Vapor analysis for MS

LFSESI
Low Flow Secondary ElectroSpray Ionizer

Breath analysis  Food control  Pharmacokinetics  Plant physiology
The LFSESI is an Add-On Ionizer that turns your MS into a powerful vapor analyzer at a very small fraction of its cost

SEADM’s LFSESI (Low Flow Secondary Electrospray Ionizer) is a vapor ion source used in substitution of the native MS source. It can be seemingly assembled with your current MS (weight between 5-6 kg depending on MS model) in less than 5 minutes.

**Unique ionization process: patented architecture**

Secondary Electrospray Ionization is a simple, well-known way to ionize vapors for mass spectrometry:

$$\text{Neutral sample vapours} + \text{Charger Ions} \rightarrow \text{Charged sample vapours}$$

LFSESI boosts this principle through a unique two-electrode architecture, reducing Coulomb repulsion, avoiding dilution, maximizing transmission and yielding **unmatched ionization efficiency**: 

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**Unique features**

- Patented architecture
- Highest ionization efficiencies currently available.
- LFSESI available for a wide range of mass specs
- Provides voltage
- Provides temperature, flow and electrospray control
- Accurate nano-electrospray current control
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**Diagram descriptions**

**SES**I

- Sample inlet (neutral vapors)
- Exhaust
- Ionization region
- Charging ions
- Ionized vapors
- Ion source
- MS curtain plate

**LFSESI**

- Sample inlet (neutral vapors)
- Exhaust
- Mass spec
- Focus electrode
- Impact electrode
- Orifice plate
- Counterflow
- FOCUSED ION BEAM: MAXIMUM TRANSMISSION
- MINIMUM COULOMB REPULSION: MAXIMUM ION CHARGER CONCENTRATION
- COUNTERFLOW DOES NOT PENETRATE THE CHAMBER: NO DILUTION EFFECT
Optimized design for superb results

![Graph of Operational advantages](image)

**Operational advantages**

- Add-on architecture to take full advantage of your MS.
- Soft ionization: LFSESI does not break your analyte molecules.
- Real time analysis
- Cost advantage: LFSESI will multiply your research capabilities at a very small fraction of the cost of your MS.
- Seamless assembly and disassembly from your MS (less than 5 minutes).
- Simple operation: working parameters and results are available through the MS user interface.
- High sensitivity (see table on the right)
- Wide range of sample flows (from 0.005 to 2 lpm).
- Carefully engineered fluid dynamics to avoid stagnant areas
- Robustness: able to continuously operate, at least, during 96 h
- Safe temperature and voltages
- Fully compliant with safety, electromagnetic and RoHS2 standards*
- Available for a wide range of Mass Spectrometers

<table>
<thead>
<tr>
<th>Compound</th>
<th>Vapour Concentration (ppt)</th>
<th>Mean intensity (arbitrary units)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melatonin [M+H]=233.13</td>
<td>54</td>
<td>5080</td>
</tr>
<tr>
<td>Propofol [M+H]=179.14</td>
<td>7</td>
<td>17600</td>
</tr>
<tr>
<td>Acetaminophen [M+H]=152.07</td>
<td>124</td>
<td>29400</td>
</tr>
<tr>
<td>Pentobarbital [M+H]=227.14</td>
<td>55</td>
<td>6140</td>
</tr>
<tr>
<td>Midazolan [M+H]=326.09</td>
<td>115</td>
<td>322</td>
</tr>
</tbody>
</table>

*Response of a MS orbitrap XL to various drug vapors; mass range (Da): 50-500; electrospray: H2O-HCOOH (0.1%); mass resolution: 30000

* Safety: EN 61010-1:2010; electromagnetic compatibility: (EN 61000-3-2:2006, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6 and EN 61326-1:2006) and RoHS2 compliant.
Applications

- The Zenobi Group, as part of the laboratory of Organic Chemistry (LOC) of ETH from Zürich, Switzerland, is currently applying LFSESI for several ground-breaking researches such as:
  
  - **Breath analysis** for rapid, non-invasive diagnosis of diseases (including alkenals and alkdienals, García-Gomez-1, 2015, and furans, García-Gomez-2, 2015).
  - Analysis of the effect of process parameters on the **quality of wine**, Farrell, 2017
  - Characterization of oxidative stress in smokers, Gaugg, 2016
  - Analysis of **vapors released from plants** (“decoding the language of the vegetable kingdom”, allowing the development of a new generation of plant treatments with reduced pesticide use), Barrios-Collado, 2016

- SEADM applies LFSESI for the detection of explosives in cargo operations at sub-trace levels (as low as 0.01 ppq for RDX explosive). (Fernandez de la Mora, 2016).

- The University Polittecnica of Madrid, in collaboration with SEADM, has applied the LFSESI-MS to detect human stress in real time and develop odor biometrics techniques from skin volatiles measurements, Rodriguez-Luján, 2013.

- The Australian Centre for Separation Science applies LFSESI for the rapid **Fingerprinting of Grape Volatile Composition** to identify grape ripening, Farrell, 2017

Customer review

**Pablo Martínez-Lozano Sinues**
ETH Zurich (Switzerland)

"In the first tests with the new and improved SESI measuring device, we were able to measure certain metabolic molecules in exhaled breath which scientists had not been able to detect in breath before."

See our LFSESI in action: watch our product videos

- Continuous monitoring of plant volatiles (Ref. Barrios-Collado, 2016.)
  https://www.youtube.com/watch?v=2WePciZtmM

- LFSESI used for breath analysis (by ETH Zürich). Watch the source in use in its prototype status:
  https://youtu.be/iEUNw6f_Pjw?t=6m34s
Selected Publications


Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>System sensitivity</td>
<td>Mean intensity of 17600 for a 7 ppt sample of propofol (MS orbitrap XI; electrospray: H2O-HCOOH (0.1%); mass resolution: 30000</td>
</tr>
<tr>
<td>Flow rate</td>
<td>0.005 ± 2 lpm.</td>
</tr>
<tr>
<td>LFSESI source</td>
<td>Dimensions: 400x300x420 mm Weight – range (depending on MS): 5-6 kg</td>
</tr>
<tr>
<td>Control Module</td>
<td>Dimensions: 410x125x255 mm Weight: 3 kg</td>
</tr>
</tbody>
</table>

Patents

"Ionizer for vapor analysis decoupling the ionization region from the analyzer", USPTO 8,461,523 B2, Jun. 11, 2013

"Ionizer for vapor analysis decoupling the ionization region from the analyzer", USPTO 8,217,342 B2, Jul. 10, 2012