Company Information

SEDET News
Latest updates
Terrorist killed, explosives-laden vehicle seized
NIO hunter finds explosives, sheriff says not related to terrorism
2 arrested on suspicion of terror offenses; Geneva remains on alert
Disneyland rolls out metal detectors, explosive-sniffing dogs in wake of terror attack
Explosives story from October goes viral; local sheriff sets record straight about terror threat
Terror suspects applied for explosives background checks, latest figures show
Explosives found in October, nothing linked to terrorists
GOP blocks efforts to deny guns to those on terrorist watch lists
Moment 'would-be terrorist tests explosives for planned attack on London'
Terrorist with explosives arrested in Benin
Certified multi-energy explosive detection
Prototype sensor can detect multiple explosives with a single test

Presentation

Sociedad Europea de Análisis Diferencial de Movilidad SL (SEADM) is a Spanish SME founded in February 2005 with the aim of developing a new generation of analytical instruments able to detect trace elements at the subfemtogram level, both in the atmosphere or within the body fluids, based on the know-how of its technical consultant and co-founder Juan Fernandez de la Mora, Yale University professor.

Areas of know-how



SEADM technology is based on the integration of commercial mass spectroscopy and two areas of proprietary know-how:

- Differential Mobility Analysis (DMA). Seadm develops Differential Mobility Analyzer (DMA) tailored to replacement of LC equipments, showing excellent characteristics of MS integration, speed, sensitivity and resolution.
- An ion source for ionisation of vapors, based on the Electrospray ionization (ESI). The ion source, or electrospray ionizer, readily interfaces with the Differential Mobility Analyzer (DMA), and allows on-line analysis of vapours, for DMA-MS applications.

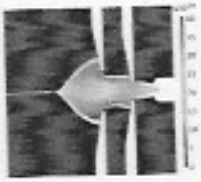
The company holds 11 patents in the area, and has the exclusive world-wide licence for 2 patents on mobility analysis property of Yale University (USA), and sublicensed by the US company NanoEngineering.

Activities

Since its foundation, SEADM has delivered equipments for the analysis of vapors and nanoparticles. These equipments are used for multiple applications within the nanoscience, health, environmental and security sectors. Our customers include mainly research institutions and instrumentation companies working in explosives detection, virus screening and aerosol measurements.








Since 2005, **SEADM** has completed or is currently developing the following **projects**:

1. EXPLOSIVE TRACE DETECTION

   - Industrial research activities in the field of explosive detection from 2005, all of them developed in partnership with Fundación CARTIF:
     - AROMA project, jointly funded by the Spanish Ministry of Industry (Profit program) and the Ministry of Defence (Coincidente program).
     - OLFATO project, funded by the Castilla y Leon Regional Government (ADE line 4), in 2006-2007.
     - DETEV project, funded by the Spanish Ministry of Industry in 2007-2009.
     - SIMDE project, funded by the Castilla y León Regional Government (ADE line 4) in 2007-2009.

     - CARGO Phase III project, under subcontract from the related company SEDET, which started in 2010 and was completed in 2013. This project was co-funded by the Spanish Ministry of Science and Innovation, under the Spanish National Plan for Scientific Research, Development and technical Innovation 2008-2011 (Ministerio de Ciencia e Innovación, dentro del Plan Nacional de Investigación Científica, Desarrollo e Innovación Tecnológica 2008-2011)

     - EFFISEC program, an FP7 integration program from the First Security Call (2009-2013), led by Morpho, where Seadm developed a trace detector based on mass spectrometry.

   - The company has developed a Demonstrator showing detection capability for vapour traces of explosive in the atmosphere at concentrations of 0.01 ppq (parts per quadrillion) .

2. DIFFERENTIAL MOBILITY ANALYSIS (DMA) DEVELOPMENTS

   - MAIMS Program (Mobility Analysis Integrated with Mass Spectrometry), an eighteen months program which began in September 2006, is an initiative to couple a Differential Mobility Analyzer (DMA) to an API Mass Spectrometer, in order to increase its resolution capability for biological analysis. MAIMS is an international Canadeka program and is partially funded by the Spanish Ministry of Industry within the 2004-2007 National R&D Plan.

- VEAME Program, which began in June 2009 and ended in December 2010. Its aim has been to develop an electronic Differential Mobility Analyzer (DMA). VEAME was supported by the Spanish Ministry of Industry. *Project number TSI-020100-2009-53.*

- EVA Program, which began in February 2010 and extended for 18 months. Its aim has been to couple Differential Mobility Analyzers (DMAs) in serie, in order to obtain a mobility filtering device with a resolution in the order of 1,000.

- VEAME DOBLE Program, which began in May 2011 and will be developed in 36 months. Its aim has been to develop a double electronic Differential Mobility Analyzer (DMA). VEAME DOBLE is supported by the Spanish Ministry of Industry, Energy and Tourism, within the National Plan for Scientific Research, Development and Technological Innovation 2008-2011 (Subprogram Avanza Competitividad I+D+I). *Project number TSI-020100-2011-34.*

3. VAPOR IONIZER BY MEANS OF AN ELECTROSPRAY CLOUD (SESI) DEVELOPMENT

- Development of an ion source for ionization of vapors based on an electrospray cloud (SESI) directly integrated to the Differential Mobility Analyzer (DMA). An internally funded program, its aim is to increased ten fold the ionization efficiency of an Electrospray source closely integrated with a Differential Mobility Analyzer (DMA).

4. IDOC Program (Odour Diagnosis of Cancer)

- IDOC Program (Odour Diagnosis of Cancer), under subcontract from the company Ilia Systems S.L., started in June 2010 and will be developed for 18 months. The aim of Seadm participation is to produce a Differential Mobility Analyzer (DMA) and its interface with a TOF mass spectrometer, and to investigate techniques for determination of the cancer olfactory bouquet. IDOC is currently supported by the Spanish Ministry of Industry, inside of the National Plan for Scientific Research, Development and Technological Innovation 2008-2011. *Project number TSI-020100-2010 -12.*

5. SIAMM (Integrated System for Mobility and Mass Analysis)

- The SIAMM program (June 2013/ December 2015) has been developed for a total duration of 29 months. The aim of this project has been to develop a double-mobility analyzer based on transversal electric fields. The analyzer has been coupled to a LTQ (Linear Trap Quadrupole) comercial mass spectometer bestowed by Thermo Scientific. SIAMM was supported by the Spanish Ministry of Industry, within the National Plan for Scientific Research, Development and Technological Innovation 2013-2016, included in the framework "Strategic Action of Economy and Digital Society (AEESD)", Order IET/786/2013. *Project number TSI-100101-2013-4.*

6. IMMA (Industrial Mobility Mass Analyzer)

- The IMMA project will develop a new technology for the analysis of chemical species in tandem with Mass Spectrometry. The new system, in combination with the pre-existing analyzers, will provide unprecedented separation capacity, which is crucial in many applications.

7. ACID: Marie Curie Industry-Academia Partnerships and Pathways (IAPP)

- The main objective of this project is to develop novel instrumentation for the characterization of gas-phase analytes with high sensitivity and in real time. These prototypes will be benchmarked by pursuing fundamental studies to address open issues around secondary electrospray ionization (SESI) and by screening volatile metabolites from biofluids, explosives and even single cells. This will provide further pre-commercial analytical alternatives to current technologies for the detection of volatile species.

8. DIOX (Fast Direct Atmospheric Dioxin Detection)

- The project main objective is the application of a new analytical technique for the quantification of dioxin, tracking continuous PCDDs/PCDFs concentrations in air, soil and biota (vegetal) at the surroundings of a MSW incineration facility. The new analytical technique will help to evaluate these pollutants dispersion and deposition in the environment, in order to reduce this environmental problem.

9. HAZEL (Trace and Sub-Trace Determination of Organic Atmospheric Pollutants)

- HAZEL is a project co-funded by the European Commission (H2020, SME program) with the aim of commercializing of a novel, high efficiency system for the determination of hazardous atmospheric pollutants at trace and sub-trace levels, including the Polycyclic Aromatic Compounds as well as Dioxins and Furans, by means of the DMA-MS SEADM's vapour analyser.

Resources

SEADM has the following **resources**:

- Personnel: 15 engineers.
- Laboratory: Installed in Fundación CARTIF facilities, Seadm laboratory covers a 250 m2 area, and includes a Sciex Q-Star XL TOF mass spectrometer, a Sciex API 5000 triple quadrupole, as well as a single quadrupole Shimadzu LCMS 2010.

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Explosives trace detector

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Explosives trace detector

Explosives trace detectors (**ETD**) are security equipment able to detect explosives of small magnitude. The detection can be done by sniffing vapors as in an explosive vapor detector or by sampling traces of particulates or by utilizing both methods depending on the scenario. Most explosive detectors in the market today can detect both vapors and particles of explosives. Devices similar to ETDs are also used to detect narcotics. The equipment is used mainly in airports and other vulnerable areas considered susceptible to acts of unlawful interference.

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Characteristics

Sensitivity

Sensitivity is defined as the lowest amount of explosive matter a detector can detect reliably. It is expressed in terms of nano-grams (ng), pico-grams (pg) or femto-grams (fg) with fg being better than pg better than ng. It can also be expressed in terms of parts per billion (ppb), parts per trillion (ppt) or parts per quadrillion (ppq).

Sensitivity is important because most explosives have a very low vapor pressure and give out very little vapor. The detector with the highest sensitivity will be the best in detecting vapors of explosives reliably.

Light weight

Portable explosive detectors need to be as light weight as possible to allow users to not fatigue when holding them. Also, light weight detectors can easily be placed on top of robots.

Size

Portable explosive detectors need to be as small as possible to allow for sensing of explosives in hard to reach places like under a car or an inside a trash bin.

Cold start up time and analysis time

The start up time should not be a parameter for evaluation of an explosive detector. Start up time only indicates the time required by the detector to reach the optimized temperature for detection of contraband substances.

Technologies used in various explosive detectors[1]

Ion mobility spectrometry

Explosive detection using Ion mobility spectrometry (IMS) is based on velocities of ions in a uniform electric field. More information on IMS is found here IMS There are some variant to IMS such as Ion trap mobility spectrometry (ITMS) or Non-linear dependence on Ion Mobility (NLDM) which are based on IMS principle. The sensitivity of devices using this technology is limited to pg levels. The technology also requires the ionization of sample explosives which is accomplished by a radioactive source such as Nickel-63 or Americium-241. This technology is found in most commercially available explosive detectors like the GE VaporTracer, Smith Sabre 4000 and Russian built MO-2M and MO-8. The presence of radioactive materials in these equipments cause regulatory hassles and requires special permissions at customs ports. These detectors cannot be field serviced and may pose radiation hazard to the operator if the casing of the detector cracks due to mishandling. Bi-yearly checks are mandatory on such equipment in most countries by regulating agencies to ensure that there are no radiation leaks. Disposal of these equipments is also controlled owing to the high half-life of the radioactive material used.

ElectroSpray Ionization, Mobility Analysis (DMA) and Tandem Mass Spectrometry (MS/MS) is used by SEDET (Sociedad Europea de Detección) for the "Air Cargo Explosive Screener (ACES)", targeted to aviation cargo containers currently under development in Spain. "SEDET" is a Joint Venture created by SEADM, Morpho and CARTIF in order to develop a new generation of explosive trace detection systems.

Thermo redox[2]

This technology is based on decomposition of explosive substance followed by the reduction of the NO_2 groups. Most military grade explosives have an abundance of NO_2 groups on them. Explosive vapors are pulled into an adsorber at a high rate and then pyrolized. The presence of NO_2 groups in the pyrolized products is then detected. This technology has significantly more false alarms because many other harmless compounds also have an abundance of NO_2 groups. For example most fertilizers have NO_2 groups which are falsely identified as explosives, and the sensitivity of this technology is also fairly low. A popular detector using this technology is Scientrex EVD 3000.

Chemiluminescence

This technology is based on the luminescence of certain compounds when they attach to explosive particles. This is mostly used in non-electronic equipment such as sprays and test papers. The sensitivity is pretty low in the order of ng.

Amplifying fluorescent polymer

Amplifying fluorescent polymer is a promising new technology and is based on synthesized polymers which bind to explosive molecules and give an amplified signal upon detection. The sensitivity is in the order of fg.

References

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