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Turnkey Laboratories Solutions

Analytical®
Technologies Limited

CAD- 3200

Charged Aerosol Detector

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Analytical Technologies Limited

An ISO 9001 Certified Company

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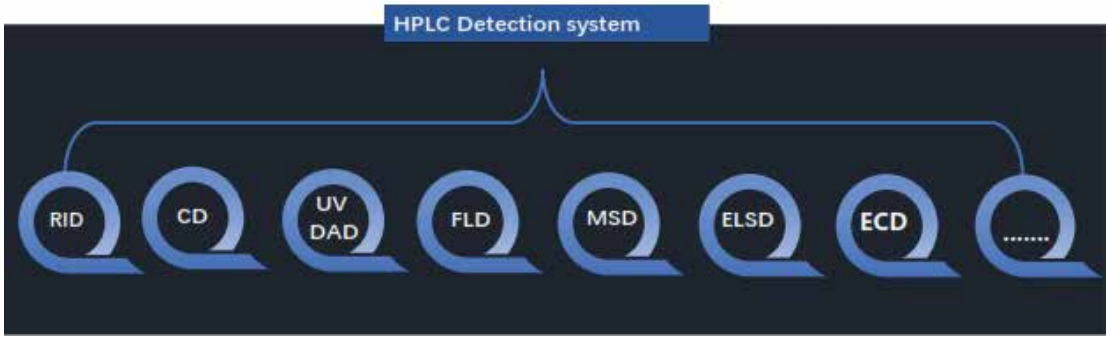
CAD - 3200 is Focus on the field of chromatography and mass spectrometry to move towards the international advanced level and provide customers with advanced and reliable laboratory analysis solutions!

Liquid chromatography detector:

Chromatographs, especially high-performance liquid chromatography (HPLC) , have become a widely used analytical tool due to their qualitative and quantitative capabilities. The detector, as the eye, becomes an essential component.

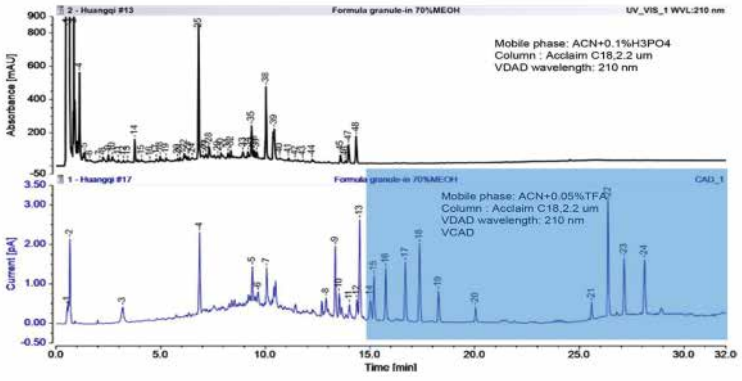


Charged Aerosol Detector (CAD):

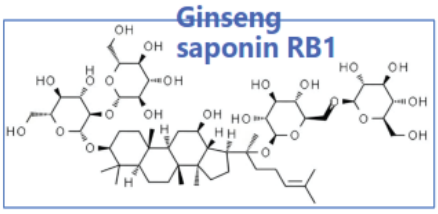
CAD: Universal Quality Detector,

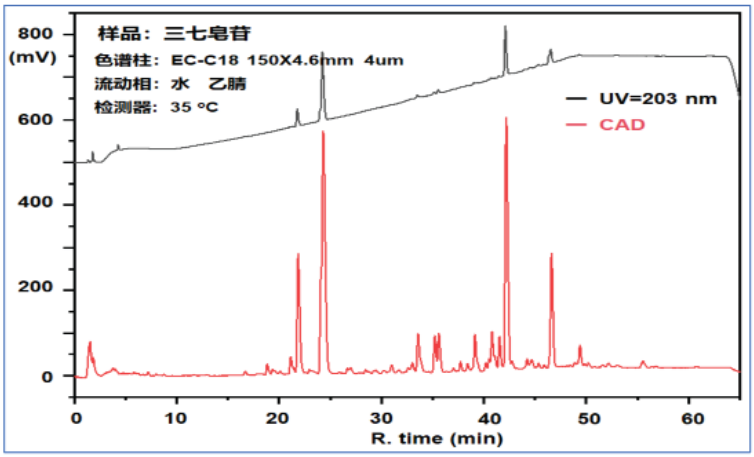
Principle: Detect the charge of aerosols after atomization of the substance to be measured.

Detection of objects: non-volatile compounds and semi-volatile compounds.



UV detection(top) and CAD detection(bottom) of astragalus particles





Features of Charged Aerosol Detector (CAD):

1. Can detect both non-volatile and semi-volatile compounds.
2. Is a mass detector with consistent response
3. No structure discrimination, no ionization required.
4. Sensitivity far exceeds RI and ELSD, comparable to UV
5. Gradient compatible, suitable for HPLC, UHPLC, Prep-LC, etc.
6. Simple operation, low operating and maintenance costs.

Liquid chromatography detector:

• Refractive Index(RI):

Low sensitivity, incompatible with gradients and very sensitive to temperature.

• Absorbance (VWD, DAD, Fluorescence):

The compound molecule must contain a chromophore. If the chromophores are not uniform, the response consistency between compounds will be poor.

Mass Spectrometry (MS):

High sensitivity and powerful function, but expensive, high operating costs, and high skill requirements for operators

Evaporative Light Scattering (ELSD):

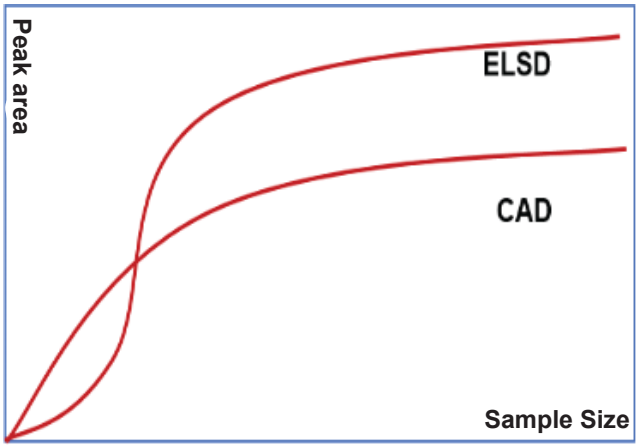
Unpredictable intercom pound responses and complex "S"• shaped nonlinear calibration curves, limited dynamic range

Advantages:

Type	CAD	UVD	ELSD	RID	MS
Sensitivity	✓	✓			✓
Gradient Compatibility	✓	✓	✓		✓
Detection Limit	✓	✓			✓
Linear Range	✓	✓			✓
Mass Response Uniformity	✓		✓	✓	✓
Operational Convenience	✓	✓	✓	✓	

CAD v/s ELSD:

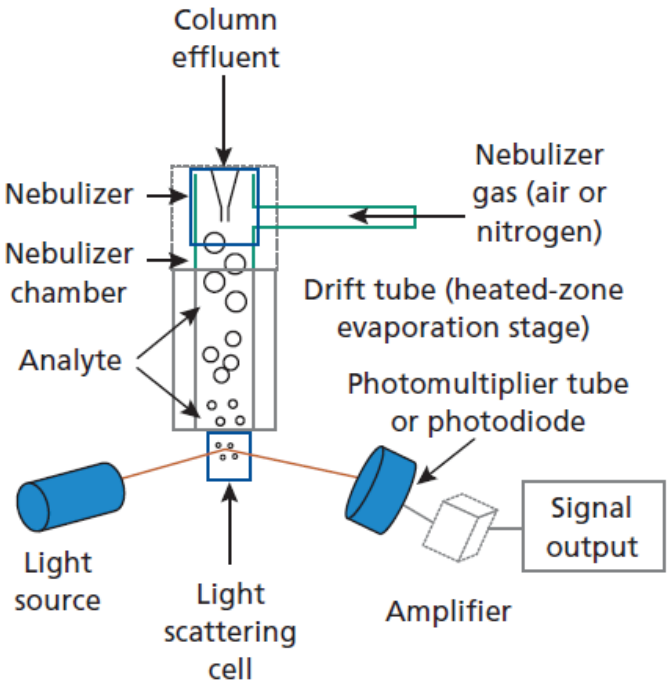
Type	ELSD	CAD
Detection method	Scattered light from dry aerosols	Charge on dry aerosol
Accuracy	In low-content regions,the index response decreases rapidly, exhibiting a narrow dynamic range, large slope variations, and poor accuracy	It can be used for low-content detection has a wide dynamic range,a gradually changing slope, and higher accuracy.
Composition Dependence	Significantly affected by particle refractive index	Very small dielectric constant dependence

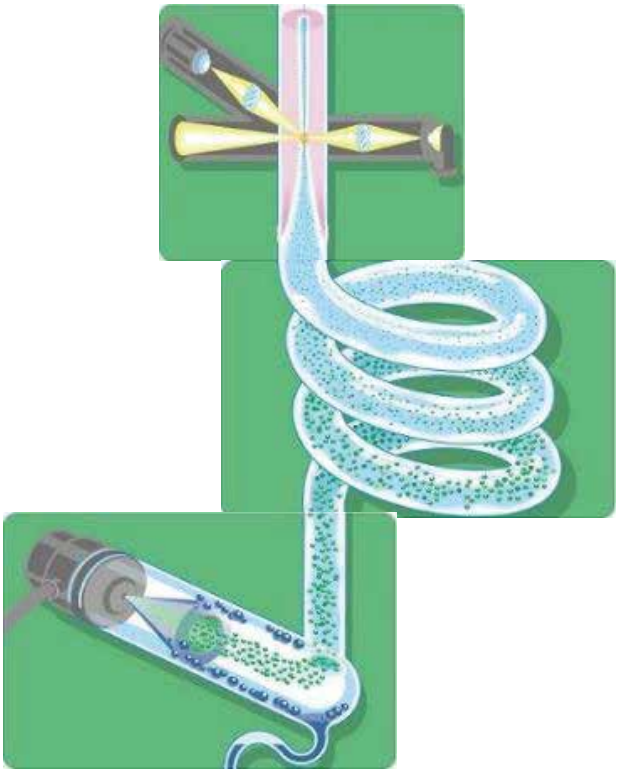


CAD vs. ELSD Response curve comparison

ELSD Disadvantages:

- ELSD has an "S" shape in response with a narrow linear range.
- ELSD response consistency is poor
- For full-range quantitation, 4 orders of magnitude dynamic range calibration curves require multiple injections at different gains.
- Low sensitivity: poor response of low- concentration samples





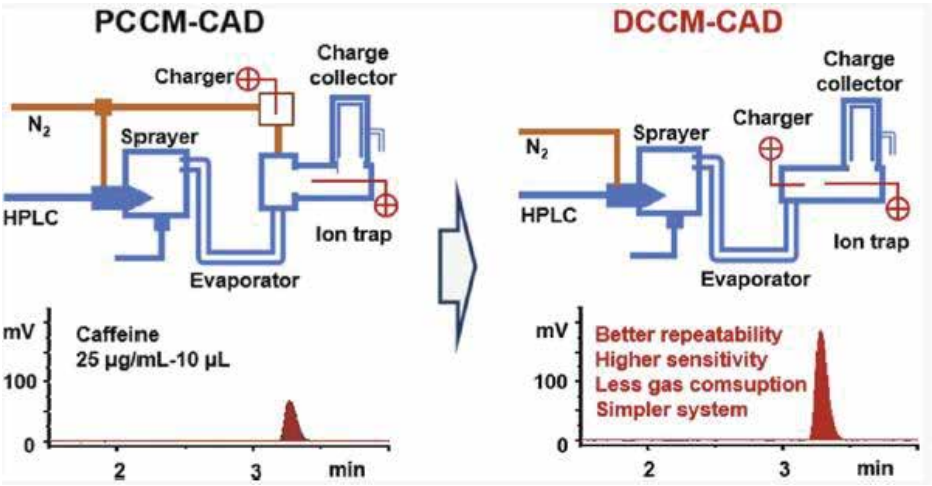
Features:

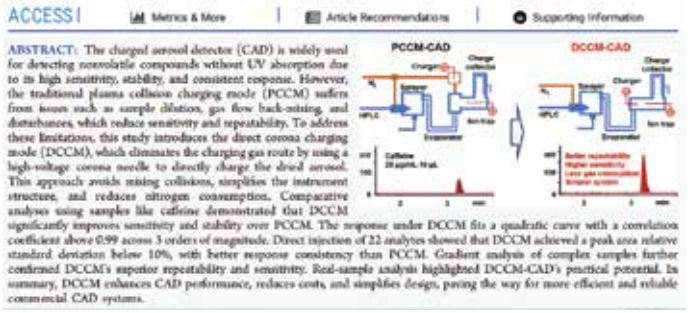
High sensitivity:	Comparable to UV detectors, LOD reaches sub-nano level
Good repeatability:	Employing a hard needle spray design, it eliminates wobbling during capillary spraying, with an RSD of <1%
Low gas consumtion:	Adopting a single gas path design, gas consumption is as low as 3L/min
Good repeatability:	Employing a hard needle spray design, it eliminates wobbling during capillary spraying, with an RSD of <1%
Wide linear range:	Built-in algorithm conversion, linear range up to 4 orders of magnitude
High response consistenc:	High consistency across different types of analysis of the same quality
Easy to use online:	It can be easily connected to various brands of liquid chromatographs

Comparison of performance parameters:

指标	SparkFlux2000	Vanquish F	CADector1
Spray method	▲Coaxial hard cone spray	Focus jet Coaxial spray	Concentric shaft two-phase spray
Ionization mode	▲0~+3 kV adjustable	Fixed ionization voltage, not adjustable	Fixed ionization voltage, not adjustable
Flow rate range	0.01 mL/min~2.0 mL/min	0.01 mL/min~2.0 mL/min	0.01 mL/min~2.0 mL/min
Temperature control range of drying pipes:	Room temperature +5°C~100°C continuously adjustable (accuracy: ±0.5°C)	35℃，50℃，70℃ Three options	Room temperature +5°C~110°C, temperature control accuracy 0.01°C
Repeatability	▲≤1%	Average during the day<5%, within Days<2%。	Average during the day<5%, within Days<2%。
Gas consumption	▲3 L/min	4L/min	4L/min
Types of carriers:	Compressed air, nitrogen, argon, helium, etc., recommended: nitrogen, purity 99.9%	Nitrogen or compressed air	Nitrogen or compressed air
Operating temperature	5℃~35℃	5℃~35℃	5℃~35℃
Inlet air pressure:	500kPa~700kPa	70-80psi（480kPa~550kPa）	70-80psi（480kPa~550kPa）
Sampling frequency:	10 Hz~200 Hz	Highest sampling frequency：100HZ	2-200HZ
Safety features:	Power-on diagnostics, inlet air overpressure, overheat protection, pump flow shut-off, liquid leak detection and safety leak treatment	Power-on diagnostics, inlet air overpressure, high evaporation temperature, pump flow shutdown, liquid leak detection and safety leak treatment	Power-on diagnostics, inlet air overpressure, high evaporation temperature, pump flow shutdown, liquid leak detection and safety leak treatment
Instrument performance indicators	1. ▲Detection limit: ≤1ng (caffeine) 2. Dynamic range: 4 orders of magnitude	Dynamic range: 4 orders of magnitude	Dynamic range: 4 orders of magnitude
Digital filtering:	Self-developed digital filtering algorithm, the filtering intensity is adjustable in six levels from 0~5	0.1, 0.2, 0.5, 1.0, 2.0, 3.6, 5.0, 10.0s Optional	0.0-9.0
Built-in air pressure control:	Electronic pressure controller		Dual gas mass flow controller
Analog signal output:	▲ 0-5 V DC		-0.5V-2.5V

First Direct Corona Charge Mode: for better repeatability and higher sensitivity

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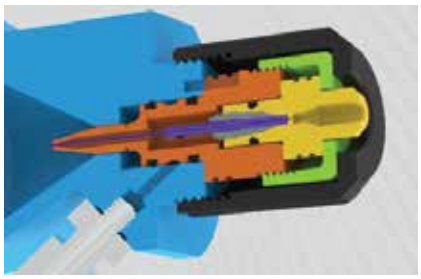
ABSTRACT: The charged aerosol detector (CAD) is widely used for detecting nonvolatile compounds without UV absorption due to its high sensitivity, stability, and consistent response. However, the traditional plasma collision charging mode (PCCM) suffers from issues such as sample dilution, gas flow back-mixing, and disturbances, which reduce sensitivity and repeatability. To address these limitations, this study introduces the direct corona charging mode (DCCM), which eliminates the charging gas route by using a high-voltage corona needle to directly charge the dried aerosol. This approach avoids mixing collisions, simplifies the instrument structure, and reduces nitrogen consumption. Comparative analyses using samples like caffeine demonstrated that DCCM significantly improves sensitivity and stability over PCCM. The response under DCCM fits a quadratic curve with a correlation coefficient above 0.99 across 3 orders of magnitude. Direct injection of 22 analytes showed that DCCM achieved a peak area relative standard deviation below 10%, with better response consistency than PCCM. Gradient analysis of complex samples further confirmed DCCM's superior repeatability and sensitivity. Real-sample analysis highlighted DCCM-CAD's practical potential. In summary, DCCM enhances CAD performance, reduces costs, and simplifies design, paving the way for more efficient and reliable commercial CAD systems.

• Coaxial hard cone spray that rejects uncertain swing of capillaries and improves reproducibility:

The innovatively developed coaxial hard cone spray needle improves spray stability while maintaining spray efficiency, significantly enhancing the repeatability of the CAD- 3200, achieving an RSD value of <1%.

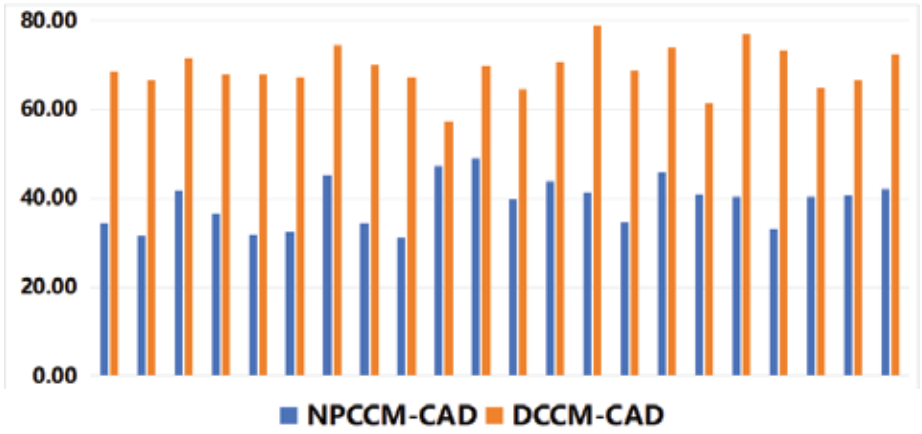
CAD- 3200

Corona Veo RS



Instrumax CADetector a1

Better response consistency:



- Under the same conditions, the peak area of the 3200 CAD was significantly larger than that of a competitor.
- The standard deviation of the peak area of each analyte was 7.4%, while the devia tion of the competitor was 13.96%.
- This result indicates that the 3200 CAD performs better in terms of response consistency.

Better repeatability, lower detection limits:

The results show that the 3200 CAD has a better s/no ratio at low concentrations, which is conducive to improved sensitivity and reproducibility.

LOD , ci=2× HN× cV/20H,

CI-minimum detection concentration, ppm;

HN - Noise peak height, mV;

c - sample concentration, ppm;

H-sample peak height, mV;

V-Injection volume, μL.

Comparison of performance parameters:

In terms of caffeine, the 3200 CAD has a minimum detection concentration of 0.4 ppm, which is a sub-nanogram level.

The connection with various brands of LC is flexible and compatible:

Connection with HPLC: Using analog-to-digital converters provided by different manufacturers as third-party detectors, the 3200 CAD signal is connected to the chromatography workstation for recording, chromatogram generation, integration, and data processing.

Data is recorded and processed via the N2000 chromatography workstation.

For chromatography systems with built-in communication protocols, the 3200 CAD can be directly controlled online, enabling condition setting,signal recording,and data processing.

Market / Application:

Market/Application						
Pharmaceutical	Cleaning verification	Impurity research	excipient	Active Pharmaceutical Ingredient (API) &counter ion	Ionic impurities	Degradation products
Biopharmaceuticals	Triglycerides	PEG	filtered material refined material	polysaccharide	Adjuvant	Peptides
chemical industry	polymer	Biodiesel	surfactant	nonpolar ion	flame retardant	catalyst
Food/Beverage	Sugars/sweeteners	additives	vitamin	lipid	fatty acids	oil
Traditional Chinese medicine/natural products	vegetable oil	Health and nutrition	Plant extracts	Phenolic acids	Phytoestrogens	Plant sterols
environment	Scale inhibitor	Cooling water	pesticide	Environmental hormones		
Life Sciences	Protein/peptide	Solidifies triglycerides	amino acid	oligosaccharide	glycoprotein	Phospholipids

Applications of CAD:

Drug analysis:

Research on drug-related substances:

Examples include the detection of paclitaxel degradation impurities,tenofovir disoproxil fumarate impurities, related substances in gadobutrol monohydrate, some related substances in metoprolol succinate powder, and the content of deoxycholic acid in deoxycholic acid powder.

Determination of excipient content:

Examples include Span, polydextrose,sodium alginate,sorbitol,sucralose,polyethylene distearate, fatty acids, sodium lauryl polyoxyethylene ether sulfate, and lactic acid.

Biopharmaceutical process residue analysis:

Examples include stabilizers (glucose, sucrose, sorbitol, etc.),buffers (arginine,glycine, etc.), surfactants, and defoamers (polypropylene glycol, Span, Tween, etc.).

Determination of active ingredients of traditional medicine:

Detection of fritillary alkaloids and fritillary alkaloids in fritillaria bulbs,and determination of the contents of ginkgolide and ginkgolide A in ginkgo leaf extract.

Injection analysis:

Determination of amino acid content in compound amino acid injection, and content of glucose and sodium chloride in glucose sodium chloride injection

food analysis:

sugar analysis:

The content of fructose syrup in honey, the content of uronic acid, amino sugar and various neutral monosaccharides in polysaccharides, and the content of arginine, glucose, fructose and xylose in culture media such as corn steep liquor were detected.

Oil analysis:

Detection of triglycerides in edible oils such as peanut oil, corn oil, rapeseed oil, and olive oil.

Functional drinks:

Determination of taurine and caffeine

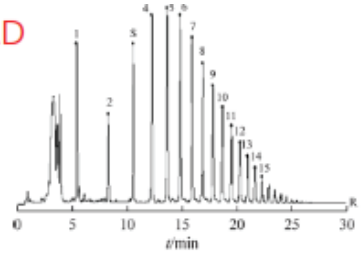
liposomes:

Other analysis

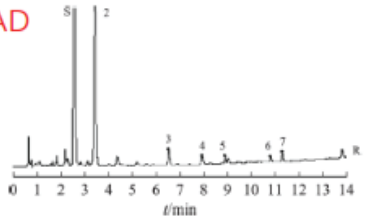
Detection of phospholipids such as dipalmitoylphosphatidylcholine,dipalmitoylcholine (DPPC), distearatelcholine (DSPC), and myristoylphosphatidylcholine (DMPC).

UPLC: DAD+CAD for the analysis of Morinda salt before and after roasting

- CAD



- DAD



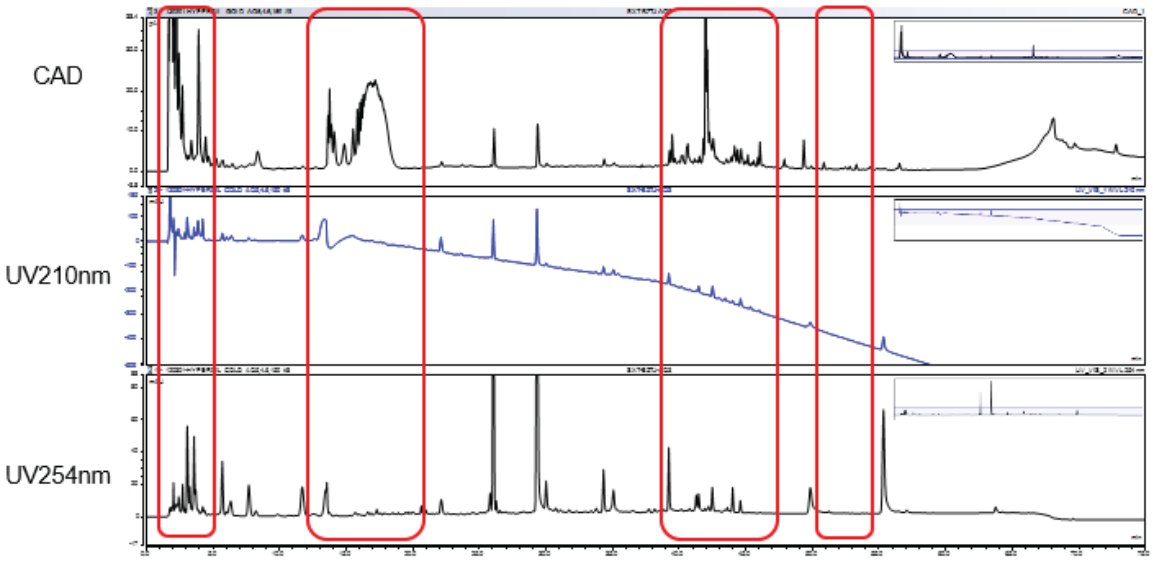
• Highlight：
• DAD and CAD dual configuration combination;
• DAD: iridoid components;
• CAD: oligosaccharide components;
• The difference in composition before and after the preparation of Morinda sample;

CAD provides new analytical methods and ideas for the study of classic prescriptions

Charged Aerosol Detector（CAD）

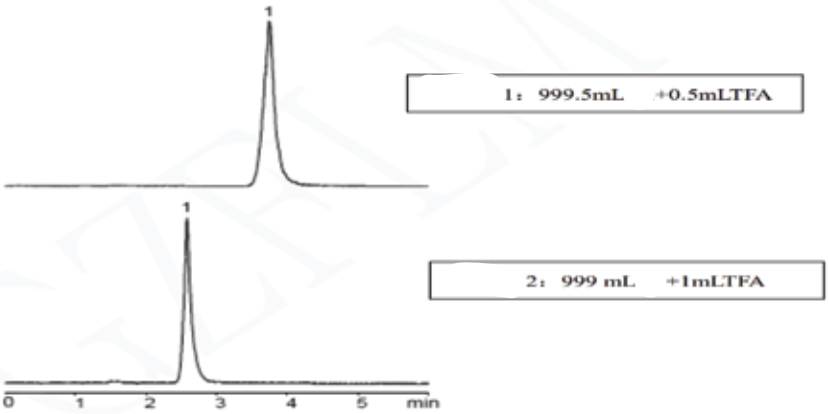
- The basic content of quality standards
• Fingerprint pattern establishment
• Key quality attribute identification
• Simultaneous determination of multiple component contents
• Evaluation of value transfer relationships
• No UV absorption active ingredient characterization
• Characterization of highly polar active ingredients
• Isomer active ingredient analysis
• Qualitative quantification of major
• classes of active ingredients

Comparison of CAD and UV of the classic famous prescription:

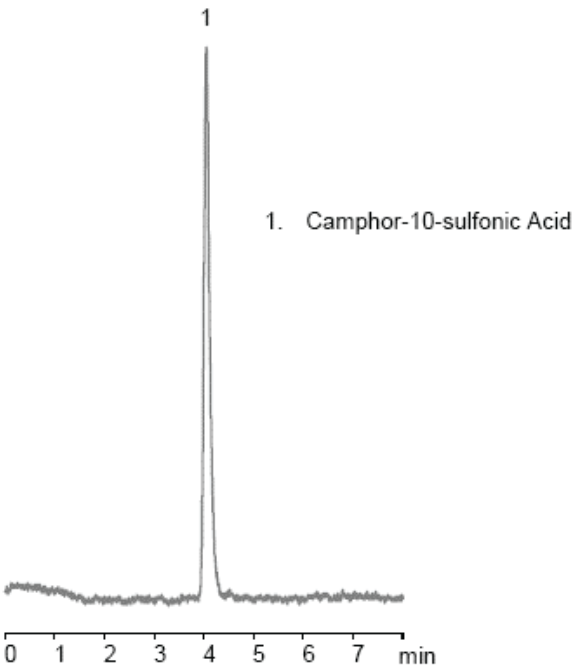


HPLC-CAD analysis of hydrazine and camphor sulfonic acid

Column: Comixshell CARP 2.7 μm 150× 4.6 mm
Mobile phase: 0.05% TFA water or 0.1% TFA
Flow rate: 1.0mL/min
Column temperature: 30° C
Detector: Sparkflux2000 CAD
Drying tube temperature: 40° C

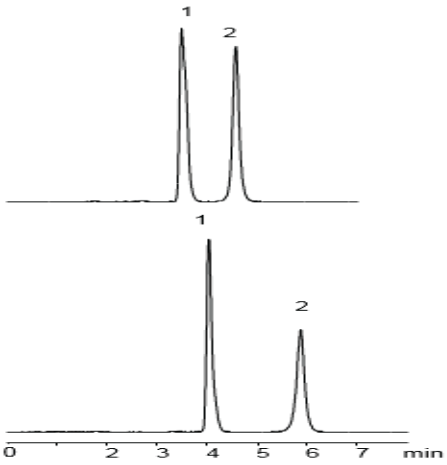


Liquid phase analysis of camphor sulfonic acid:
(This method is also applicable to the simultaneous detection of taurocholic acid and sodium ions)
Chromatographic column: Comixsil ACRP 5μm 150×4.6mm
Mobile phase: 400 mL acetonitrile + 100 mL water + 500 mL 40 mM ammonium acetate (pH 4)
Flow rate: 1.0 mL/min
Detector: Sparkflux2000 CAAD
Drying tube temperature: 40° C
Ionization voltage: 3KV



HPLC-CAD analysis of glucose and glucuronic acid:

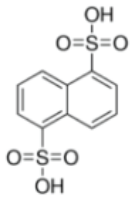
Column: Comixsil ACRP 5 μm 150× 4.6 mm
Flow rate: 1.0mL/min
Detector: Hunan Lingfeng Sparkflux2000 CAD
Drying tube temperature: 35° C,
Ionization voltage: 3KV
1. Glucose
2. Glucuronic acid
Mobile phase 1:
acetonitrile: 200mM pH 4
ammonium acetate =70:30
Mobile phase 2:
acetonitrile: 80mM pH 4
ammonium acetate =75:25



Note: This method can also analyze various monosaccharides, disaccharides and polysaccharides, such as glucose, fructose, xylose, sucrose, etc.

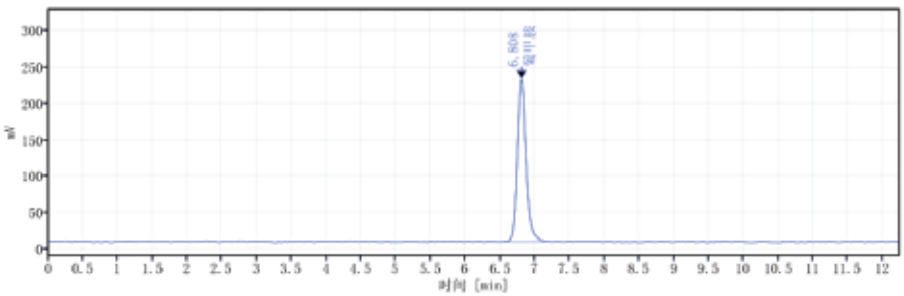
HPLC-CAD analysis of 1,5-naphthalene disulfonic acid and methyl glucosamine:

Column: Comixsil ACRP 5 μm 100× 4.6 mm
Mobile phase: 300mL acetonitrile + 100mL water + 600mL 100mM ammonium formate (pH 3)
Flow rate: 1.0 mL/min
Detector: Sparkflux2000 CAD
Drying tube temperature: 35° C,
Ionization voltage: 3KV



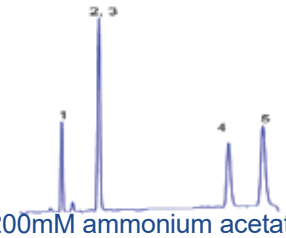
1,5-Naphthalenedisulfonic acid

Column: Comixsil ACRP 5μm 250× 4.6mm
Mobile phase: acetonitrile: 100mM ammonium formate (pH 3) =50:50
Flow rate: 1.0mL/min
Column temperature: 30° C
Detector: Sparkflux2000 CAD
Drying tube temperature: 35° C,
Ionization voltage: 3KV

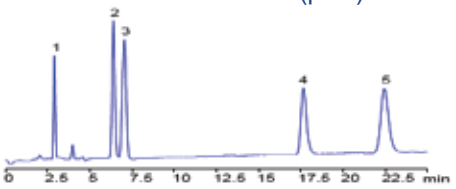


HPLC-CAD analysis of amino acids:

Column: Comixsil HCS 3u 150× 4.6 mm)
Flow rate: 1 mL/min
Injection volume: 2 μL
Detector: Sparkflux2000 CAD
Drying tube temperature: 35° C,
Ionization voltage: 3KV

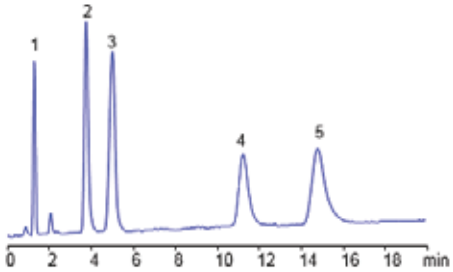


Acetonitrile: 200mM ammonium acetate (pH5) = 70:30



Mobile phase: acetonitrile: 200mM ammonium acetate (pH5)=65:35

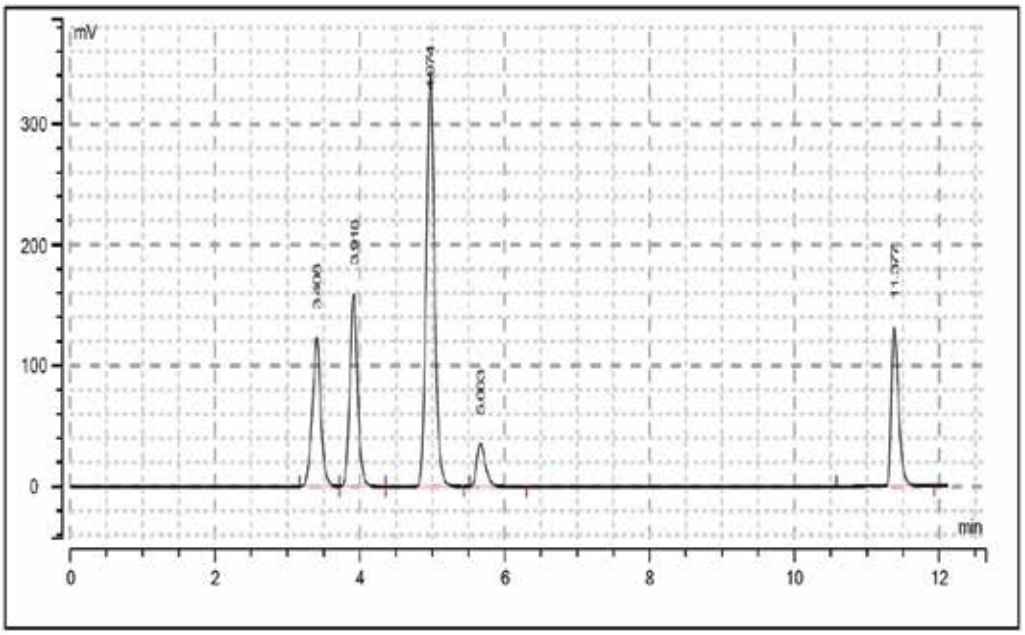
1. Chloride ions
2. Glutamine
3. Glutamic acid
4. Arginine
5. Lysine



Acetonitrile: 200mM ammonium acetate (pH5)=75:25

HPLC-CAD separation detection of ions

Column: Comixsil ACRP 3μ 150*4.6mm
Flow rate: 1mL/min
Mobile phase: A: H2O; B：ACN； C: 200 mM ammonium formate (pH 3)
Detector: Sparkflux2000 CAD
Drying tube temperature: 40° C,
Ionization voltage: 3KV



Comparison of performance parameters:

The gradient method

T/min	A/%	B/%	C/%
1-7	45	40	15
7.5	0	40	60

This method is explained by using liquid chromatography combined with a CAD detector and column to retain a variety of anions and cations through anion/cation exchange to achieve the detection of anions and cations.

This method is also suitable for the analysis of other inorganic ions when adjusting the organic ratio and buffer salt concentration.

HPLC-CAD method separates and detects 11 anions :

Column: Comixsil HAX 3u 100*3.0mm

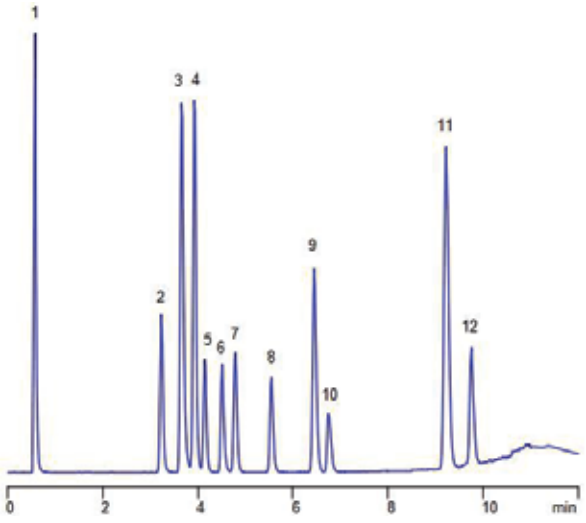
Flow rate: 0.8mL/min

Mobile phase: A: H2O; B：ACN； C: 200 mM ammonium formate (pH 3)

Detector: Sparkflux2000 CAD

Drying tube temperature: 40° C,

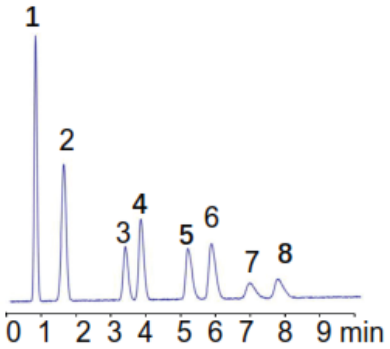
Ionization voltage: 3KV



1. Sodium ion
2. Phosphate
3. Phosphite
4. Methane sulfonate
5. Chloride
6. Citrate
7. Bromide
8. Nitrate
9. Iodide
10. Trifluoroacetate
11. Perchlorate
12. Sulfate

Eight aminoglycosides analysis by HPLC-CAD:

Column: Comixsl HAC 5u 100*3.0mm
Flow rate: 0.6mL/min
Injection volume: 2 μL
Detector: Sparkflux2000 CAD
Drying tube temperature: 35° C,
Ionization voltage: 3KV



Mobile phase:
A: Acetonitrile: Water: 100 mM ammonium formate pH 3 = 75:20:5
B: Acetonitrile: Water: 100 mM Ammonium formate pH 3 = 40:40:20
Gradient Method:

	A%	B%
0	100	0
12	0	100

1.Erythromycin
2. Spectinomycin
3. Hygromycin B
4. Streptomycin
5. Amikacin
6. Kanamycin
7. Tobramycin
8. Neomycin

Analytical®
Technologies Limited

HPLC Servicing, Validation, Trainings and Preventive Maintenance :

HPLC Servicing :HPLC Servicing : We have team of service engineers who can attend to any make of HPLC promptly @the most affordable cost.

Trainings :We also take up preventive Maintenace to reduce downtime of HPLC's Trainings.

AMC's/CMC :AMC's/CMC :We offer user training both in-House and at customer sites on HPLC principles, operations, trouble-shooting.

Validations :Validations :We have protocols for carrying out periodic Validations as per GLP/GMP/USFDA norms.

Instruments :Instruments :We offer instruments/Renting Services Modules like pumps,detector etc. on Rent.

About Analytical Technologies

Analytical Technologies is synonymous for offering technologies for doing analysis and is the Fastest Growing Global Brand having presence in at least 96 countries across the global. Analytical Technologies Limited is an ISO:9001 Certified Company engaged in Designing, Manufaturing, Marketing & providing Services for the Analytical, Chromatography, Spectroscopy, Bio Technology, Bio Medical, Clinical Diagnostics, Material Science & General Laboratory Instrumentation. Analytical Technologies, India has across the Country operations with at least 4 Regional Offices, 6 Branch Offices & Service Centers. Distributors & Channel partners worldwide.

Our Products & Technologies

LCMS

Maldi TOF

Optima Gas Chromatograph

Flash Chromatograph

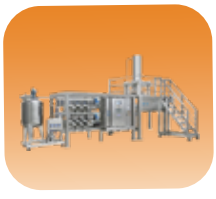
DAC Column

GCMS 3068

UHPLC

HPTLC

Ion Chromatograph



Production HPLC

HPLC

Column

DLS

Water purification system

Regulatory compliances

Corporate Social Responsibility

Analytical Foundation

ANALYTICAL FOUNDATION is a Nonprofit Organization (NGO) for the purpose of:

1. Research & Innovation **Scientist's awards & International Conferance visit sponsership / QC Professional Awards**: Quality life is possible by innovation only and the innovation is possible by research only, hence **ANALYTICAL FOUNDATION** is committed to identify such personallities for their contributions across various field of Science and Technology and awarding them yearly. To participate for award, send us your details of research /testing/ publication at info@analyticalfoundation.org

2. Improving quality of life by offering **YOGA Training courses, Work shops / Seminars** etc.

3.**ANALYTICAL FOUNDATION** aims to DETOXIFY human minds, souls and body by means of Yoga, Meditation, Ayurveda,Naturecure, Health Care, Ara, Events, Camps etc.

- A portion of profit of **ANALYTICAL GROUP** Company's goes into **ANALYTICAL FOUNDATION** for the aboce noble cause.

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Corporate & Regd. Office:
Analytical House, # E67 & E68,
Ravi Park, Vasna Road, Baroda,
Gujarat 390 015. INDIA

T: +91 265 2253620
+91 265 2252839
+91 265 2252370
F: +91 265 2254395

E :- info@analyticalgroup.net
info@hplctechnologies.com
info@multiplelabs.com

W:- www.analyticalgroup.net
www.hplctechnologies.com
www.multiplelabs.com

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