

UV 225 nm
0.9 ml/min

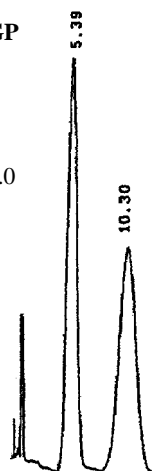
Ketoprofen



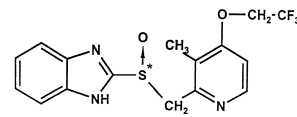
CHIRAL-AGP
100x4.0 mm

1 mM DMOA
in 10 mM
sod.ph.b. pH 7.0

UV 225 nm
0.9 ml/min



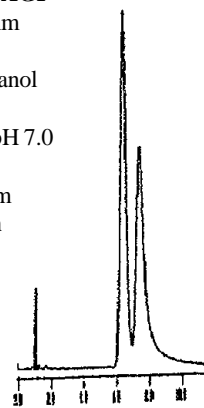
Lanzoprazol



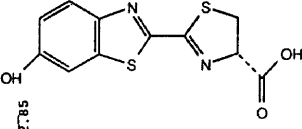
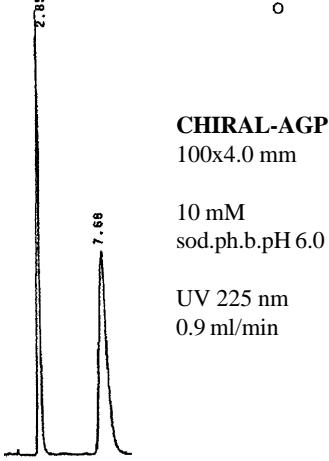
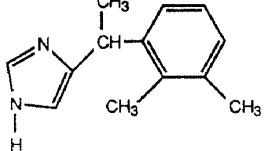
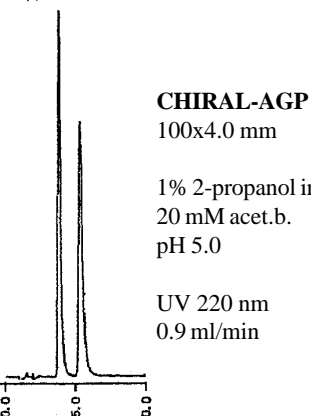
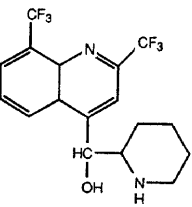
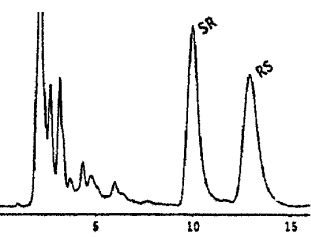
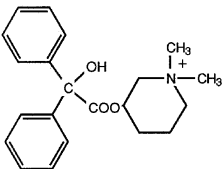
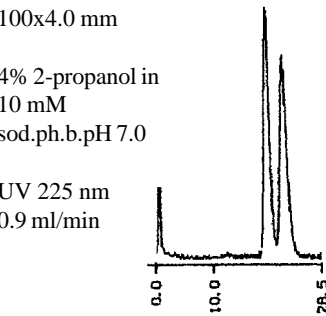
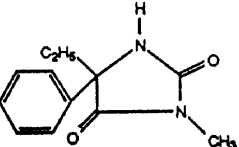
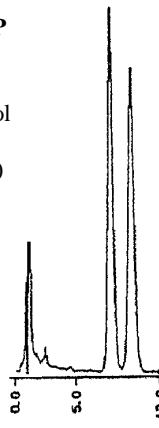
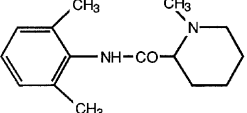
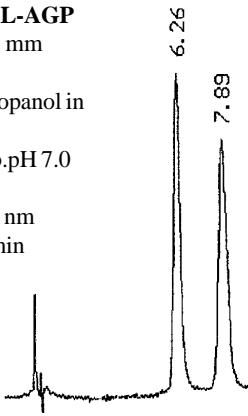
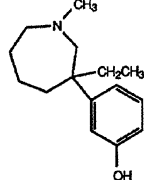
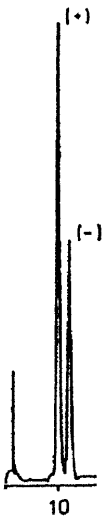
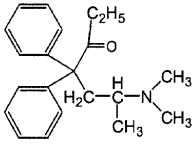
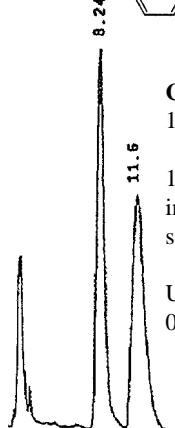
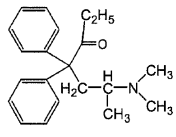
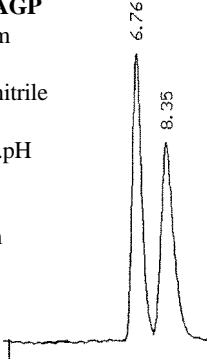
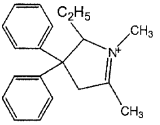
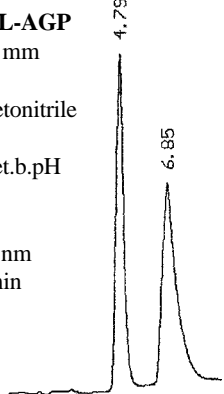
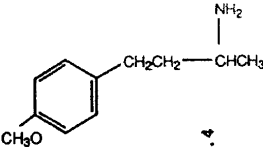
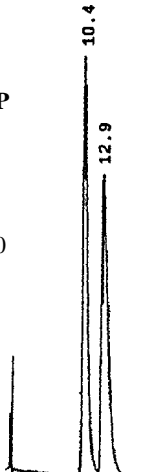
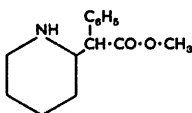
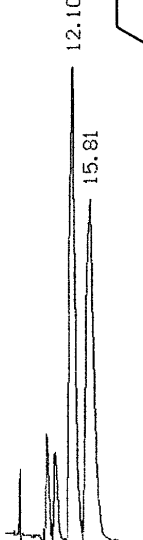
CHIRAL-AGP
100x4.0 mm

6% 2-propanol
in 10 mM
sod.ph.b. pH 7.0

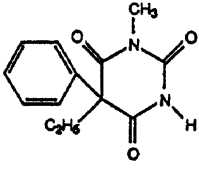
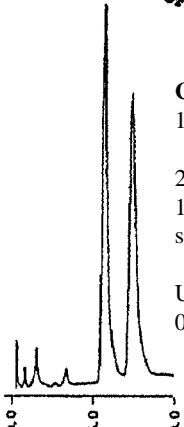
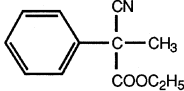
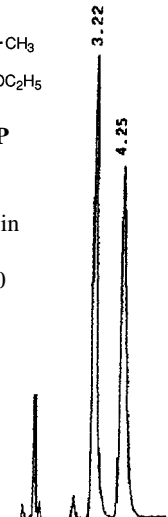
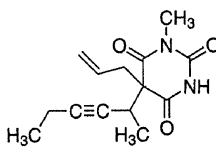

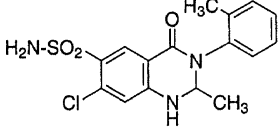
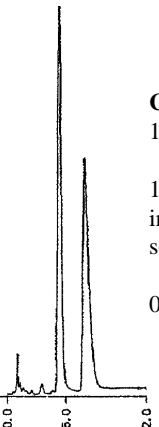
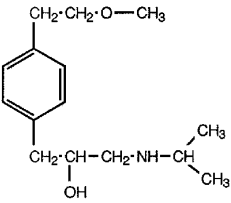
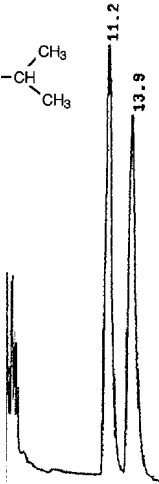
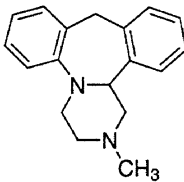
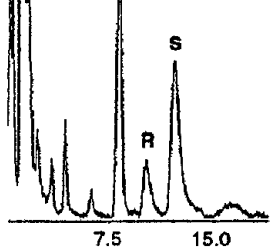
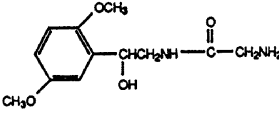
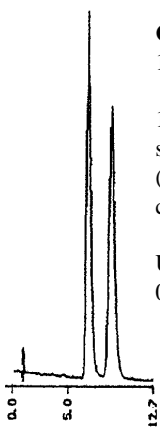
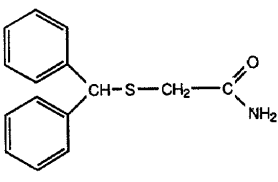
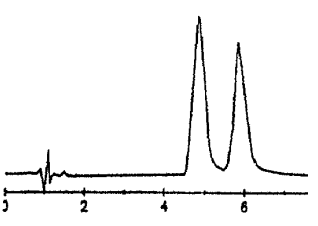
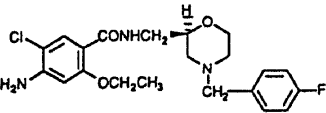
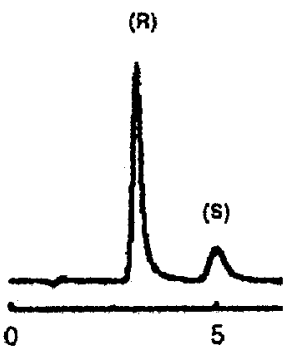
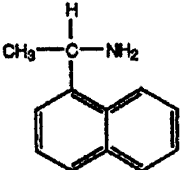
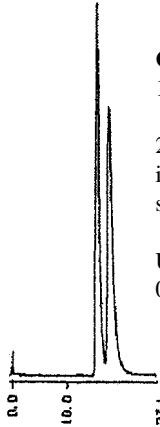
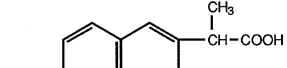
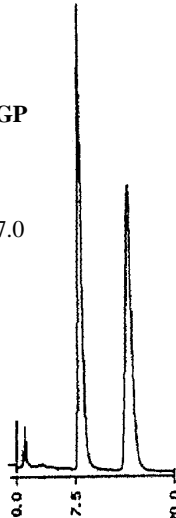
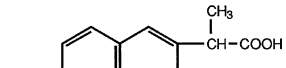
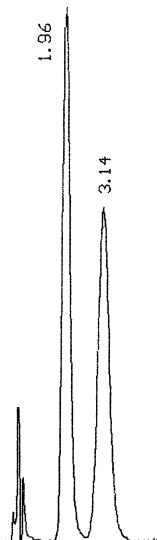
UV 283 nm
0.9 ml/min



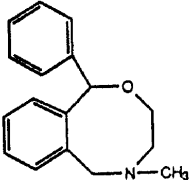
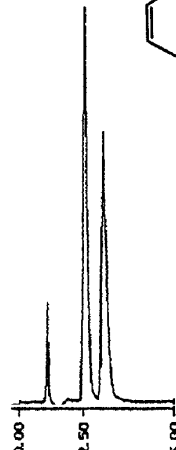
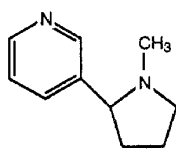
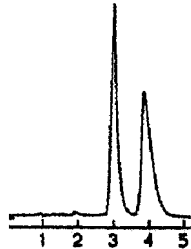
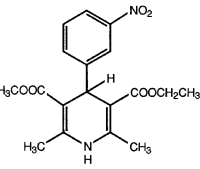
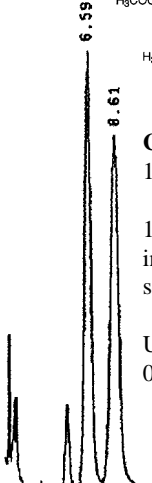
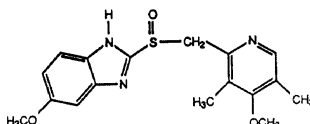
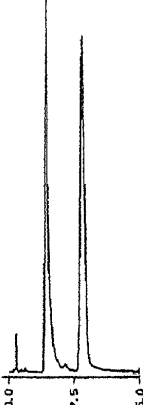
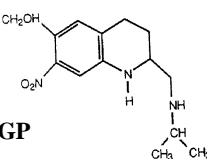
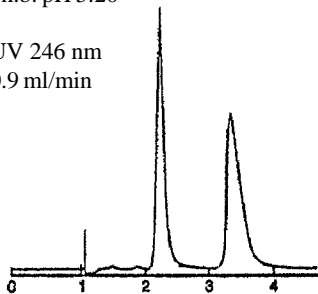
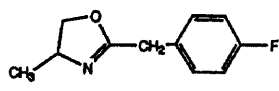
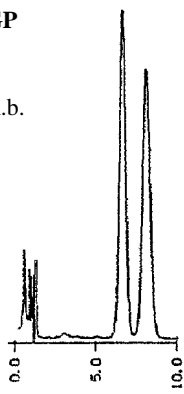
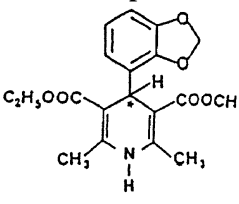
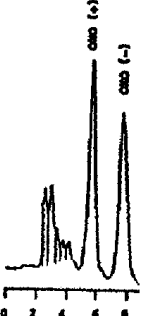
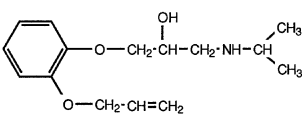
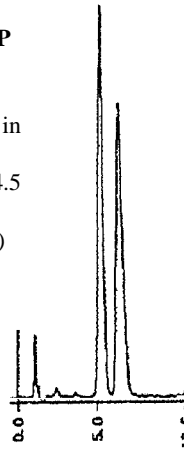
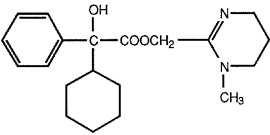
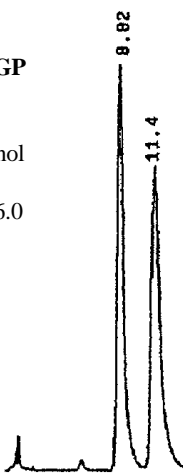
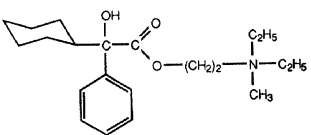

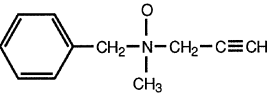
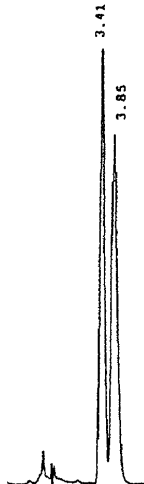
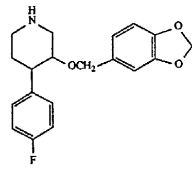
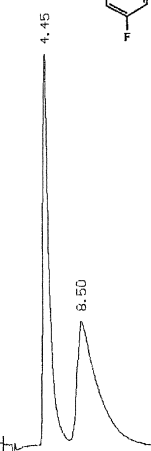
Applications on CHIRAL-AGP

<p>Luciferin</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM sod.ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Medetomidine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 20 mM acet.b. pH 5.0</p> <p>UV 220 nm 0.9 ml/min</p>	<p>Mefloquine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 1-propanol in 50 mM sod.ph.b. pH 4.85</p> <p>UV 222 nm, 0.9 ml/min</p>	<p>Mepenzolate bromide</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>4% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>
<p>Mephénytoin</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.3% 1-propanol in 100 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Mepivacaine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>9% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Meptazinol</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% acetonitrile in 10 mM phosph.b.pH 7.0</p>	<p>Methadone</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 10 mM sod.ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p>
<p>Methadone</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>2.5% acetonitrile in 5 mM amm.acet.b.pH 4.1</p> <p>UV 225 nm 0.8 ml/min</p>	<p>Methadone metabolite (EDDP)</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>2.5% acetonitrile in 5 mM amm.acet.b.pH 4.1</p> <p>UV 225 nm 0.8 ml/min</p>	<p>1-(p-Methoxyphenyl)-3-butylamine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% acetonitrile in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Methylphenidate</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM amm.acetate (pH 5.5)</p> <p>UV 210 nm 0.8 ml/min</p>

Applications on CHIRAL-AGP

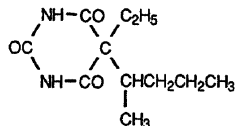
<p>Methylphenobarbital</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>2% 2-propanol in 100 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Methylphenylcyanoacetic acid ethyl ester</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>7% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Methohexital</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 10 mM sod.ph.b.pH 6.0</p> <p>UV 195 nm 0.9 ml/min</p> 	<p>Metolazone</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>0.9 ml/min</p> 
<p>Metoprolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Mianserin</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>6% acetonitrile in 20 mM pot.ph.b. pH 5.30</p> <p>UV 214 nm, 0.9 ml/min</p> 	<p>Midodrine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM sod.acet.b.pH 6.0 (total acetate conc.=11 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Modafinil</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.1% 1-pentanol in 100 mM amm.acet.b. pH 6.75</p> <p>UV 267 nm, 1.0 ml/min</p> 
<p>Mosapride</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>30% methanol in acetate buffer pH 4.0</p> 	<p>1-(1-Naphthyl)-ethylamine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>2.5% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Naproxen</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>25 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Naproxen</p>  <p>CHIRAL-AGP 50x2.0 mm</p> <p>1% acetonitrile in 10 mM amm.acetate (pH 6.6)</p> <p>UV 225 nm 0.22 ml/min</p> 

Applications on CHIRAL-AGP

<p>Nefopam</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.acet.b.pH 4.5 (total acetate conc. = 25 mM)</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Nicotine</p>   <p>CHIRAL-AGP 100x4.0 mm For conditions see ref A.93</p>	<p>Nitrendipine</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Omeprazole</p>   <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% acetonitrile in 10 mM sod.ph.b.pH 6.5</p> <p>UV 210 nm 0.9 ml/min</p>
<p>Oxamniquine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.6% acetonitrile in 10 mM sod. ph.b. pH 5.20</p> <p>UV 246 nm 0.9 ml/min</p> 	<p>Oxazoline</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM sod.ph.b. pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Oxidipine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>7% 2-propanol in 10 mM phosph.b.pH 7.4</p> <p>UV 236 nm 1.0 ml/min</p> 	<p>Oxprenolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.acet.b.pH 4.5 (total acetate conc. = 25 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>Oxyphencyclimine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 1-propanol in 10 mM sod.ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Oxyphenonium</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% 2-propanol in 20 mM sod.ph.b. pH 6.9+50 DAS</p> 	<p>Pargyline N-oxide</p>  <p>CHIRAL-AGP 150x4.0 mm</p> <p>10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Paroxetine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>2% acetonitrile in 20 mM amm.acet.b.pH 4.25</p> <p>UV 295 nm 0.9 ml/min</p> 

Applications on CHIRAL-AGP

Pentobarbitone

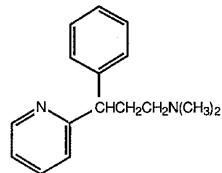


CHIRAL-AGP

100x4.0 mm

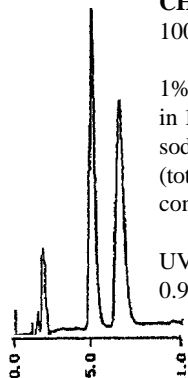
4.5% 2-propanol
in 100 mM
phosph.b.pH 6.2

Pheniramine

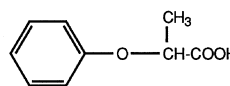


CHIRAL-AGP

100x4.0 mm

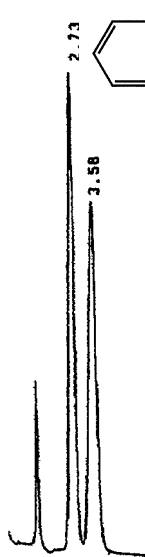
1% acetonitrile
in 10 mM
sod.acet.b.pH 5.0
(total acetate
conc. = 15 mM)UV 210 nm
0.9 ml/min

2-Phenoxypropionic acid

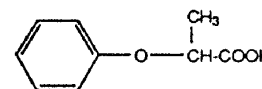


CHIRAL-AGP

100x4.0 mm

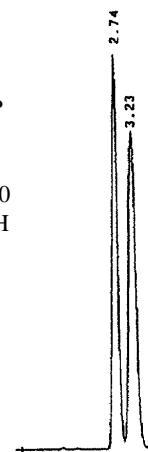
10 mM
sod.ph.b.pH 5.5UV 225 nm
0.9 ml/min

2-Phenylbutyric acid

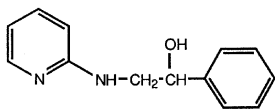


CHIRAL-AGP

100x4.0 mm

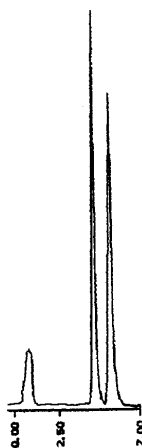
6% ethanol in 10
mM sod.ph.b.pH
5.1UV 225 nm
0.9 ml/min

Phenylamidol

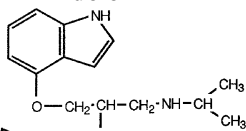


CHIRAL-AGP

100x4.0 mm

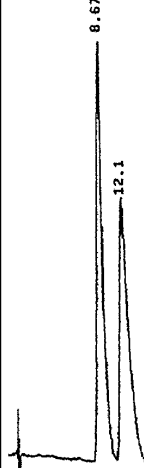
4% THF in 10
mM sod.ph.b.pH
7.0UV 225 nm
0.9 ml/min

Pindolol

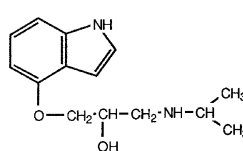


CHIRAL-AGP

100x4.0 mm

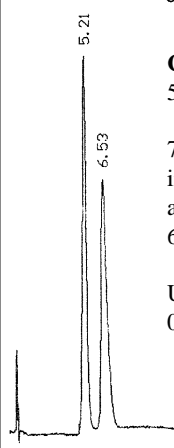
10% acetonitrile
in 10 mM
sod.ph.b.pH 7.0UV 225 nm
0.9 ml/min

Pindolol

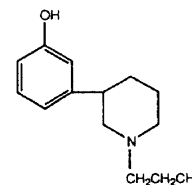


CHIRAL-AGP

50x2.0 mm

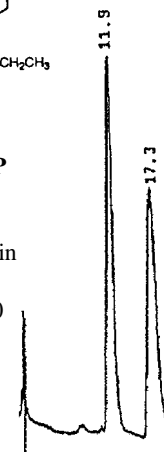
7% acetonitrile
in 10 mM
amm.acetate (pH
6.6)UV 225 nm
0.22 ml/min

3-PPP

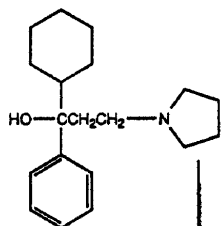


CHIRAL-AGP

100x4.0 mm

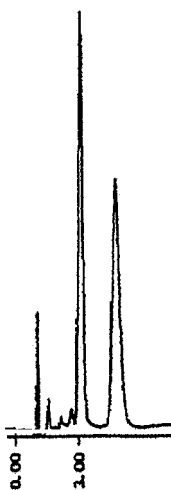
2% 1-propanol in
10 mM
sod.ph.b.pH 7.0UV 225 nm
0.9 ml/min

Procyclidine

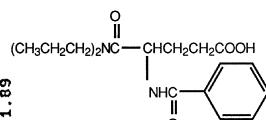


CHIRAL-AGP

100x4.0 mm

5% acetonitrile
in 10 mM
sod.acet.b.pH 4
(total acetate
conc. = 50 mM)UV 210 nm
0.9 ml/min

Proglumide

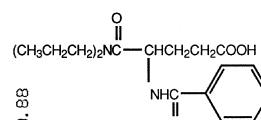


CHIRAL-AGP

100x4.0 mm

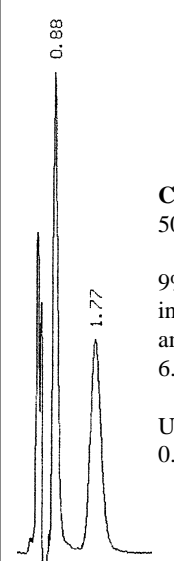
5% 2-propanol in
10 mM
sod.ph.b.pH 6.0UV 225 nm
0.9 ml/min

Proglumide

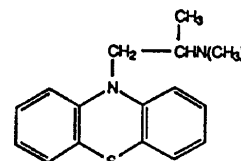


CHIRAL-AGP

50x2.0 mm

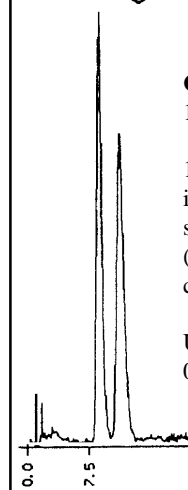
9% acetonitrile
in 10 mM
amm.acet. (pH
6.6)UV 225 nm
0.22 ml/min

Promethazine

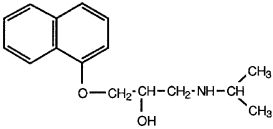
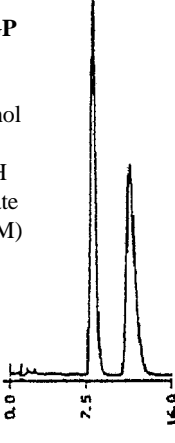
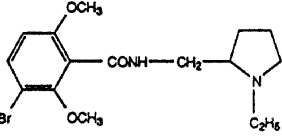
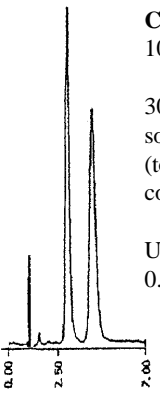
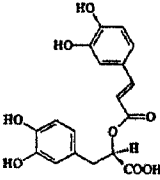
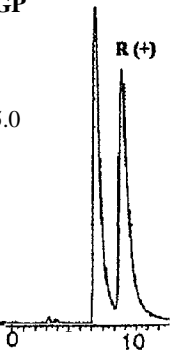
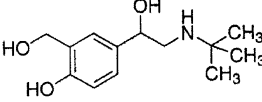
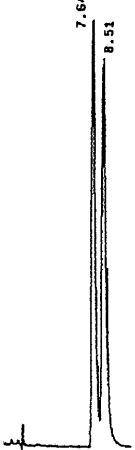
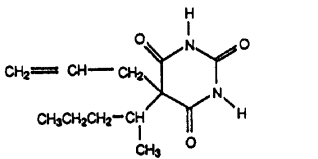
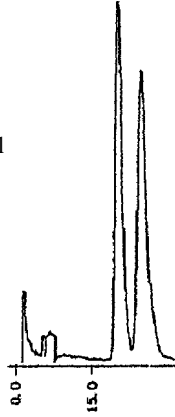
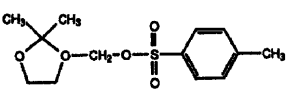
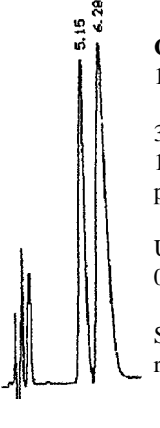
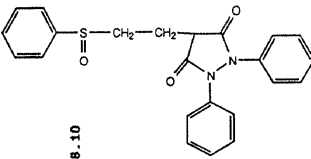
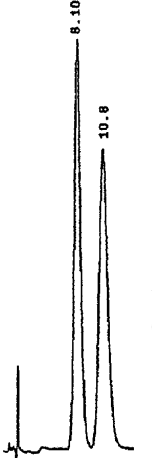
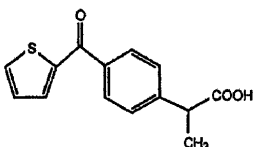
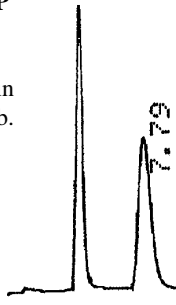

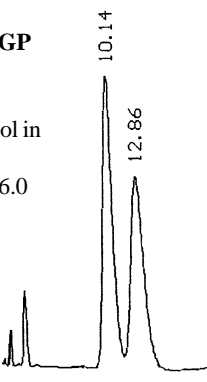
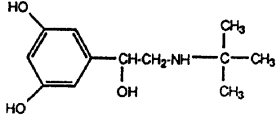
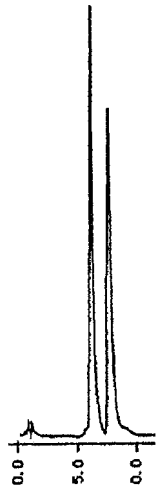
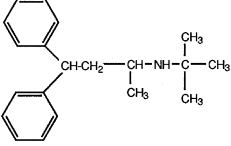
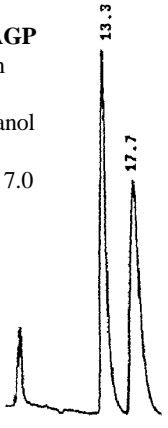
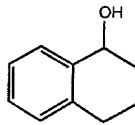
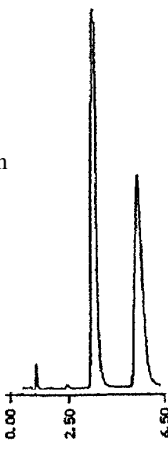


CHIRAL-AGP

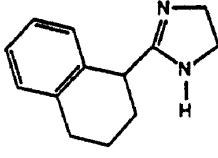
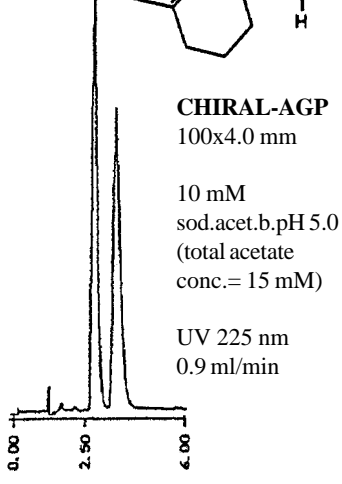
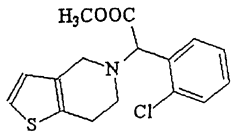
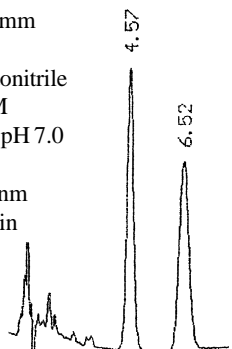
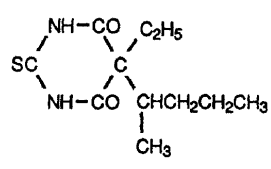

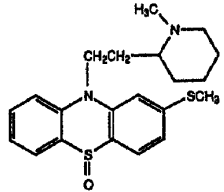
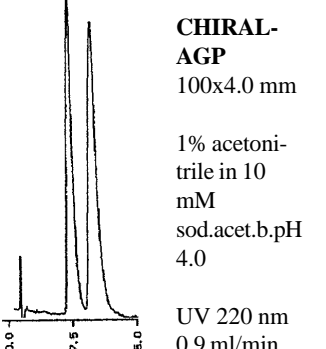
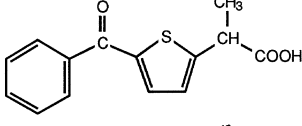
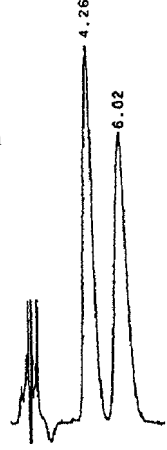
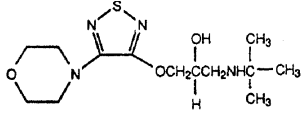
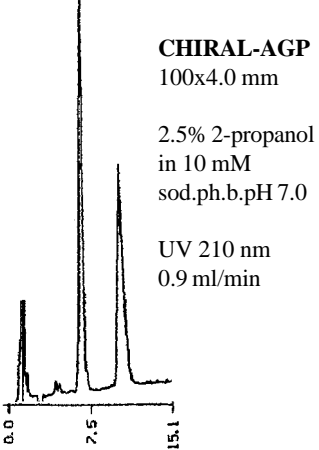
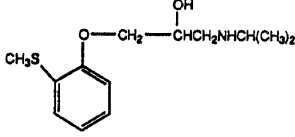
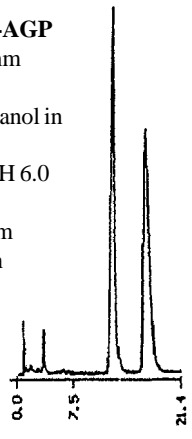
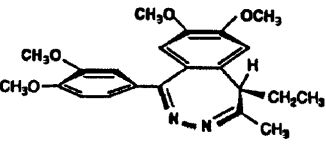
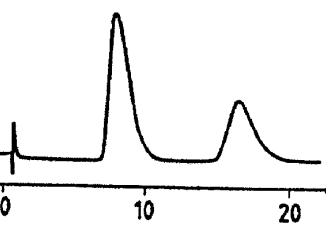
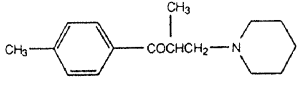
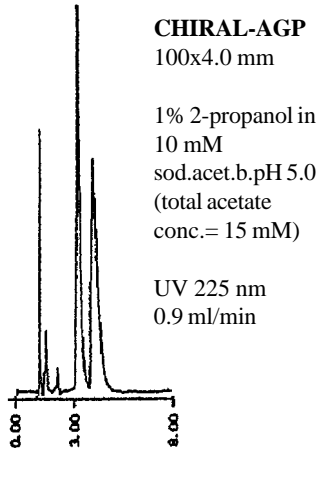
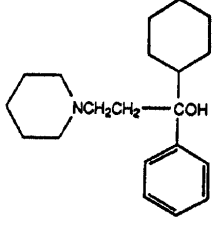
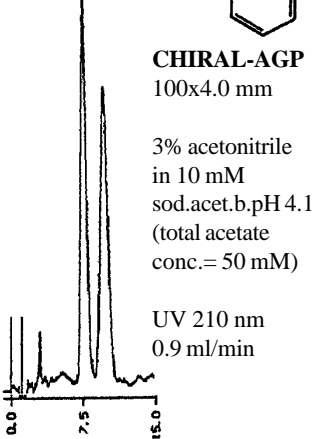
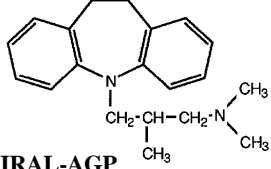
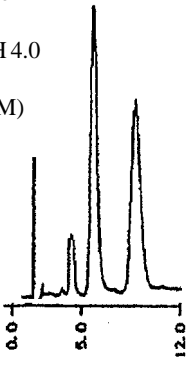
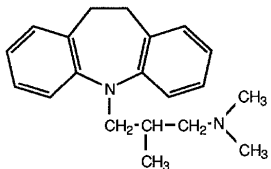
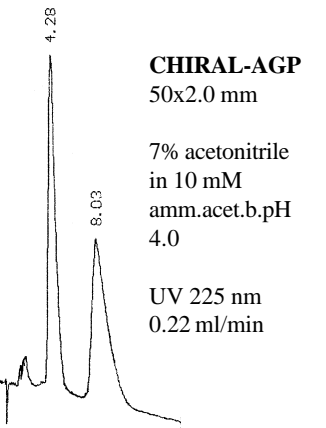
100x4.0 mm

1% acetonitrile
in 10 mM
sod.acet.b.pH 4.0
(total acetate
conc. = 60 mM)UV 225 nm
0.9 ml/min

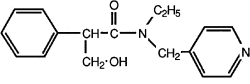
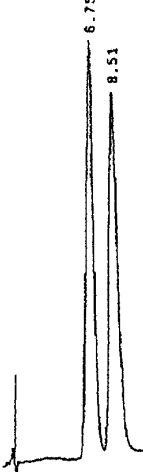
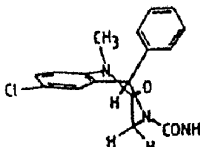
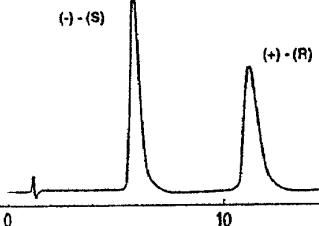
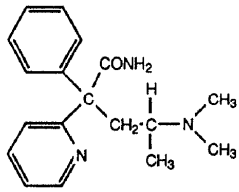
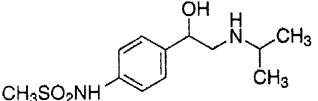
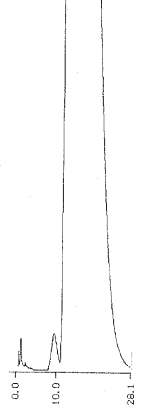
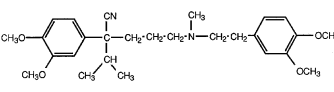
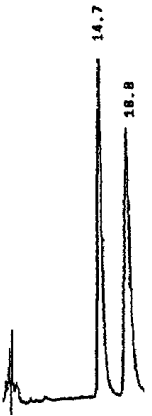
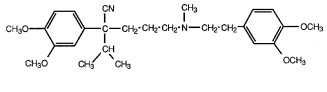
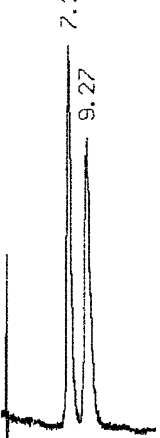
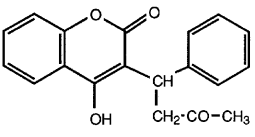
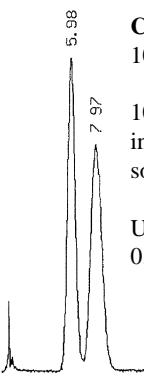
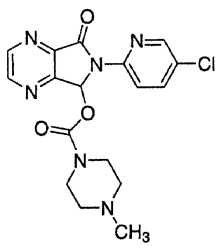

Applications on CHIRAL-AGP

<p>Propranolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.5% 2-propanol in 20 mM amm.acet.b.pH 4.1 (total acetate conc.= 110 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Remoxipride</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>30 mM sod.acet.b.pH 4.0 (total acetate conc.= 170 mM)</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Rosmarinic acid</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>100 mM pot.ph.b.pH 5.0</p> <p>UV 330 nm 0.9 ml/min</p> <p>S (-) R (+)</p> 	<p>Salbutamol</p>  <p>CHIRAL-AGP 150x4.0 mm</p> <p>10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>Secobarbital</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>0.3% 2-propanol in 100 mM sod.ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Solketyl tosylate</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 2-propanol in 10 mM phosph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> <p>Sample not a racemate</p> 	<p>Sulfipyrazon</p>  <p>CHIRAL-AGP 150x4.0 mm</p> <p>3% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Suprofen</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5 mM DMOA in 20 mM pot.ph.b. pH 7.0</p> <p>UV 302 nm</p> 
<p>TCP-D,L-methionine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 2-propanol in 10 mM sod.ph.b.pH 6.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Terbutaline</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Terodiline</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>15% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>1,2,3,4-tetrahydro-1-naphthol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 

Applications on CHIRAL-AGP

<p>Tetrahydrozoline</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10 mM sod.acet.b.pH 5.0 (total acetate conc. = 15 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>4,5,6,7-tetrahydro(3,2-c)-thieno-pyridinyl-5-chloro-phenylacetate</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>20% acetonitrile in 10 mM sod.ph.b.pH 7.0</p> <p>UV 220 nm 0.9 ml/min</p> 	<p>Thiopentone (Penthiobarbital)</p>  <p>CHIRAL-AGP 100x4.0 mm 4.5% 2-propanol in 100 mM phosph.b.pH 6.2</p> 	<p>Thioridazine sulfoxide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% acetonitrile in 10 mM sod.acet.b.pH 4.0</p> <p>UV 220 nm 0.9 ml/min</p> 
<p>Tiaprofenic acid</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 1-propanol in 10 mM sod.ph.b.pH 6.5</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Timolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>2.5% 2-propanol in 10 mM sod.ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Tiprenolol</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% 2-propanol in 10 mM sod.ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Tofisopam</p>  <p>CHIRAL-AGP 100x4.0 mm 5% 2-propanol in 10 mM phosph.b.pH 7.0</p> <p>UV 220 nm</p> 
<p>Tolperisone</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.acet.b.pH 5.0 (total acetate conc. = 15 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Trihexyphenidyl</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% acetonitrile in 10 mM sod.acet.b.pH 4.1 (total acetate conc. = 50 mM)</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Trimipramine</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in 10 mM sod.acet.b.pH 4.0 (total acetate conc. = 60 mM)</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Trimipramine</p>  <p>CHIRAL-AGP 50x2.0 mm</p> <p>7% acetonitrile in 10 mM amm.acet.b.pH 4.0</p> <p>UV 225 nm 0.22 ml/min</p> 

Applications on CHIRAL-AGP

<p style="text-align: center;">Tropicamide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>3% acetonitrile in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p style="text-align: center;">Uxepam</p>  <p>(-) - (S) (+) - (R)</p>  <p>CHIRAL-AGP 100x4.0 mm 10% acetonitrile in 10 mM phosph.b.pH 7.0</p>	<p style="text-align: center;">Vamicamide</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>5% acetonitrile in 20 mM sod.ph.b.pH 6.3</p> <p>UV 260 nm 0.9 ml/min</p> <p>S,S-vamicamide $t_r = 5.9$ min R,R-vamicamide $t_r = 8.34$ min $R_s = 2.7$</p>	<p style="text-align: center;">Valsartan (Purity determination)</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>1% 2-propanol in phosph..b.pH 7.0</p> <p>UV 227 nm 0.8 ml/min</p> 
<p style="text-align: center;">Verapamil</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>12% acetonitrile in 10 mM sod.ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p style="text-align: center;">Verapamil</p>  <p>CHIRAL-AGP 50x2.0 mm</p> <p>9% acetonitrile in 5 mM amm.acet.(pH 6.6)</p> <p>UV 225 nm 0.22 ml/min</p> 	<p style="text-align: center;">Warfarin</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>10% 2-propanol in 10 mM sod.ph.b pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p style="text-align: center;">Zopiclone</p>  <p>CHIRAL-AGP 100x4.0 mm</p> <p>20 mM sod.acet.b.pH 5.0</p> <p>UV 225 nm 0.9 ml/min</p> 

Preparation of mobile phases

The mobile phases used in the Applications are prepared according to the guidelines below.

General:

The buffer salt is weighed into a beaker and distilled water is added. pH is adjusted. (Please note that if a charged modifier is used in the mobile phase, it has to be added before pH is adjusted). The solution is poured into a volumetric flask. The organic modifier is added using Voll-pipettes or weighing. Distilled water is then added to make up the final volume.

Phosphate buffers:

Potassium or sodium salts are normally used. For pH adjustment use diluted potassium or sodium hydroxide.

Acetate buffers:

Sodium or ammonium acetate are normally used. Diluted acetic acid is used for pH adjustment.

In a mobile phase containing an acetate buffer the acetate salt concentration is given together with the total acetate concentration. The total acetate concentration is higher than the acetate salt concentration, since acetic acid is added to adjust the pH.

It is important with a high precision when preparing mobile phases. The retention, selectivity and the resolution are highly affected by the mobile phase composition.

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- | Ref.no. | Author/Journal | Ref.no. | Author/Journal |
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The CHIRAL-CBH column

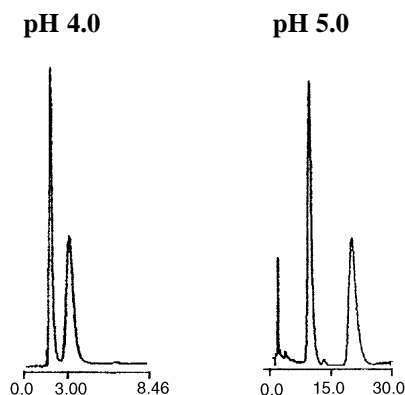
Cellobiohydrolase(CBH) is the chiral selector in the CHIRAL-CBH column. CBH is a very stable protein, which has been immobilized onto spherical 5 μm silica particles. The column is used in the reversed-phase mode, preferably for the separation of enantiomers of basic drugs from many compound classes. The retention and the enantioselectivity can be regulated by changes in pH, the nature and the concentration of organic modifier and the buffer concentration.

The same types of forces are involved in the retention process of the solute as was described for the AGP column earlier in this Handbook, which also means that the same type of mobile phases can be used on both columns. Please note that in all mobile phases for the CHIRAL-CBH column, 50 μM disodium EDTA must be added, to complex metal ions present in the buffer salts.

Method Development Strategies

1. pH

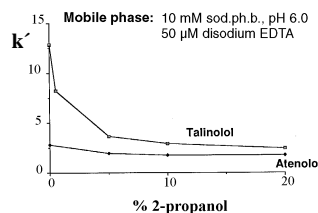
A decrease in pH will result in decreasing retention and in most cases lower enantioselectivity, as is demonstrated for **epanlolol** below.



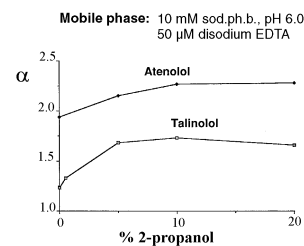
2. Organic modifier (solvent)

The most widely used organic modifiers on the CBH column are 2-propanol and acetonitrile. Addition of an organic modifier has in almost all cases a positive influence on the chromatographic performance compared to chromatography in pure buffers. Normally, increasing modifier concentration results in reduction of the retention and increasing enantioselectivity. These effects are illustrated below for **atenolol** and **talinolol**.

Retention vs. modifier conc.



Separation factor vs. modifier conc.



Method Development Scheme

In order to use the **CHIRAL-CBH** column and develop methods, it is possible to use the knowledge from reversed phase chromatography. Begin with the starting mobile phase, see table. Depending on the result obtained, follow the Method Development Scheme, that is shipped with each column, to optimize the method.

Compound type	Starting mobile phase
Hydrophobic and hydrophilic amine	5% 2-propanol in 10 mM sodium phosphate buffer pH 6.0 + 50 μM disodium EDTA

References CHIRAL-CBH

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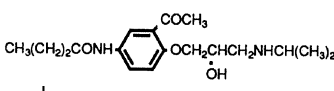
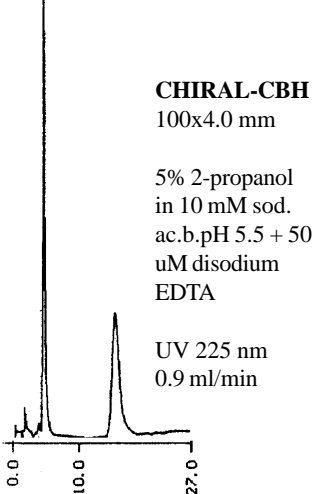
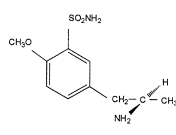
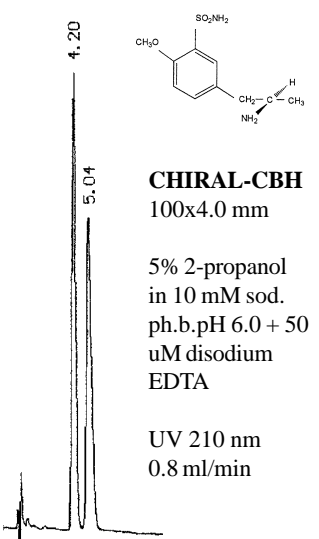
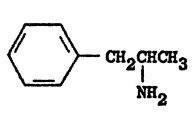
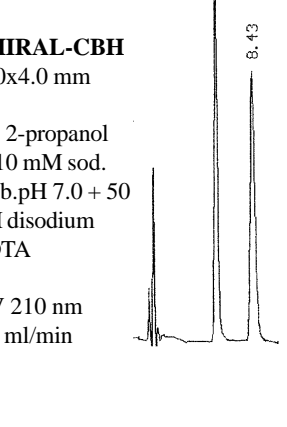
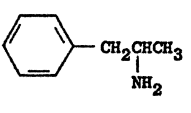
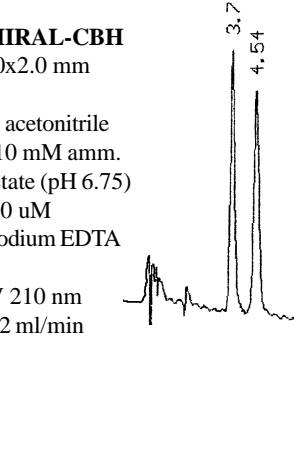
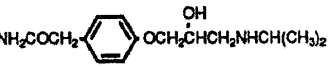
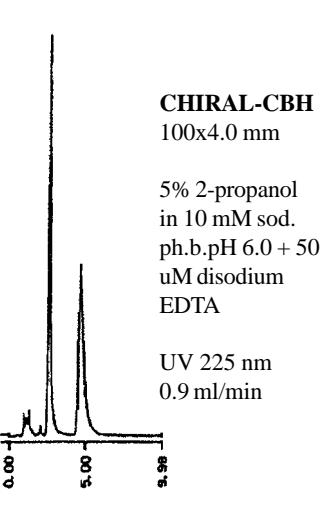
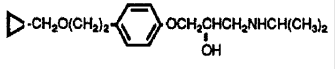
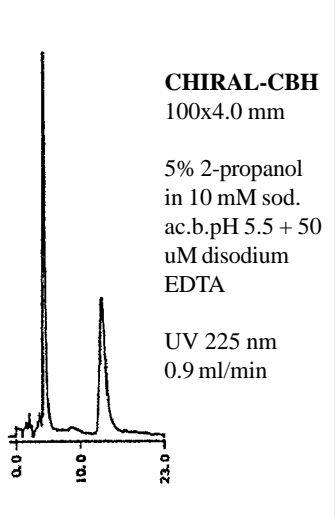
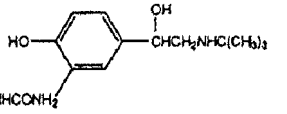
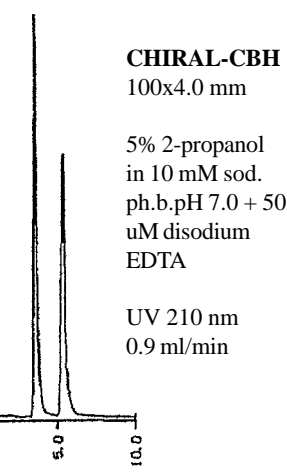
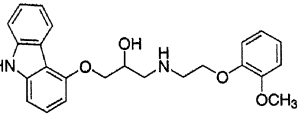
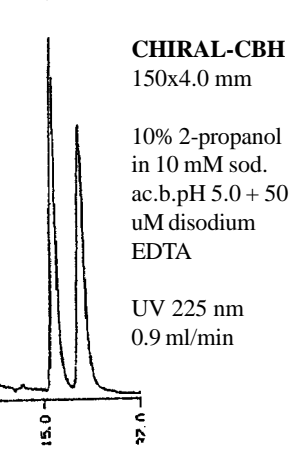
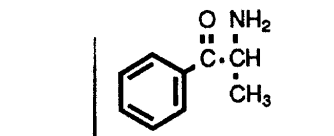
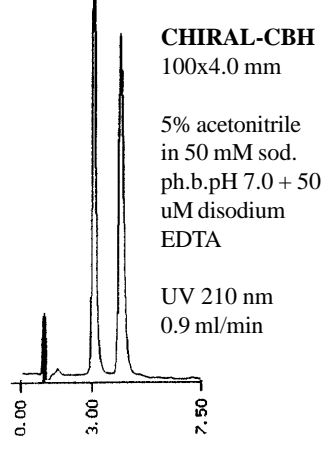
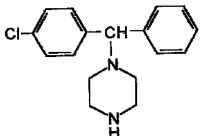
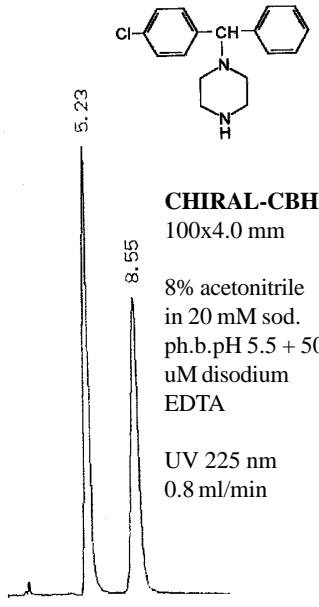
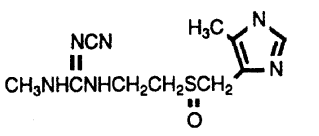
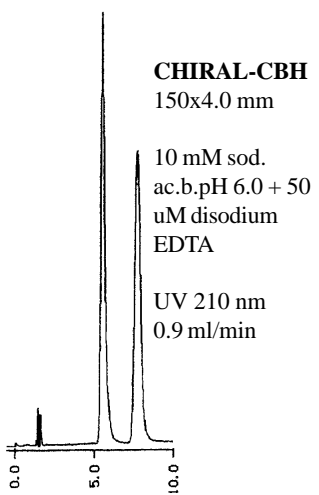
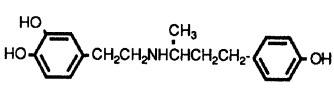
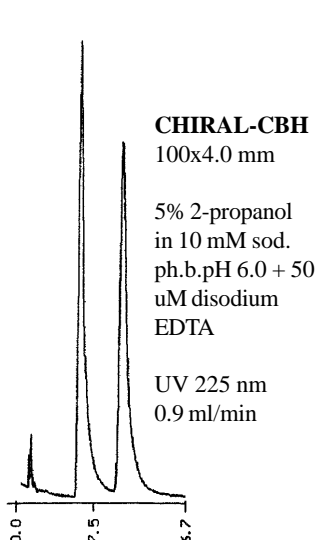
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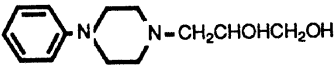
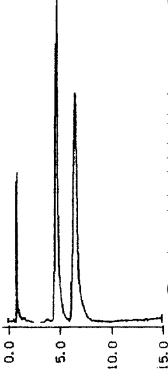
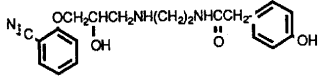
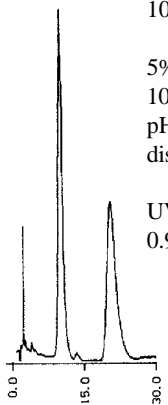
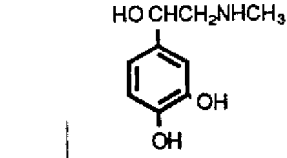
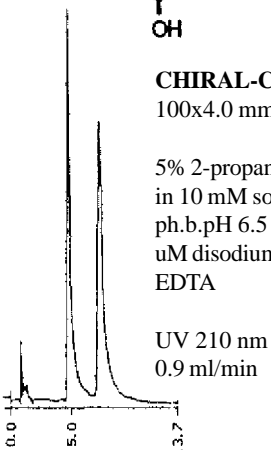
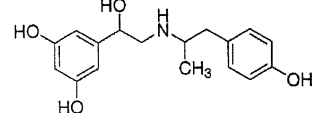
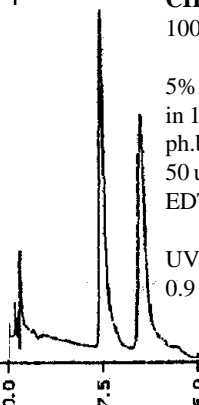
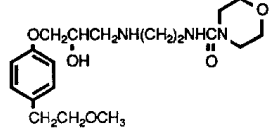
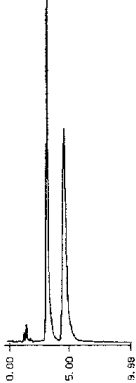
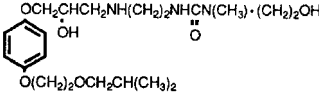
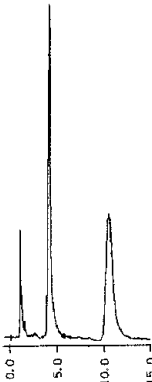
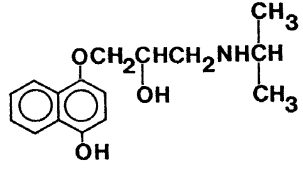
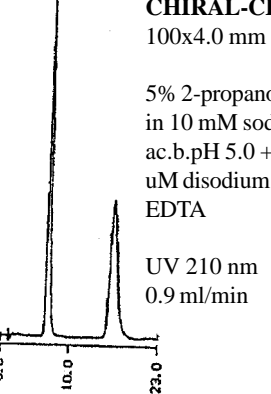
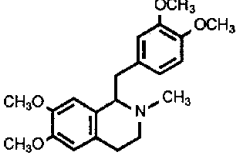

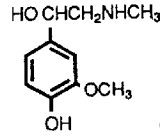
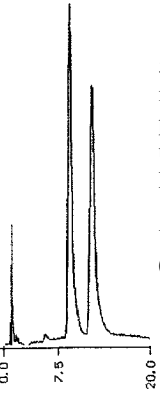
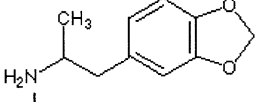
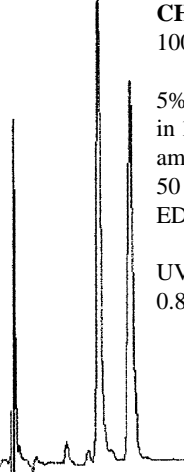
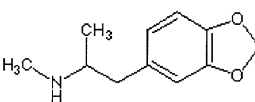
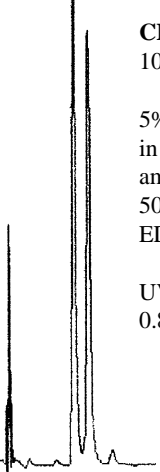
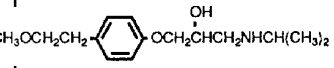
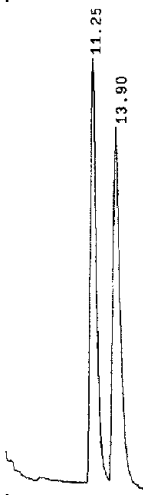
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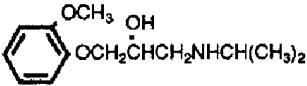
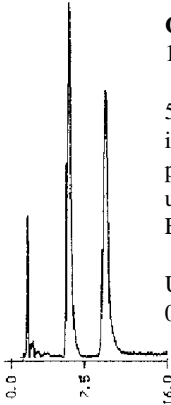
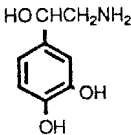
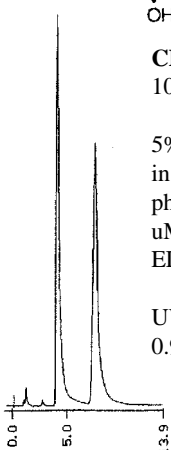
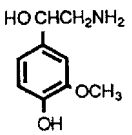
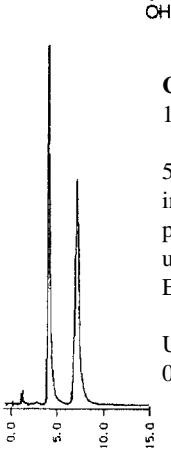
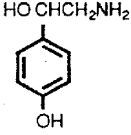
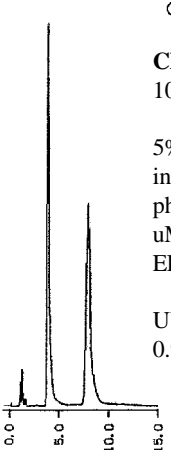
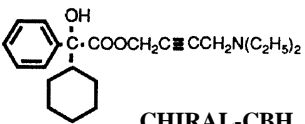
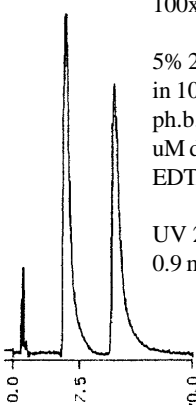
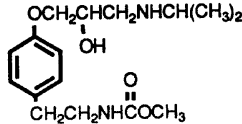
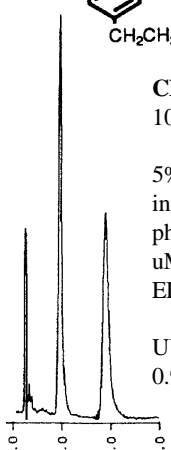

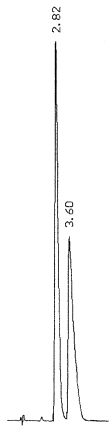
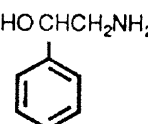
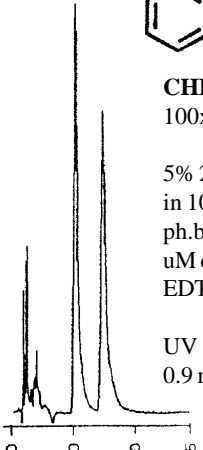
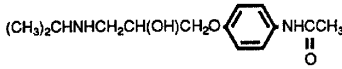
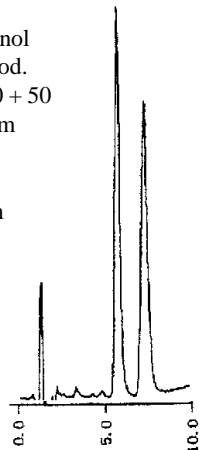
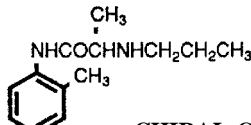
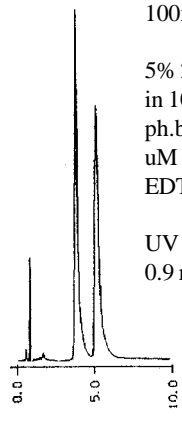
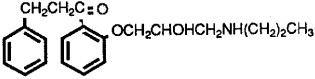
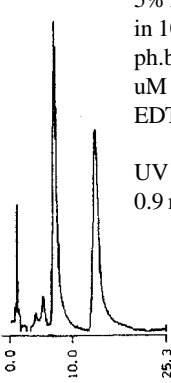
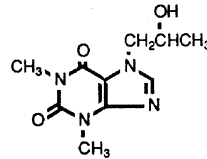
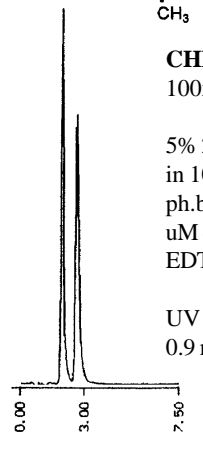
Applications on CHIRAL-CBH

<p>Acebutolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ac.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>5-(2-aminopropyl)-2-methoxybenzene sulphonamide</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.8 ml/min</p> 	<p>Amphetamine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.8 ml/min</p> 	<p>Amphetamine</p>  <p>CHIRAL-CBH 100x2.0 mm</p> <p>6% acetonitrile in 10 mM amm. acetate (pH 6.75) + 50 uM disodium EDTA</p> <p>UV 210 nm 0.22 ml/min</p> 
<p>Atenolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Betaxolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ac.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Carbuterol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Carvedilol</p>  <p>CHIRAL-CBH 150x4.0 mm</p> <p>10% 2-propanol in 10 mM sod. ac.b.pH 5.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>Cathinone</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% acetonitrile in 50 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>N-(4-chlorobenzhydryl)-piperazine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>8% acetonitrile in 20 mM sod. ph.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.8 ml/min</p> 	<p>Cimetidine sulphoxide</p>  <p>CHIRAL-CBH 150x4.0 mm</p> <p>10 mM sod. ac.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Dobutamine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 

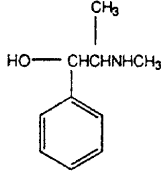
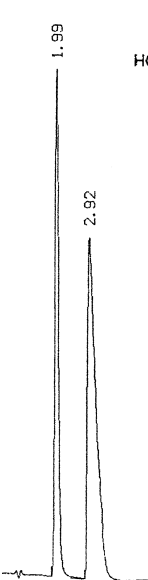
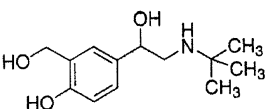
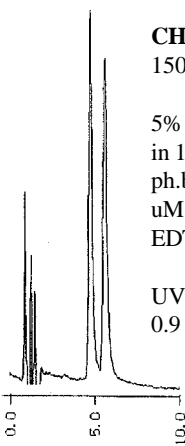
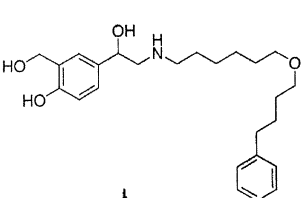
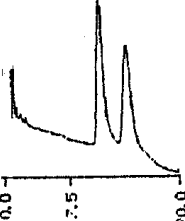
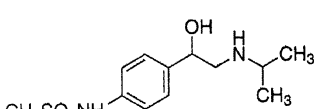
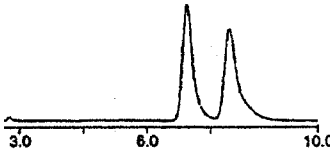
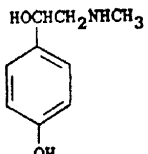
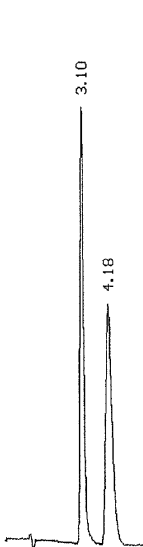
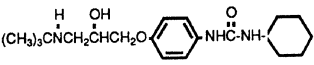
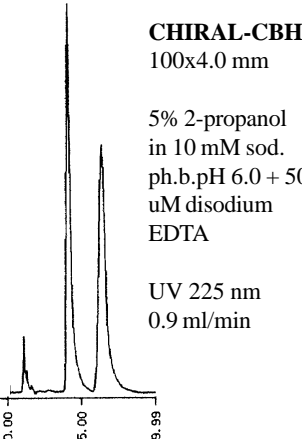
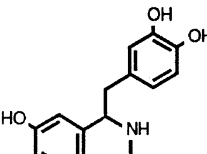
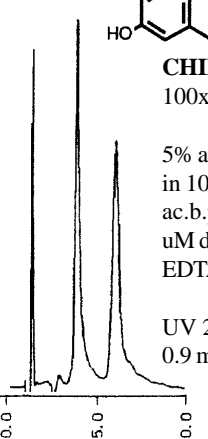
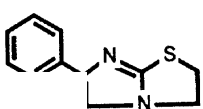
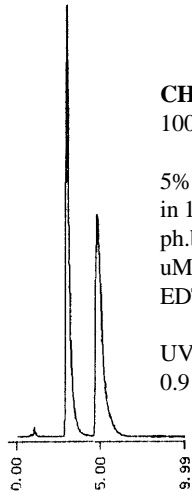
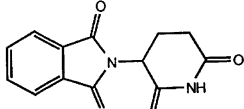
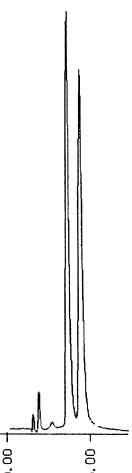
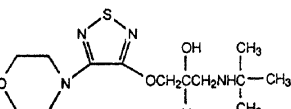
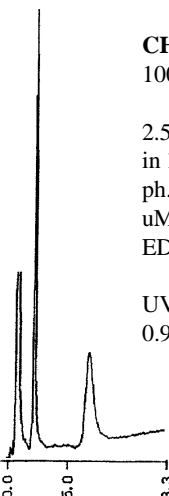
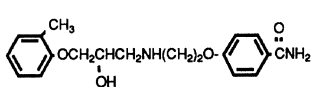
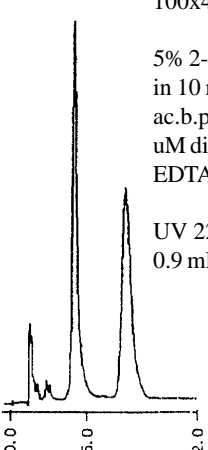
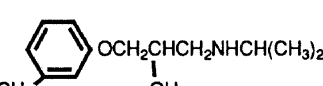
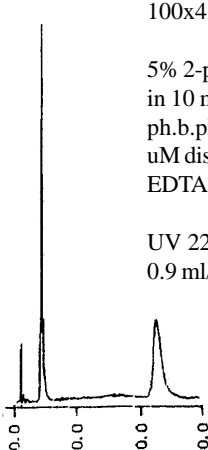
Applications on CHIRAL-CBH

<p>Dropropizine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Epanolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod.ac.b. pH 5.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Epinephrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.5 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Feneterol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.15 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>H174/48</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>H201/68</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>4-Hydroxypropranolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ac.b.pH 5.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Laudanosine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>Metanephrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>3,4-methylenedioxy- amphetamine (MDA)</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% acetonitrile in 10 mM amm.acetate + 50 uM disodium EDTA</p> <p>UV 210 nm 0.8 ml/min</p> 	<p>3,4-methylenedioxymeth- amphetamine (MDMA)</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% acetonitrile in 10 mM amm.acetate + 50 uM disodium EDTA</p> <p>UV 210 nm 0.8 ml/min</p> 	<p>Metoprolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 

Applications on CHIRAL-CBH

<p>Moprolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Norepinephrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Normethanephrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Octopamine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 
<p>Oxybutynine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Pamatolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Phenylephedrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>3% 2-propanol in 10 mM sod. ph.b.pH 6.10 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.8 ml/min</p> <p>Non-racemic sample</p> 	<p>Phenylethanolamine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.5 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 
<p>Practolol</p>  <p>CHIRAL-CBH 150x4.0 mm</p> <p>5% 2-propanol in 50 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Prilocaine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Propafenone</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Proxiphylline</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 

Applications on CHIRAL-CBH

<p>Pseudoephedrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>3% 2-propanol in 10 mM sod. ph.b.pH 6.10 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.8 ml/min</p> <p>Non-racemic sample</p> 	<p>Salbutamol</p>  <p>CHIRAL-CBH 150x4.0 mm</p> <p>5% acetonitrile in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Salmeterol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm, 0.9 ml/min</p> 	<p>Sotalol</p>  <p>CHIRAL-CBH 150x4.0 mm</p> <p>10% acetonitrile in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 225 nm, 0.9 ml/min</p> 
<p>Synephrine</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.8 ml/min</p> 	<p>Talinolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Tetrahydropapaveroline</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% acetonitrile in 10 mM sod. ac.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Tetramisol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>Thalidomide</p>  <p>CHIRAL-CBH 150x4.0 mm</p> <p>2% acetonitrile in 10 mM sod. ph.b.pH 5.5 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Timolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>2.5% 2-propanol in 10 mM sod. ph.b.pH 7.0 + 50 uM disodium EDTA</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Tolamolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ac.b.pH 5.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Toliprolol</p>  <p>CHIRAL-CBH 100x4.0 mm</p> <p>5% 2-propanol in 10 mM sod. ph.b.pH 6.0 + 50 uM disodium EDTA</p> <p>UV 225 nm 0.9 ml/min</p> 

The CHIRAL-HSA column

The chiral selector used for this stationary phase is the human serum albumin (HSA). The protein has been immobilized onto spherical 5 μm silica particles. The column is used in the reversed-phase mode. The majority of the compounds that have been resolved on the CHIRAL-HSA column are acids, ampholytes and non-protolytes. The CHIRAL-HSA column is used in the reversed-phase mode.

The same type of mobile phases as used on the CHIRAL-AGP columns, can be used on the CHIRAL-HSA columns. The retention and the enantioselectivity are affected by the pH, the buffer concentration, the nature and the concentration of the organic modifier. The same types of forces are involved in the retention process of the solute as was described for the AGP column earlier in this handbook.

Method Development Strategies

1. pH

Depending of the nature of the analyte, a change in pH will have different effects. For an acid, a decreasing pH will result in higher retention and increasing resolution. If the analyte is an ampholyte as tryptophan, the result can be seen in the table below.

Tryptophan, influence of pH

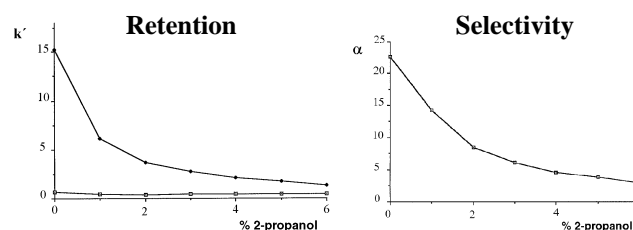
pH	k'1	k'2	α
5.0	1.44	1.82	1.26
6.0	1.30	1.87	1.44
7.0	0.75	3.72	4.97

Columns for protein binding studies

A range of columns for protein binding studies are available. Columns are based on immobilized albumins from different species (human, rat, dog, mouse etc) and immobilized α_1 -acid glycoprotein. Column dimensions are 50x3.0 mm and 50x4.0 mm. For information please visit www.chromtech.co.uk/protbind

2. Organic modifier (solvent)

2-propanol, 1-propanol and acetonitrile are frequently used modifiers on the CHIRAL-HSA column. A higher organic modifier concentration reduces the retention. Normally, also the enantioselectivity will decrease. These effects are exemplified below for kynurenine.



However, for certain acidic compounds it has been observed that the enantioselectivity is increasing when an organic modifier is added to the mobile phase as is demonstrated below for abscisic acid.

Abscisic acid, effect of 2-propanol

% 2-propanol	k'1	k'2	α
0	3.62	4.56	1.26
1	1.96	3.37	1.92

Mobile phase: 100 mM sod. ph. b. pH 7.0

References CHIRAL-HSA

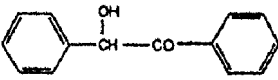
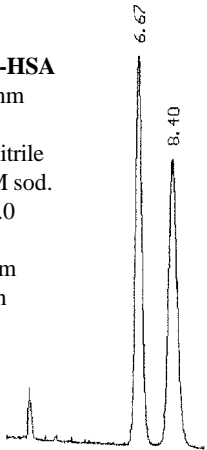
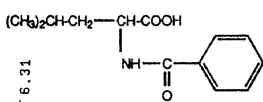
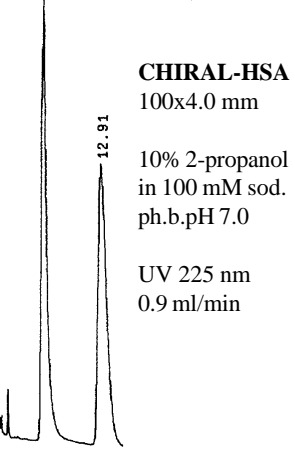
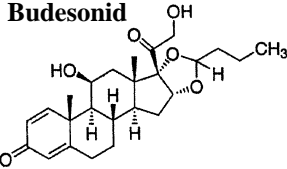
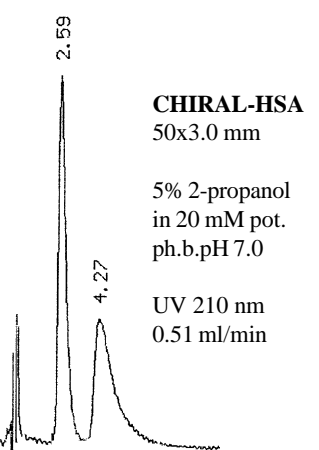
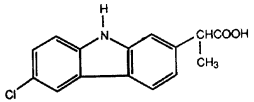
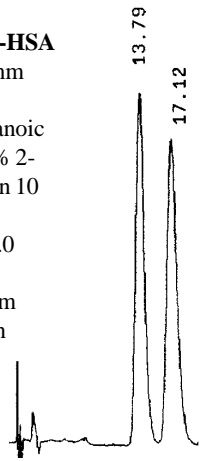
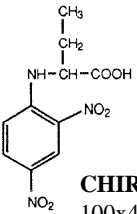
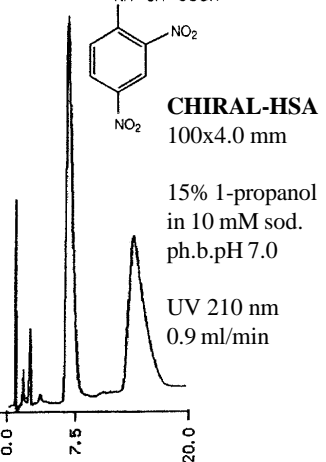
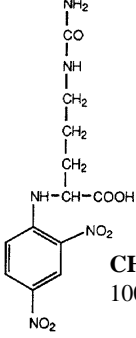
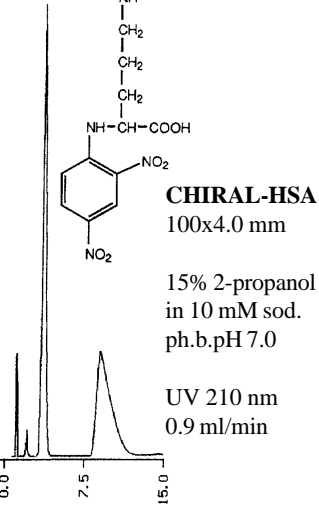
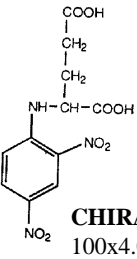
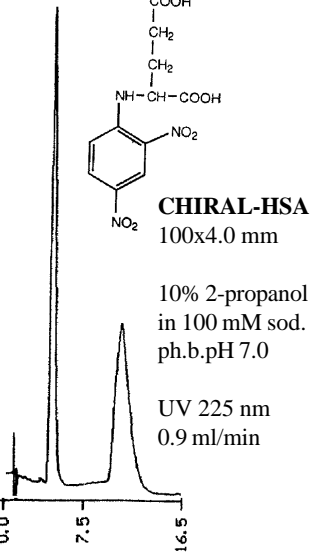
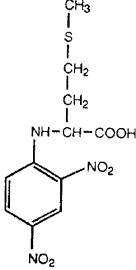
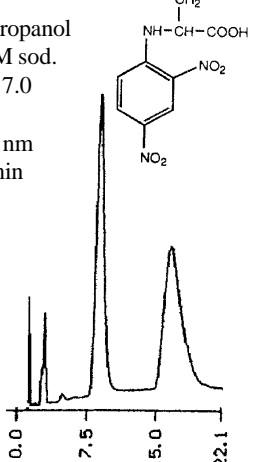
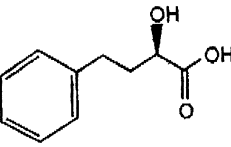

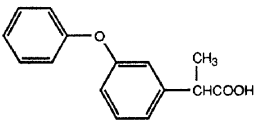
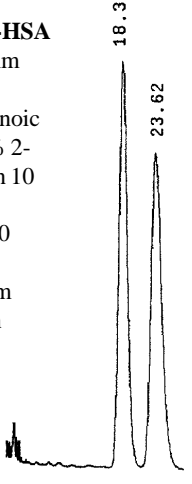
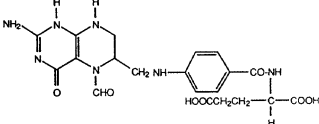
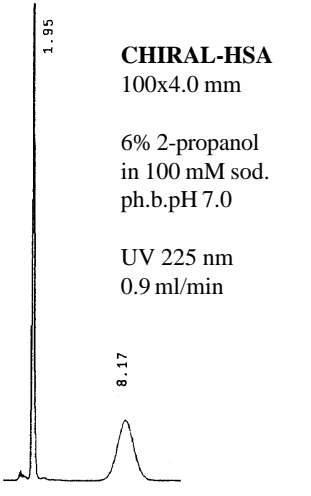
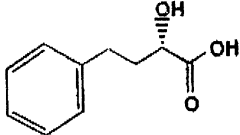
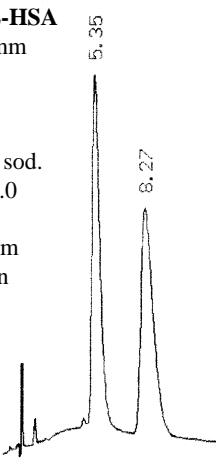
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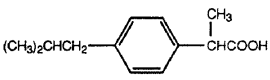
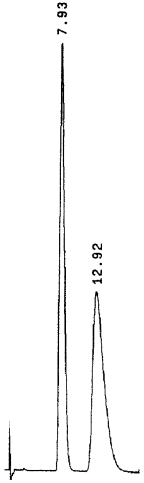
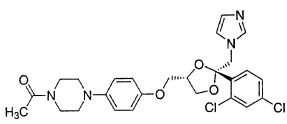
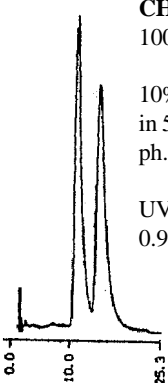
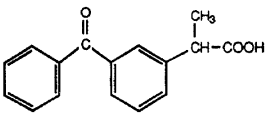
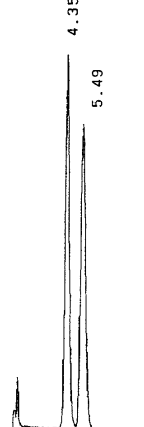
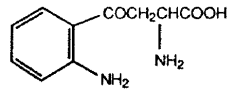
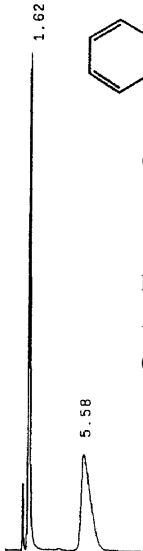
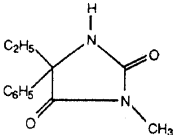
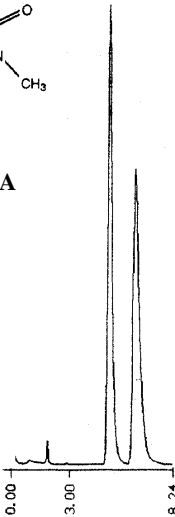
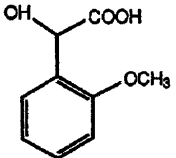
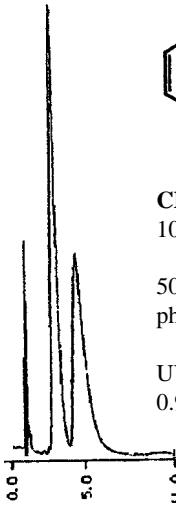
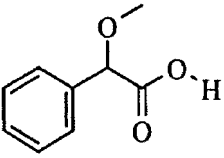
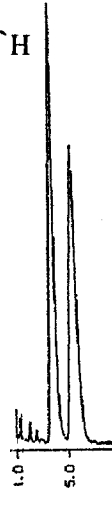
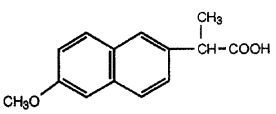
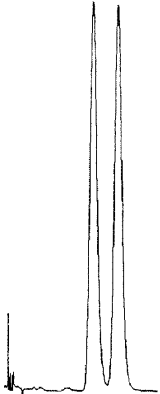
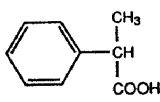
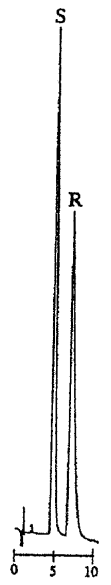
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<p>Benzoin</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>3% acetonitrile in 100 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>N-benzoyl-D,L-leucine</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>10% 2-propanol in 100 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Budesonid</p>  <p>CHIRAL-HSA 50x3.0 mm</p> <p>5% 2-propanol in 20 mM pot. ph.b.pH 7.0</p> <p>UV 210 nm 0.51 ml/min</p> 	<p>Carprofen</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>5 mM octanoic acid + 10% 2- propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 
<p>N-2,4-DNP-DL-α-amino-n-butyrac acid</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>15% 1-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>N-2,4-DNP-DL-citrulline</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>15% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>N-2,4-DNP-DL-glutamic acid</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>10% 2-propanol in 100 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>N-2,4-DNP-DL-methionine</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>15% 1-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 
<p>Ethylhydroxy phenyl-butyrate</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>6% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 	<p>Fenoprofen</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>1 mM octanoic acid + 10% 2- propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Folinic acid (Leucovorin)</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>6% 2-propanol in 100 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p> 	<p>Hydroxyphenyl butyric acid</p>  <p>CHIRAL-HSA 100x4.0 mm</p> <p>15.5% 2- propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p> 

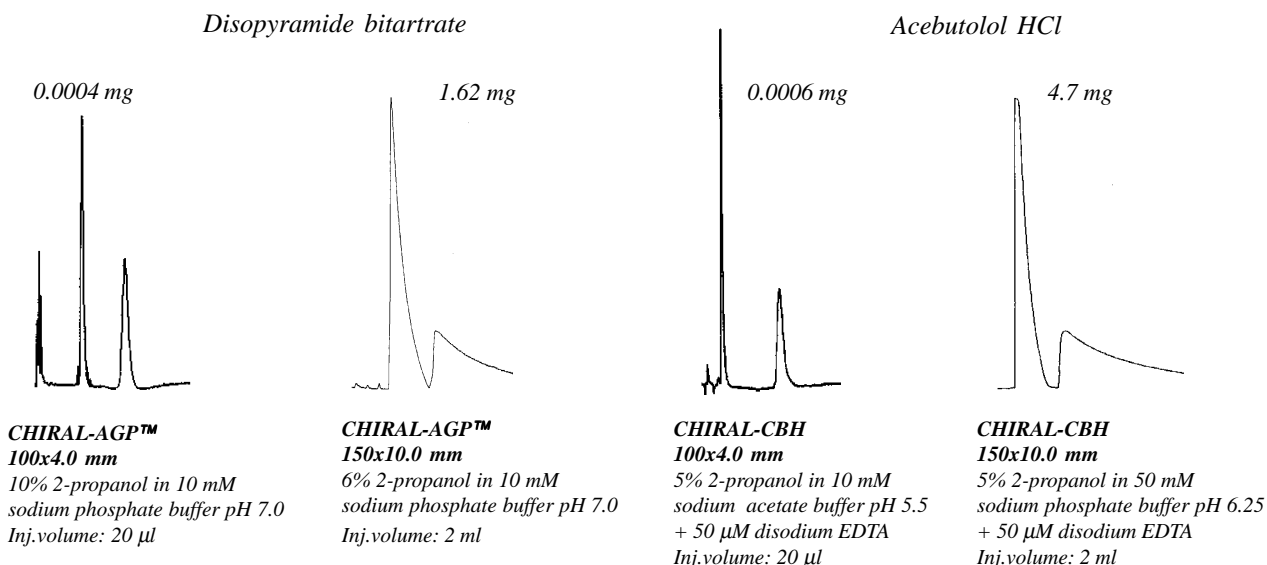
Applications on CHIRAL-HSA

<p>Ibuprofen</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>5 mM octanoic acid and 10% 2-propanol in 100 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Ketoconazole</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>10% 2-propanol in 50 mM sod. ph.b.pH 0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Ketoprofen</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>5 mM octanoic acid and 10% 2-propanol in 10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>Kynurenine</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>10 mM sod. ph.b.pH 6.0</p> <p>UV 225 nm 0.9 ml/min</p>
<p>Mephénytoin</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>10 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>	<p>o-Methoxymandelic acid</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>50 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p>	<p>o-Methoxyphenylacetic acid</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>10 mM sod. ph.b.pH 7.0</p> <p>UV 210 nm 0.9 ml/min</p>	<p>Naproxen</p>   <p>CHIRAL-HSA 100x4.0 mm</p> <p>5 mM octanoic acid and 2% 2-propanol in 100 mM sod. ph.b.pH 7.0</p> <p>UV 225 nm 0.9 ml/min</p>
<p>2-Phenylpropionic acid (Hydratropic acid)</p>   <p>CHIRAL-HSA 150x4.0 mm</p> <p>7.5% acetonitrile in 67 mM sod. ph.b.pH 6.5</p> <p>UV 225 nm 0.9 ml/min</p>			

Semipreparative separations on CHIRAL-AGP™ and CHIRAL-CBH

CHIRAL-AGP™ and CHIRAL-CBH columns are mainly used for analytical separations. However, due to the broad applicability of the columns, they are also used for semipreparative separations on 10 mm ID columns.

In order to obtain optimal loadability on the 10 mm ID columns it is essential to optimize the chromatographic parameters.



To be able to load more sample on the CHIRAL-AGP™ semipreparative column the 2-propanol concentration in the mobile phase is reduced to 6% from 10% for the analytical separation.

The amount of sample that can be injected will of course depend on the nature of the compound and on the resolution. Up to 3-4 mg of sample has been injected/injection on the semipreparative CHIRAL-AGP™ column.

To be able to load more sample on the CHIRAL-CBH semipreparative column, the buffer concentration and the pH is increased. The type of compound and the resolution will determine the amount that can be loaded onto the column. Up to 5-6 mg has been injected on the semipreparative CHIRAL-CBH column.

General rules for transformation of a method from analytical to semipreparative scale

AGP + CBH columns

- Inject diluted sample solutions for better chromatographic performance. 2 ml injection volume is recommended.
- If the last eluted enantiomer is tailing, use a gradient to elute it faster.

CBH columns

- The buffer concentration of the analytical mobile phase is normally 10 mM. In semipreparative scale 50 mM buffer should be used.
- When going from an analytical to a semipreparative method increase the pH of the mobile phase 0.5 - 1 pH unit.

Free screening service

If there is no application or literature reference available for the specific compound, we offer a free screening service. Send a description of the sample which preferably contains the structure. If necessary we sign a secrecy agreement. If the compound is found to be suitable for our chiral columns, send a sample (10-100 mg) together with information about the compound (on a form provided by us).

The sample must be sent as a pure compound, not in a solution. When received it is tested at the Application laboratory using the CHIRAL-AGP, CHIRAL-CBH and/or the CHIRAL-HSA columns.

Before requesting a chiral sample screening, please consult the index in the Chiral Application Handbook or the website to find if a method has already been developed on the sample or a similar compound.

If separation is obtained in the screening, a chromatogram and instructions on how to optimize the method is provided. If an optimized and validated method is requested, this service will be provided against a charge.

Product list Chiral Columns and Accessoires

CHIRAL-AGP™

Art.no.	Column
AGP100.4	100x4.0 mm, 5 µm
AGP150.4	150x4.0 mm, 5 µm
AGP50.4	50x4.0 mm, 5 µm
AGP100.3	100x3.0 mm, 5 µm
AGP150.3	150x3.0 mm, 5 µm
AGP50.3	50x3.0 mm, 5 µm
AGP100.2	100x2.0 mm, 5 µm
AGP150.2	150x2.0 mm, 5 µm
AGP50.2	50x2.0 mm, 5 µm
AGP100.10	100x10.0 mm, 5 µm
AGP150.10	150x10.0 mm, 5 µm
AGP10.22	guard cartr. 10x2 mm 5 µm 2-p
AGP10.32	guard cartr. 10x3 mm 5 µm 2-p
AGP10.42	guard cartr. 10x4 mm 5 µm 2-p

CHIRAL-CBH

Art.no.	Column
CBH100.4	100x4.0 mm, 5 µm
CBH150.4	150x4.0 mm, 5 µm
CBH50.4	50x4.0 mm, 5 µm
CBH100.3	100x3.0 mm, 5 µm
CBH150.3	150x3.0 mm, 5 µm
CBH50.3	50x3.0 mm, 5 µm
CBH100.2	100x2.0 mm, 5 µm
CBH150.2	150x2.0 mm, 5 µm
CBH50.2	50x2.0 mm, 5 µm
CBH100.10	100x10.0 mm, 5 µm
CBH150.10	150x10.0 mm, 5 µm
CBH10.22	guard cartr. 10x2 mm 5 µm 2-p
CBH10.32	guard cartr. 10x3 mm 5 µm 2-p
CBH10.42	guard cartr. 10x4 mm 5 µm 2-p

CHIRAL-HSA and columns for protein binding studies

Art.no.	Column
HSA100.4	100x4.0 mm, 5 µm
HSA150.4	150x4.0 mm, 5 µm
HSA50.4	50x4.0 mm, 5 µm
HSA100.3	100x3.0 mm, 5 µm
HSA150.3	150x3.0 mm, 5 µm
HSA50.3	50x3.0 mm, 5 µm
HSA100.2	100x2.0 mm, 5 µm
HSA150.2	150x2.0 mm, 5 µm
HSA50.2	50x2.0 mm, 5 µm
HSA100.10	100x10.0 mm, 5 µm
HSA150.10	150x10.0 mm, 5 µm
HSA10.22	guard cartr. 10x2 mm 5 µm 2-p
HSA10.32	guard cartr. 10x3 mm 5 µm 2-p
HSA10.42	guard cartr. 10x4 mm 5 µm 2-p
RSA50.3	50x3.0 mm, 5 µm
RSA50.4	50x4.0 mm, 5 µm
DSA50.3	50x3.0 mm, 5 µm
DSA50.4	50x4.0 mm, 5 µm
MSA50.3	50x3.0 mm, 5 µm
MSA50.4	50x4.0 mm, 5 µm

Columns with albumin from other species available on request.

Accessoires

Art.no.	Description
CH10.3	Guard column holder
CON2	Guard column coupler
CON4	Guard column coupler micro
F-423	Carbon PEEK column fitting, 5-pack

It is recommend that a **guard column** (of the same type as the analytical column) should always be used. The guards are available in three different dimensions. The same guard column holder (CH10.3) can be used for all dimensions.

The fingertight guard column connectors are a convenient way of connecting the guard to the analytical column without using tools.

Additional column dimensions may be available on request.