MULTICAPILLARY NEBULIZER FOR SIMULTANEOUS NEBULIZATION OF TWO OR MORE LIQUIDS

TECNOLOGÍA PATENTADA

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RESUMEN

The research group "Atomic-mass spectroscopy and analytical chemistry under extreme conditions" of the University of Alicante has developed a new pneumatic multicapillary nebulizer that it allows the simultaneous nebulization of two or more liquids -miscible or immiscible between them- through different independent liquid input capillaries, and provided with a single exit orifice for the aerosol generated. The device offers the possibility of simplifying the analysis process and reducing the consumption of resources (i.e., time, sample and reagents). In addition, a high mixing efficiency is achieved, with stable emulsions and excellent aerosol characteristics. Moreover, it can be connected to any commercial spray chamber. A laboratory-constructed prototype is available for any demonstration. This device can be used as a sample preparation and liquid sample introduction system in spectrometric techniques within the field of chemical analysis. The research group is looking for companies interested in transferring this technology for commercial exploitation.

VENTAJAS Y ASPECTOS INNOVADORES

MAIN ADVANTAGES OF THE TECHNOLOGY

This multicapillary nebulizer has the following advantages over current multiple nebulizer devices of the state of the art:

- A **high mixing efficiency** between different nebulized liquids in the aerosol droplets is achieved because the mixing takes place under turbulent conditions of high pressure and speed.
- Even if liquids are not miscible, the device obtains **stable emulsions** during the time in which the droplet is transported to the plasma.
- It can work either in a conventional way (by nebulizing a single liquid: sample or calibration standard), or by combining the sample preparation and sample introduction by **simultaneous nebulization of different liquids**.
- **The work** performed manually **is reduced** and **simplified**.
- **Uncertainty** is **reduced** and accidental **errors** in the analysis process are eliminated.
- Significant **time saving**.
- The amount of **samples** and **reagents are reduced.**
- **Some processes are intensified** due to the high pressure and speed of liquid flows in the mixing zone.
- The nebulizing gas flow is not divided between different exit orifices, so the **working conditions** are equal to the optimum working conditions of the spectrometer. In this way, the quantity of liquid input capillaries can be adjusted to the specific application of the nebulizer.
- It can be constructed using **adequate dimensions** to allow the connection to any commercial spray chamber (for all manufacturers and models of spectrometers based on plasma).
- Depending on the geometry of the exit orifice of the aerosol, an **aerosol with excellent characteristics** can be achieved over a wide range of liquid flow leading to different nebulization mechanisms.

INNOVATIVE ASPECTS

This multicapillary nebulizer allows **simultaneous mixing** and **nebulization** of **two or more liquids, miscible or not**.

This device differs from other conventional nebulizers or multiple nebulizers, by the **large number of independent liquid input capillaries** with a single exit orifice of the aerosol.

APLICACIONES DE LA OFERTA

The present invention falls within the field of liquid nebulization technologies. Specifically, this device allows mixing and nebulizing two or more liquids, which makes it particularly suitable for **sample preparation** and **liquid sample introduction** in spectrometric techniques in the field of chemical analysis.

The multicapillary nebulizer can be used for the following:

- **Sample dilution** (allowing the automatization of the dilution process).
- **Internal standard calibration** (allowing interference corrections).
- **Standard addition calibration** (allowing the automatization and simplification of the process).
- **Isotopic dilution analysis**.
- **Derivatization** and **chemical vapour generation of analytes** (allowing chemical reactions to take place in aerosol phase between the analytes of the sample and calibration standards, and one or more reagents).
- **Organic sample analysis** (allowing the organic sample analysis in the plasma by emulsifying with aqueous solutions. A high mixing efficiency is achieved and the formation of carbon deposits on the exit orifice of the injector tube is removed).
- **Liquid-liquid extraction** (reducing the experimental time, analyte losses and sample contamination. In addition, large sample amounts, expensive organic reagents and/or toxic ones are not required).
- **Discrete samples/standards introduction** (directly introducing the analyte in a discrete way in aerosol phase into the spray chamber, removing diffusion problems).
- **Medical and Health related:**
    - o Diagnostic: Forensic science.
    - o Therapeutic: Drug delivery and other equipment.
    - o Clinical medicine:
        - - Pulmonary medicine.
        - - Ophthalmology, ear, nose and throat diseases.
- **Other electronics related**: analytical and scientific instrumentation (other analytical and scientific instrumentation).

COLABORACIÓN BUSCADA

Companies interested in acquiring this invention for **commercial exploitation** by:

- Patent license agreement.
- Searching for financial support in order to develop new applications, adapt to specific requirements of the company, etc.
- Technology and knowledge transfer agreements.
- Preparing technical reports and providing scientific advice to companies.
- Providing specific training adapted to company requirements.
- Services of standardization, calibration, development of national and international technical standards, etc.
- Providing technical support in those techniques that require highly skilled researchers or sophisticated instruments that are not available to the company.
- Personal exchange for a defined period of time (for learning a technique, etc.).
- Equipment rental to customers who wish to carry out their own tests (at the Department of Analytical Chemistry or Technical Services Research (SSTTI) of the University of Alicante).