**Experience**

In our laboratory at the University of Geneva, we are using SEDEX LT-ELSD technology for more than 20 years as a complementary tool to LC detector and to develop LC-HRMS frontloading since this prerequisite concerns one of the core pillars of analysis. We have a long-term collaboration with the manufacturer, SEDERE, to demonstrate the potential of such detector in the pharmaceutical field. Their latest product, namely SEDEX LT-ELSD, is more sensitive than the previous generation and still robust, reliable, easy-to-use and robust against interferences.

Jean-Luc Veuthey, Ph.D. & Davy Guillarme, Ph.D.
Professor & Senior lecturer
School of Pharmaceutical Sciences, University of Geneva

**Bibliography**

- Evaporative Light-Scattering Detection. J.L. Veuthey, Ph.D. & Davy Guillarme, Ph.D.

**SEDEX LT-ELSD®**

- **Components**
  - Light Source: 10mW - 405nm Laser
  - Detector: Photomultiplier (PMT) Photodiode
  - Temperature Range: Ambient to 100°C
  - Flow Rate: 1 lpm (max.
  - Gain Adjustment)
  - Signal Amplification: SAGA (SEDEX 0 - 0.5 - 1 - 2 …. 10) Algorithm (0 - 0.5 - 1 - 2 …. 10)
  - Filter: Moving Average Moving Average Moving Average Dedicated Numerical Moving Average 2048 (2048) (2048)
  - Power Supply: 230V/50Hz 100V to 240V
  - External Requirements: Gas Supply: Nitrogen or Air
  - Gas Flow: Less than 3L/min
  - Weight: 30kg

- **Specifications**
  - Typical Sensitivity: 1000pg
  - Typical Accuracy: 0.5%
  - Sensitivity: 500pg
  - Accuracy: 0.5%
  - Resolution: 1.5
  - Sensitivity: 1 ng
  - Accuracy: 0.5%
  - Resolution: 1.5
  - Sensitivity: 5 ng
  - Accuracy: 0.5%
  - Resolution: 1.5
  - Sensitivity: 100 ng
  - Accuracy: 0.5%
  - Resolution: 1.5

- **Technical Support**
  - On-site installation and training.
  - Full SOP (Standard Operating Procedures) including IQ, OQ, PQ.
  - Technical and applications support.
  - Easy-to-order spare parts and accessories.
  - Flexible service contract options.

- **Contact Information**
  - Email: info@sedere.com
  - Tel: +33 (0)1 45 18 05 18 - Fax: +33 (0)1 45 18 05 25
  - 94141 Alfortville Cedex - FRANCE

SEDEX LT-ELSD® is more sensitive than the previous generation and still robust, reliable, easy-to-use and robust against interferences. It provides you with:

- A Workflow dedicated networks at your service.
- On-site installation and training.
- Full SOP (Standard Operating Procedures) including IQ, OQ, PQ.
- Technical and applications support.

SEDERE is committed to user satisfaction with every SEDEX detector, and provides you with:

- Web-access to applications in many fields.
- User seminars, on and off-site.
- Possible service contract options.
- Easy-to-order spare parts and accessories.

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www.sedere.com

**SEDEX LT-ELSD®**

- The Result of 25 Years of Evolution
- Low Temperature - Evaporative Light Scattering Detectors
Introducing SEDEX detectors

SEDEX develops, manufactures, distributes and supports SEDEX detectors, the most complete and versatile product line dedicated to Low-Temperature Light-Scattering, Detection (LT-ELSD™). As one of the pioneers of this detection mode, SEDEX remains exclusively focused on this technology as its core competency.

As the industry leader, SEDEX leverages decades of experience and customer knowledge to continually improve the range for High Sensitivity, High Flexibility and High fidelity performance for chromatography laboratories. The unparalleled selection of five SEDEX LT-ELSD™ models can satisfy both high performance requirements and budget limitations for all analytical and preparative chromatography applications from basic research to quality control.

Evaporative Light-Scattering Detection (ELSD) provide a Universal detection mode for the following analysis technologies:

- RS 232, USB.
- Safety features, patented Gas Supported Focusing (GSF™),
- Complete, efficient and reliable information and SOP,
- Data rate up to 100Hz,
- Nebulizer design for all applications,
- SEDEX Automated Gain Adjustment (SAGA),
- Enhanced digital signal processing,
- SEDEX TECHNOLOGY

SEDEX LT-ELSD™ is commonly used in Industrial, Governmental and University research and control laboratories.

The integration of the SEDEX ELSD in our preparative chromatography system was very fast and easy. This detector has proven to be a reliable solution for our customers who want to collect non-UV absorbing compounds. Thanks to its simplicity of use and its robustness this ELSD device requires no particular maintenance from the user; it can really be integrated in any preparative chromatography system as an easy and affordable "universal" detector.

By combining reliability and versatility, SEDEX detectors take their place in the armamentarium of excellent techniques for medicinal chemistry.

Coming up in the next section, benefits and features of the SEDEX detectors in detail.

Sensitivity

Evaporative Light-Scattering Detection (ELSD) is a Universal detection mode for the following analysis technologies:

- Standard HPLC,
- U-HPLC,
- HTLC,
- µ-HPLC,
- GC,
- Preparative HPLC,
- Flash Chromatography,
- Counter Current Chromatography,
- SFC.

ELSD doesn't rely on the optical properties of the analyte. This makes this detection mode ideal for all compounds less volatile than the middle phase, including those with no chromophore or widely differing extinction coefficients.

CASE 4

**UNDERIVATIZED AMINO ACIDS**

Analysis of amino acids has typically been complicated by the absence of adequate chromophores in naturally occurring amino acids. Using LT-ELSD™, sensitivity is excellent with detection limits as low as 2ng on column. In this study, twenty-five amino acids have been separated and quantified within 20min without any sample preparation step for derivation.

**Injection Volume:** 2µl
**Column:** Diol (5µm, 4.6 x 250mm), 40°C
**Gradient:** from 5%B to 35%B
**Flow Rate:** 1mL/min
**Eluent:** A - 0.1% formic acid in H2O; B - 0.1% formic acid in Acetonitrile

**Chromatogram of the HPLC/ELSD analysis of underivatized amino acids**

**CASE 5**

**U-HPLC**

The advent of high-throughput screening requires an increasing number of rapid high-throughput methods such as U-HPLC to decrease the number of primary screening assays. In this respect, the powerful and versatile LT-ELSD™ is the detector of choice because of its universality, high sensitivity and optimized technology that provides the smallest peaks widths, the best symmetry, and high data rate. This example shows an application which combines an ultra-fast liquid chromatography system with LT-ELSD™ to determine pharmaceuticals and non-chromatographic compounds such as artesunate used as an antimalaric drug.

**Injection Volume:** 2µL
**Column:** Chiracel OD (5µm, 4 x 150mm), 35°C
**Gradient:** from 0%B to 100%B in 1min
**Flow Rate:** 5mL/min
**Eluent:** A - H2O + (0.5% TFA, 0.3% HFBA); B - Acetonitrile

**Chromatogram of the U-HPLC/ELSD analysis of ten active pharmaceutical ingredients**

**CASE 6**

**HPLC**

Supercritical Fluid Chromatography is gaining increasing interest. It presents many advantages compared to other chromatography techniques and is a hitherto important in a powerful and green technology in industries such as pharmaceutical, agricultural, food and environmental, etc. The following example demonstrates that the combination of SFC-LT-ELSD™ provides a much simpler and quicker alternative to Gas Chromatography for the fast screening of impurities in biodiesel.

**Injection Volume:** 2µL
**Column:** Diol (5µm, 4.6 x 150mm), 60°C
**Gradient:** from 5%B to 35%B in 1min
**Flow Rate:** 1mL/min
**Eluent:** A - 0.1% formic acid in Acetonitrile; B - 0.1% formic acid in H2O

**Chromatogram of SFC/ELSD analysis of AMDS standard for biodiesel quality determination**

**FEATURES**

- High sensitivity for semivolatiles and thermo-sensitive compounds.
- Low noise background (-90dB).
- Improved signal-to-noise ratio (S/N ratio).
- Optimization of peak shape and peak width.
- Compatibility of operating protocols.
- Compatibility with any HPLC protocol.
- Prevents contamination of critical detector components.
- User friendly, low maintenance system.
- Integrates readily with HPLC software with drivers.

**ORDERING INFORMATION**

**Standards Sets**

- SEDEX HPLC (90000)
- SEDEX U-HPLC (90050)
- SEDEX HTLC (90070)
- SEDEX µHPLC (90090)
- SEDEX Prep. Chromatography & Melting Point (90100)
- SEDEX Prep. Chromatography (90110)
- SEDEX LC (85000)
- SEDEX Micro LC (85050)
- SEDEX Prep LC (85100)
- SEDERE ELSD (85125)
- SEDERE Prep. Prep. Chromatography (85200)

**OVERVIEW**

An Industry Standard for Evaporative Light-Scattering Detection

The arrival of the Ultra Fast HPLC has fueled the demand for technology capable of both rapid screening and quantitative analysis of complex mixtures at high speed. SEDERE LT-ELSD™ technology provides a complete solution for high throughput applications within the drug discovery, pharmaceutical and academic research domains. SEDEX detectors are used in many stage administration company and in hundreds of chromatography laboratories in industry and academia.

For many research and process requirements, complementary detection by LT-ELSD™ has proven invaluable in high quality LCMS and other HPLC procedures. SEDERE LT-ELSD™ is particularly valuable for high speed analytical screening where sample contamination may be unacceptable. With other ELSD detectors, visualization would lead the detection capability of the platform, rendering it of little use.

By combining reliability and versatility, SEDEX detectors have taken their place in the armamentarium of efficient techniques for medicinal chemistry.

**ORDERING INFORMATION**

- **Standards Sets**
  - SEDEX HPLC (90000)
  - SEDEX U-HPLC (90050)
  - SEDEX HTLC (90070)
  - SEDEX µHPLC (90090)
  - SEDEX Prep. Chromatography & Melting Point (90100)
  - SEDEX Prep. Chromatography (90110)
  - SEDEX LC (85000)
  - SEDEX Micro LC (85050)
  - SEDEX Prep LC (85100)
  - SEDERE ELSD (85125)

- **Micro LC**
  - Low Flow Version (85300)
  - Prep LC Version (85600)
  - Micro LC Version (85400)
  - SFC Version (85500)

- **HPLC**
  - HPLC Version (85000)
  - HPLC Version (85100)
  - HPLC Version (85200)

- **U-HPLC**
  - UHPLC Version (85400)
  - UHPLC Version (85600)

- **HTLC**
  - Prep LC Version (85101)
  - Prep LC Version (85125)
  - Prep LC Version (85132)

- **LCMS**
  - LCMS Version (85002)
  - LCMS Version (85010)
  - LCMS Version (85020)

- **SFC**
  - SFC Version (85500)
  - SFC Version (85502)
  - SFC Version (85503)

- **Prep LC**
  - Prep LC Version (85600)
  - Prep LC Version (85601)

- **SFC**
  - SFC Version (85500)
  - SFC Version (85501)
  - SFC Version (85502)
  - SFC Version (85503)

- **Prep LC**
  - Prep LC Version (85600)
  - Prep LC Version (85601)

- **Prep LC**
  - Prep LC Version (85602)
  - Prep LC Version (85603)

- **Prep LC**
  - Prep LC Version (85604)
  - Prep LC Version (85605)

**Sensitivity**

**Flexibility**

**Experience**
Low Temperature Evaporative Light-Scattering Detectors

Nebulize eluent

Nebulize eluent

ND select small droplets to minimize background noise

The eluent from the column is mixed with an inert gas and goes through the narrow orifice of a nebulizer to generate a homogeneous mist. This fine mist is composed of droplets of mobile phase containing the eluting compound of interest.

SEDEX LT technology allows the selection of droplets as a function of their size in order to prevent larger droplets from entering the evaporation (drift) tube. Large droplets would require higher temperatures to be dried, resulting in increased background noise. This selection of droplets by size enables detection using a very low evaporation temperature, with resulting low baseline noise and excellent sensitivity to solutes, including semi-volatile solutes.

Evaporate at low temperature every time so you won’t miss any compound

The nebulized eluent goes through a heated tube to evaporate the mobile phase. Solute molecules are obtained from the mist using a heated evaporation (drift) tube, at a low temperature. All SEDEX detectors are designed to evaporate mobile phases with high boiling points at very low temperatures. This unique feature minimizes the potential for evaporation or thermal decomposition of the compounds of interest, and makes the SEDEX LT technology a more reliable way to detect everything in the sample.

Detect light-scattering using gas supported focusing (GSF) for less maintenance and better data

The stream of solid particles enters a flow cell which includes a light source and a photomultiplier or a photodiode. The intensity of the light scattered by the particles is directly related to the mass of the eluted compound. The solute molecules from the mist, assisted by GSF™, go through an optical head designed to measure the scattered light. GSF™ involves the addition of gas to focus the solute particles within the optical head for enhanced detection and safety.

Why Low-Temperature evaporation is important in ELS detection

In an ELSD, the nebulized eluent is evaporated by going through a heated tube. The temperature of this tube is undoubtedly the most critical parameter when optimizing detection. If the temperature is too high, semi-volatile or thermally labile compounds in the sample may evaporate or decompose and will not be detected. Most of our competitors’ ELSD systems do not select droplets and require higher temperatures to reach acceptable levels of noise during the analysis, resulting in much lower sensitivities for semi-volatile and thermo-labile compounds.

• All SEDERE detectors feature low-temperature operation to ensure that excellent sensitivity is provided even for semi-volatile or thermally labile compounds. These detectors can be used with conventional analytical and preparative Liquid Chromatography, as well as with U-HPLC, HTLC, µ-HPLC, GPC, Flash Chromatography, CCC, and SFC.

Caffeine Injection

Better Detection of Semi-Volatile Solutes with SEDEX LT-ELSD™

Poor Detection of Semi-Volatile Solutes with High Temperature Evaporation

Why Low-Temperature evaporation is important in ELS detection

In an ELSD, the nebulized eluent is evaporated by going through a heated tube. The temperature of this tube is undoubtedly the most critical parameter when optimizing detection. If the temperature is too high, semi-volatile or thermally labile compounds in the sample may evaporate or decompose and will not be detected. Most of our competitors’ ELSD systems do not select droplets and require higher temperatures to reach acceptable levels of noise during the analysis, resulting in much lower sensitivities for semi-volatile and thermo-labile compounds.

• All SEDERE detectors feature low-temperature operation to ensure that excellent sensitivity is provided even for semi-volatile or thermally labile compounds. These detectors can be used with conventional analytical and preparative Liquid Chromatography, as well as with U-HPLC, HTLC, µ-HPLC, GPC, Flash Chromatography, CCC, and SFC.
SEDEX Model LC combines sensitivity, reliability, and accuracy for all your analytical works, thanks to unrivalled SEDEX technology.

The SEDEX Model LC detector provides the cost-effective solution in Evaporative Light-Scattering Detection for standard Liquid Chromatography. Control of the system can be done either locally or via a PC. A remote shut down mode is also provided to minimize cost and enhance system lifetime.

**FEATURES AND BENEFITS:**

- Optimizes sensitivity of non-volatile, thermally labile and semi-volatile compounds.
- Minimized band broadening thanks to a dedicated SEDEX LC HPLC nebulizer and an innovative cell design. This nebulizer covers the flow rate range from 200µL/min to 2mL/min and can be easily mounted and dismounted.
- With SAGA (SEDEX Automated Gain Adjustment)*, an innovative gain control available when it is driver-controlled by software, SEDEX LC automatically adapts the gain setting to avoid any off-scale saturation of the detector.
- Complete Remote Control: the gas, heater, photodiode and light source can be automatically shut off at the end of a series of analyses.

**TYPICAL APPLICATION: NATURAL PRODUCTS**

Many natural products such as herbal drugs are gaining more and more interest in the pharmaceutical and nutraceutical industry because they contain bioactive compounds. Some of these compounds such as saponins and terpenes do not possess any chromophore and therefore cannot be analyzed in HPLC using a UV detector. Only SEDEX ELSD can detect chromophoric and non-chromophoric molecules in a single gradient HPLC analysis with an excellent sensitivity, thanks to SEDEX technology. The following example shows a method for a quick and simultaneous determination of terpenic lactones and flavonoids present in Ginkgo Biloba.

**CHROMATOGRAM OF FOUR TERPENIC LACTONES AND THREE FLAVONOIDS BY HPLC/ELSD**

1 - Bilobalide,  
2 - Ginkgolide C,  
3 - Ginkgolide A,  
4 - Ginkgolide B,  
5 - Quercetin,  
6 - Isorhamnetin,  
7 - Kaempferol

**Injection Volume:** 1 µL  
**Column:** Hypersil Gold (1.9µm, 2.1 x 50mm), 30°C  
**Eluent:** A - 0.1% formic acid in H2O; B - 0.1% formic acid in Acetone  
**Gradient:** 0-0.5 minute: 5%B, 0.5-4 minutes: from 5%B to 50%B, 4-6 minutes: 50%B  
**Flow Rate:** 0.6mL/min
SEDEX Model FP combines simplicity, reliability, and robustness for all your purification works, thanks to unrivalled SEDEX technology.

The SEDEX Model FP provides the cost-effective solution in Evaporative Light-Scattering Detection for purification by preparative HPLC, preparative SFC, Flash Chromatography or CounterCurrent Chromatography. Control of the system can be done either locally or via a PC. A remote shut down mode is also provided to minimize cost and enhance system lifetime.

Sophisticated, yet easy to use, SEDEX FP, mounted with an external splitter, is ready to detect and monitor your fraction collection.

**FEATURES AND BENEFITS:**

- Minimized band broadening thanks to a dedicated SEDEX FP nebulizer and an innovative cell design. This nebulizer covers the flow rate range from 100µL/min to 5mL/min and can be readily and quickly mounted and dismounted.
- With **SAGA (SEDEX Automated Gain Adjustment)***, an innovative gain control available when it is driver-controlled by software, SEDEX FP automatically adapts the gain setting to avoid any off-scale saturation of the detector.
- An optimized liquid flow path and a Gas-Focusing technology in the optical detection cell prevent the detector from any clogging or contamination, and extend its operability.
- Complete remote control: the gas, heater, photodiode and light source can be automatically shut off at the end of a series of purifications.

**TYPICAL APPLICATION: AMINO ACIDS, PEPTIDES, PROTEINS**

In protein and peptide “mapping” and purification, where gradient elution is required, SEDEX ELSD has a key advantage over UV detection: it can detect all compounds including single amino acids, its baseline is unperturbed by the mobile phase change during the gradient, and remains flat. As a mass detector, ELSD can also provide a material balance purity assessment.

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**Injection Volume:** 2µL

**Column:** Ascentis Express Peptide ES-C18

2.7µm, 2.1 x 150mm), 25°C

**Eluent:** A - 0.1% TFA in H2O; B - 0.1% TFA in Acetonitrile

**Gradient:** 0-0.5 minute: 2%B, 0.5-15 minutes: from 2%B to 60%B, 15-20 minutes: 60%B

**Flow Rate:** 0.3mL/min

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*patent pending
SEDEX Model 80 LT-ELSD™ combines sensitivity, reliability, and accuracy for your analyses, thanks to the univalled SEDEX low-temperature technology.

SEDEX Model 80 LT-ELSD presents a number of innovative features including a unique low-temperature technology, with a competitive price. The evaporation drift tube design optimizes both efficiency and sensitivity. In addition, you can control the system locally or via a PC (with RS-232 activated models) thanks to drivers. A remote shut down mode is also provided to minimize cost and enhance system lifetime.

**Features and Benefits:**

- Low-temperature evaporation of the mobile phase: optimizes sensitivity of thermally labile and semi-volatile compounds.
- Minimized band broadening thanks to an innovative cell design and a choice of nebulizers. Two nebulizers, HPLC and Flash Chromatography, are available to optimize your applications. These nebulizers cover the flow rate range from 100µL/min to 5mL/min and can be easily changed to meet your application requirements. In addition, all parts of SEDEX Model 80LT are designed so that the observed peak widths are similar to those obtained with UV/Vis detectors.
- Complete Remote Control: gas, heater, photomultiplier and light source can be automatically switched off at the end of a series of analyses.

**Typical Application: Surfactants**

The high sensitivity and time saving potential of LT-ELSD™ are evident in the HPLC/ELSD analysis of mixtures of polymers in a single run which is not feasible with alternative methods such as RI, UV and MS detection.

**Column:** Acclaim Surfactant Plus (3µm, 3.0 x 150mm), 30°C

**Eluent:**
- A - Ammonium acetate, 100mM, pH5;
- B - Acetonitrile

**Gradient:** 0-0.1 minute: 2%B, 0.1-20 minutes: from 2%B to 20%B, 20-30 minutes: 20%B to 50%B, 30-35 minutes: 50%B

**Injection Volume:** 2µL

**Flow Rate:** 0.6mL/min
SEDEX Model 85 LT-ELSD™ combines total remote control with excellent sensitivity and provides the standard solution in Low-Temperature Evaporative Light-Scattering Detection for HPLC, U-HPLC, and SFC.

**FEATURES AND BENEFITS:**

- Low-temperature evaporation of the mobile phase: optimizes sensitivity of thermally labile and semi-volatile compounds.
- Minimized band broadening thanks to an innovative cell design and a wide choice of nebulizers. Six nebulizers are available to optimize your applications. Four nebulizers cover the flow rate range from 5μL/min to 5mL/min, additionally there is one nebulizer optimized for U-HPLC and another one specifically for SFC. All these nebulizers can be easily changed to meet the requirement of the application. In addition, all parts of SEDEX Model 85LT are designed to provide the lowest dispersion, so that the observed peak widths are similar to those obtained with the most advanced UV/Vis detectors.
- Complete Remote Control: gas, heater, photomultiplier and light source can be automatically switched off at the end of a series of analyses.

**TYPICAL APPLICATION: POLAR, NON-POLAR, NEUTRAL, ACIDIC, BASIC API AND THEIR COUNTERIONS**

The outstanding combination of multimodal columns with a unique detection mode such as LT-ELSD™ can provide simple, direct and simultaneous analyses of active pharmaceutical ingredients of different chemical structures and their respective counterions.

**HIGH PERFORMANCE AND HIGH THROUGHPUT**

**SEDEX 85LT**

**LT-ELSD™**

1 - Acetaminophen, 2 - Sodium, 3 - Potassium, 4 - Hydrocortisone, 5 - Procainamide, 6 - Chloride, 7 - Nitrate, 8 - Miconazole, 9 - Losartan, 10 - Diclofenac

**Injection Volume:** 2μL

**Column:** Acclaim Trinity P1 (3μm, 2.1 x 150mm), 30°C

**Eluent:** A - 80% Ammonium acetate 20mM, pH5 / 20% Acetonitrile; B - 30% Ammonium formate 200mM, pH3 / 70% Acetonitrile

**Gradient:** 0-2 minutes: 0%B, 2-17 minutes: from 0%B to 100%B

**Flow Rate:** 0.35mL/min
SEDEX Model 90 LT-ELSD combines total remote control with unrivalled sensitivities compared to all other aerosol-based detectors. It provides the ultimate solution in low-temperature evaporative light-scattering detection for HPLC, U-HPLC, and SFC, resulting from a new optical head design based on laser technology. This detector shows a number of innovative features including the ability to select the best nebulizer and a unique low-temperature technology. The evaporation drift tube design optimizes both efficiency and sensitivity. In addition, you can control the system locally or via a PC thanks to drivers. A remote shut down mode is provided to minimize consumable cost and enhance system lifetime.

Features and Benefits:

- Low-temperature evaporation of the mobile phase: optimizes sensitivity of thermally labile and semi-volatile compounds.
- New optical head design based on a selected laser: provides the highest signal-to-noise ratio for all compounds (typical sensitivity down to the mid picogram level on column).
- Dynamic range of over four orders of magnitude: enhanced determination of very low percentage of impurities.
- Direct linearity on the global dynamic range: enhanced correlation coefficients.
- Minimized band broadening thanks to an innovative cell design and a wide choice of nebulizers. Six nebulizers are available to optimize your applications. Four nebulizers cover the flow rate range from 5µL/min to 5mL/min, additionally there is one nebulizer optimized for U-HPLC and another one specifically for SFC. All these nebulizers can be readily and quickly changed to meet the requirement of the application. In addition, all parts of SEDEX Model 90LT are designed to provide the lowest dispersion, so that the observed peak widths are similar to those obtained with the most advanced UV/Vis detectors (typically below 1 second in U-HPLC).
- Complete Remote Control: gas, heater, photomultiplier and light source can be automatically switched off at the end of a series of analyses.

**Chromatograms of the simultaneous HPLC/ELSD analysis of imipramine and its counterion, with and without an impurity (sodium, 5ppm)**

1. Impurity assessment

**Injection Volume:** 2µL (20µg Imipramine, 10ng Sodium on column)

**Column:** Acclaim Trinity P1 (3µm, 2.1 x 150mm), 35°C

**Eluent:** Ammonium acetate 50mM, pH5 / Acetonitrile (60:40)

**Flow Rate:** 0.5mL/min
**TYPICAL APPLICATIONS:**
**IMPURITY ASSESSMENT AND RESPONSE CONSISTENCY**

Aerosol-based detectors are very useful to pharmaceutical analysis, particularly those which provide the best sensitivity and reproducibility, a wide dynamic range, a correct direct linearity and response consistency, and which can suit both conventional HPLC and U-HPLC. SEDEX Model 90 LT-ELSD meets perfectly well these requirements. As an example, two case studies are presented on impurity assessment and response consistency.

1 - 5-Fluorocytosine,
2 - Theophylline,
3 - Acetaminophen, (500ppm each)

**Injection Volume:** 2µL

**Column:** Halo C18 (2.7µm, 2.1 x 150mm), 30°C

**Eluent:** H2O / Acetonitrile (85:15)

**Flow Rate:** 0.5mL/min

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**SEDEX Drives**

SEDEX ELS detectors are designed to integrate into any LC or SFC system, from any manufacturer. They can also be directly controlled and data collected via drivers with the following major chromatography software:

- OpenLAB® (ChemStation and EZChrom editions)
- ChemStation®
- EZChrom®
- Chromeleon®
- Xcalibur®
- Clarity®
LT-ELSD™ solves the major problems common to other HPLC detectors: lack of sensitivity, incompatibility with multi-solvent gradients. This state-of-the-art technique is ideally suited to non-chromophoric compounds, such as lipids and phospholipids.

LT-ELSD™ is also highly useful where the mobile phase contains a chromophore, such as Acetone, which blanks out the UV detector.

### CASE 1  
**LIPIDS**

LT-ELSD™ allows gradient elution. Gradient elution provides increased resolution of sugars in minimal time, impossible with RI and isocratic elution. Moreover, lower detectable limits (sensitivity) can be improved by orders of magnitude. Nanomole and picomole detectability are obtained with the improved sensitivity of LT-ELSD™. Mono-, oligosaccharides and polyols are easily and rapidly characterized by gradient HPLC with LT-ELSD™. Previously, RI detection entailed slow and tedious programmed flow, often up to several hours. LT-ELSD™ also enables analysis of high "DPs" which is an important advantage.

### CASE 2  
**CARBOHYDRATES**

### CASE 3  
**INORGANIC IONS**

LT-ELSD™ can dramatically simplify the analysis of inorganic ions in aqueous samples. A broad range of volatile buffers can be used to separate the ions. Since the mobile phase and buffers are vaporized before the ions are detected, the need for ion suppression is eliminated. This example shows a generic method to determine rapidly and simultaneously inorganic cations and anions.
FEATURES

Sedex Technology
- High sensitivity for semi-volatile and thermo-sensitive compounds.
- Improved background noise to provide excellent SN ratio.
- Optimization of peak shape and peak width.
- Consistency of operating protocols.
- Compatibility of operation with any HPLC protocol.
- Prevention of contamination of critical detector components.
- User-friendly, low maintenance system.
- Integrates readily with HPLC software with drivers.

Evaporative Light Scattering Detection (ELSD) provides a Universal detection mode for the following analyte technologies:
- Standard HPLC.
- U-HPLC.
- HTLC.
- IPC.
- Preparative HPLC.
- Flash Chromatography.
- Counter Current Chromatography.
- SFC.

ELSD does not rely on the optical properties of the analyte, making this detection mode ideal for all compounds less volatile than the middle phase, including those with no chromophore or widely differing extinction coefficients.

The detection mode is able to accurately measure a wide range of analytes with consistent response and is therefore an extremely useful technique to get the complete picture of complex samples. In some cases, SEDEX LT-ELSD™ presents great advantages over UV, RI and MS:
- UV detection fails to detect compounds without chromophores.
- RI detection lacks sensitivity, cannot be used with gradient and is often difficult to operate due to drift and instability.
- MS mandates specific technical skills to be operated and cannot be used when analytes are difficult to ionize.

Typical applications using ELSD include Lipids, Carbohydrates, Aromatic Polymers but also Pharmaceutical High Throughput Screening. Peptides and Proteins, Natural Products and small molecules such as Amino Acids (without any derivatization) or Inorganic Ions (without the need of any additional post-column device).

SEDEX LT-ELSD™ is commonly used in Industrial, Governmental, and University Research and control laboratories.

CASE 4

UPPER DERIVATIZED AMINO ACIDS

Analysis of amino acids has typically been performed by the absence of volatile amino acids in naturally occurring amino acids. Using LT-ELSD™, sensitivity is excellent; with detection limits as low as 2ug on column study. Twenty amino acids have already been separated and quantified within 20min without any sample preparation step for derivatization.

Inlet: Micro LC, 22H, 2.1 x 150mm, Zorbax SB-C18 (1.8µm).
Flow Rate: 3 mL/min.
Eluent: CO2 / Ethanol (isocratic, 95:5); P (out) = 15MPa.
Injection Volume: 1 μL.
Detector: UV 180 - 400 nm (Standard, 280 nm).
Temperature: 90°C.
Detection: 3 µL/min.

CASE 5

U-HPLC

This methodological discovery environment requires an increasing number of rapid high-throughput methods such as the U-HPLC to detect and identify compounds present at low quantities. In this context, the powerful and versatile LT-ELSD™ is the detector of choice because of its high sensitivity and optimized technology which provides the smallest peaks widths, the best symmetry, and high data rate. This example shows an application which combines an ultra-fast liquid chromatographic system with LT-ELSD™ to determine chromatographic and non-chromatographic components such as artefacts used as an antimicrobial drug.

Inlet: Micro LC, 22H, 2.1 x 150mm, Zorbax SB-C18 (1.8µm).
Flow Rate: 4 mL/min.
Eluent: (A): Buffer 0.1% (Acetic acid), (B): 100% acetonitrile.
Injection Volume: 1 μL.
Detector: UV 180 - 400 nm (Standard, 280 nm).
Temperature: 80°C.
Detection: 100 µL/min.

CASE 6

UHPLC

Supercritical Fluid Chromatography is gaining an increasing interest. It presents more advantages compared to other chromatographic techniques and is often prioritized in a greener way in industries such as pharmaceutical, agricultural, food and environmental etc. The following example demonstrates that the combination of SFC-LT-ELSD™ provides a much simpler and quicker relevant alternative to Gas Chromatography for the fast screening of impurities in biodiesel.

Inlet: Micro LC, 22H, 2.1 x 150mm, Zorbax SB-C18 (1.8µm).
Flow Rate: 3 mL/min.
Eluent: CO2 / Ethanol (isocratic, 95:5); P (out) = 15MPa.
Injection Volume: 1 μL.
Detector: UV 180 - 400 nm (Standard, 280 nm).
Temperature: 90°C.
Detection: 3 µL/min.
SEDEX LT-ELSD™

**Low Temperature - Evaporative Light Scattering Detectors**

**THE RESULT OF 25 YEARS OF EVOLUTION**

**SEDEX** is committed to user satisfaction with every SEDEX detector, and provides you with:

- A Worldwide distribution network at your service.
- On-site installation and training.
- Full SOP (Standard Operating Procedures) including IQ, OQ, PQ.
- Technical and applications support.
- Web-access to applications in many fields.
- User manuals, on and off-site.
- Possible service contract options.
- Easy-to-order spare parts and accessories.

**SEDERE**

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www.sedere.com

**SENSITIVITY** | **FLEXIBILITY** | **EXPERIENCE**

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**SEDEX**

**LT-ELSD™**

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**EXPERIENCE**

Our laboratory at the University of Geneva. We use the SEDEX LT-ELSD technology for more than 20 years as a complementary tool in LC detector and to develop LC-FAB Frontrunning since the prerequisite concerning the nature of the mobile phases is easier. We have a long-term collaboration with the manufacturer, SEDERE, to demonstrate the interest concerning the nature of the mobile phase in order to adapt and/or improve the detector in the pharmaceutical field. Our latest product, namely SEDEX LT, is more sensitive than the previous generation and still robust, reliable, easy-to-use and almost universal.

Jean-Luc Veuthey, Ph.D. & Davy Guillarme, Ph.D. Professor & Senior lecturer School of Pharmaceutical Sciences, University of Geneva

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**Bibliography**

GETTING MORE OUT OF YOUR HPLC, U-HPLC, LCMS, AND SFC ANALYSIS

Introducing SEDEX detectors

SEDEX develops, manufactures, distributes and supports SEDEX detectors, the most complete and versatile product line dedicated to Low-Temperature Evaporative Light Scattering Detection (LT-ELSD™). As one of the pioneers of this detection mode, SEDEX remains exclusively focused on this technology as its core competency.

As the industry leader, SEDEX leverages decades of experience and customer knowledge to continually raise the bar for High Sensitivity, High Flexibility and High reliability detector performance for chromatography laboratories.

The unparalleled selection of five SEDEX LT-ELSD™ models can satisfy any high performance requirements and budget limitations for all analytical and preparative chromatography applications from basic research to quality control.

FEATURES

- User friendly, low maintenance system,
- Prevents contamination of critical detector components,
- Lowest background noise to provide excellent S/N ratio,
- Pounds,
- High sensitivity for semi-volatile and thermo-sensitive compounds,
- Superior signal stability over the entire mobile phase, including those with no chromophore or widely differing extinction coefficients.

Introducing SEDEX Light Scattering Detection (ELSD) provides a Universal detection mode for the following analyte technologies:

- Standard HPLC,
- U-HPLC,
- HPLC,
- CPC,
- Preparative HPLC,
- Flash Chromatography,
- Counter Current Chromatography,
- SFC.

ELSD doesn’t rely on the optical properties of the analyte, making this detection mode ideal for all compounds less volatile than the mobile phase, including those with no chromophore or widely differing extinction coefficients.

This detection mode is able to accurately measure a wide range of analytes with consistent response and is therefore an extremely useful technique to get the complete picture of complex samples.

In some cases, SEDEX LT-ELSD™ presents great advantages over UV, RI and MS:
- UV detection fails to detect compounds without chromophores:
- RI detection lacks sensitivity, cannot be used with gradient and is often difficult to operate due to drift and instability.
- MS necessitates specific technical skills to be operated and cannot be used when analytes are difficult to ionize.

Typical applications using ELSD include Lipids, Carbohydrates, Steroids, Polymers but also Pharmaceutical High Throughput Screening, Peptides and Proteins, Natural Products and small molecules such as Amino Acids (without any derivatization step) or Inorganic Surfactants, Polymers but also Pharmaceutical High Throughput Screening.

SEDEX LT-ELSD™ is commonly used in industrial, Governmental, and University research and control laboratories.

ORDERING INFORMATION

For further details on our products, please contact your local SEDEX representative, visit our website at www.sederco.com or send an e-mail to sales@sederco.com.

CASE 4

UNDERIVATIZED AMINO ACIDS

Analysis of amino acids typically has been complicated by the absence of adequate chromatographic methods in naturally occurring amino acids. Using LT-ELSD™, sensitivity is excellent with detection limits as low as 2 pg on column study. Twenty five amino acids have been separated and quantified within 20 minutes with no sample preparation step for derivatization.

Injection Volume: 1µL Column: Quinax 5µm (column: 1 x 150 mm) Flow Rate: 0.5mL/min. Sample: 10 µL of amino acids in 0.1% TFA

CASE 5

U-HPLC

This analytical discovery environment requires an increasing number of rapid high-throughput methods such as UHPLC to detect compounds possessing a wide variety of properties. In this respect the powerful and versatile LT-ELSD™ is the detector of choice because of its universality, high sensitivity, and optimized technology that provides the smallest peak widths, the best symmetry, and high data rate. This example shows an application which combines an ultra-fast liquid chromatography system with LT-ELSD™ to determine pharmaceutical and non-chromophoric compounds such as artesunate used as an antimalaric drug.

Injection Volume: 2µL Column: ReproFire® C21, 5µm, 5x150mm, Flow Rate: 2µL/min. Gradient: 0% A to 100% A in 3 minutes. Flow Rate: 0.5mL/min. Sample: 0.5µL of Artesunate

CASE 6

SFC

Supercritical Fluid Chromatography is gaining an increasing interest. It presents many advantages compared to other chromatography techniques and it has enjoyed a powerful and great penetration in industries such as pharmaceutical, agricultural, food environments, etc. The following example demonstrates that the combination of SFC-LT-ELSD™ provides a much simpler and quicker relevant alternative to Gas Chromatography for the fast screening of impurities in Biodiesel.

Injection Volume: 10µL Column: SunFire®silica-C18 5µm, 5x150mm, Flow Rate: 1mL/min. Gradient: 0% A to 100% A in 10 minutes. Flow Rate: 1mL/min. Sample: 10µL of 1% B (Biodiesel from Castor Plant)

An Industry Standard for Evaporative Light-Scattering Detection

The arrival of the Ultra Fast HPLC has fueled the demand for technology capable of both high-volume and high-performance analyses of complex matrices at high speed. SEDEX LT-ELSD™ technology is increasingly used across a wide range of applications within the drug discovery, pharmaceutical and custom synthesis industries. SEDEX detectors are used in many large pharmaceutical company and in hundreds of biotechnology laboratories in industry and universities.

For every research and process requirement, complementary detection by SEDEX LT-ELSD™ has proven indispensable to high quality LC/MS and other HPLC procedures. SEDEX LT-ELSD™ is particularly valuable for the fast and reliable tracking of mixtures, which would otherwise be unapproachable. With other ELSD detectors, visualization could limit the detection capability of the platform, resulting in loss of vital data.

By combining reliability and sensitivity, SEDEX detectors have taken their place in the armamentarium of excellent techniques for medicinal chemistry.

The integration of the SEDEX ELSD in our preparative chromatography system was very fast and easy. This detector has proven to be a reliable solution for our customers who want to collect non-crystallization compounds. Thanks to its simplicity of use and its robustness this ELSD doesn’t require any particular maintenance from the user. It can really be integrated in any preparative chromatography system, as an easy and affordable “universal” detector.

John Foster Ph.D., Product Group Manager, Prep. Chromatography & Making Ready BVH UV Laboratories AG

CASE 7

Chromatogram of the UHPLC analysis of ten active pharmaceutical ingredients.

Chromatogram of the HPLC/ELSD analysis of underivatized amino acids.

Chromatogram of UHPLC analysis of five active pharmaceutical ingredients.

Chromatogram of SFC-ELSD analysis of A592H DSM standard for bacterial quinoline determination.
### Specifications

| Component | SEDEX LT | SEDEX LT-ELSD
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Detector</td>
<td>Liquid/Plasma PFP</td>
<td>Liquid/Plasma PFP</td>
</tr>
<tr>
<td>Light Source</td>
<td>15W - 45W Laser</td>
<td>Laser LED</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>Ambient to 100°C</td>
<td>Liquid/Plasma PFP</td>
</tr>
<tr>
<td>Flow Rate</td>
<td>Up to 500µL/min</td>
<td>Liquid/Plasma PFP</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>1ng - 5ng</td>
<td>Liquid/Plasma PFP</td>
</tr>
<tr>
<td>Weight</td>
<td>15kg (33lb)</td>
<td>Liquid/Plasma PFP</td>
</tr>
</tbody>
</table>

### External Requirements

- **Power**
  - 105/230V (120/240V) 50/60Hz
  - **Gas Supply**
    - Nitrogen or Air
    - Pressure: 3.5bar (less than 3L/min)

### Other Features

- **Ease of Use**
  - User-friendly interface
  - Robust, reliable, easy-to-use and virtually maintenance-free.

- **Patent Protection**
  - Patent pending

- **Technical Support**
  - Technical and applications support.

- **Installation**
  - On-site installation and training.
  - Full SOP (Standard Operating Procedures) including IQ, OQ, PQ.

- **Sensitivity**
  - Sensitivity levels adjusted to suit specific applications.

- **Flexibility**
  - Adaptable to various operating conditions.

- **Robustness**
  - Robust, reliable, easy-to-use and virtually maintenance-free.

- **Performance**
  - Robust, reliable, easy-to-use and virtually maintenance-free.

### Contact Information

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