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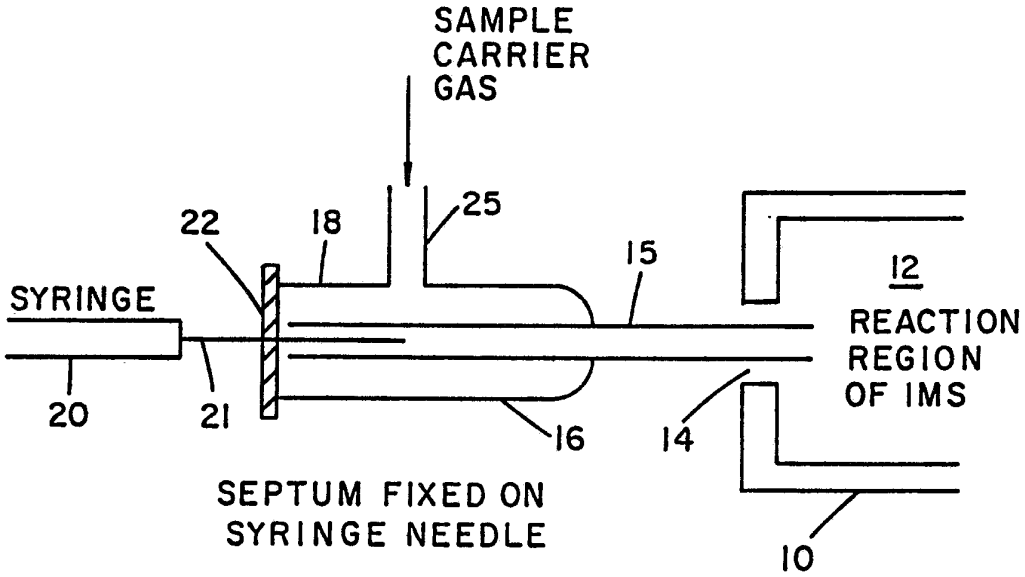
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(54) Title: METHOD AND APPARATUS FOR SAMPLE INJECTION INTO ION MOBILITY SPECTROMETER



(57) Abstract

Disclosed is a method and apparatus for injecting a sample of material to be tested into an ion mobility sensor (IMS). A syringe needle is provided with a septum, preferably of Teflon®. In use, the septum closes an open end of a sample receptacle, sample material is injected and is taken into the IMS by a carrier gas, after which the syringe and septum are removed. This minimizes the change of contaminants in or on the septum reaching the IMS.

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METHOD AND APPARATUS FOR SAMPLE INJECTION INTO ION MOBILITY SPECTROMETER

BACKGROUND OF THE INVENTION

This invention relates to a method and apparatus for injecting a sample of material to be tested into an ion mobility sensor (IMS).

Various methods are known for injecting a sample into an IMS. One method involves injecting sample material with a syringe by passing the needle of the syringe through a septum covering an opening in a sample receptacle from where it is taken by a carrier gas into the IMS. An arrangement of this type, although for a mass spectrometer, is disclosed in Canadian patent No. 1,045,253 of McLafferty, et al, issued December 26, 1978. However, it has been found that, when used with an IMS, particularly if the sample receptacle is heated, all septa tried give background ions which remain while the septa are in place, and indeed long after the septa are removed. Septa were preconditioned in a vacuum oven but to no avail. A Teflon (trade mark) faced septum gave the fewest background peaks but the spectrum was still unacceptable.

SUMMARY OF THE INVENTION

I have discovered that this problem can be solved by placing a septum (preferably Teflon or Teflon faced) on to a syringe needle and holding it in place over the end of the sample receptacle only during sample injection. This actually achieved two objectives: firstly peaks due to the septum were not observed and secondly flow of gas out of the reaction region swept out any gas which adsorbed on the inner walls of the central tube of the injector and thus reduced "clear-out" time between samples.

Thus, in accordance with a broad aspect of the invention, there is provided a method for injecting a sample of material to be tested into an ion mobility sensor (IMS) comprising arranging an outlet tube projecting from one end of a sample receptacle into a sample inlet of said IMS, said sample receptacle enclosing

a portion of said outlet tube and having an open other end opposite said one end and an inlet for a carrier gas, said method further comprising placing a sample of said material into a syringe, said syringe having a hollow needle passing through a septum, placing said septum against the open end of said sample receptacle so that said septum closes the end of said sample receptacle and said needle enters said outlet tube, passing carrier gas into said sample receptacle to thereby convey at least part of said sample into the IMS, and then removing said syringe and septum.

In accordance with another broad aspect of the invention there is provided apparatus for injecting a sample of material to be tested into an ion mobility sensor (IMS) comprising a sample receptacle having an outlet tube projecting from one end and adapted to be inserted into a sample inlet of an IMS, said receptacle enclosing a portion of said outlet tube and having an open other end opposite said one end and an inlet for a carrier gas, said apparatus further comprising a syringe for injecting sample material into said receptacle, said syringe having a needle projecting through a septum adapted to close said other end of said receptacle whereby said sample receptacle can be closed only long enough for sample injection after which it is open so that it does not receive contaminants from said septum.

BRIEF DESCRIPTION OF THE DRAWING

The sole drawing figure illustrates a preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The drawing shows the reaction region 12 of an IMS 10 which is provided with a sample inlet 14. An outlet tube 15 of a sample receptacle 16 is received in the sample inlet 14 of the IMS. The sample receptacle 16 has an open end 18. For sample injection, a syringe 20 having a needle 21 provided with a septum 22 is placed so that the

septum covers the end 18 of receptacle 16. The needle 21 of the syringe projects into the outlet tube 15. Sample material is injected into the receptacle using the syringe 20 and is taken by carrier gas introduced at 25 through outlet tube 15 and into IMS 10. The syringe and septum are then removed. Gas flow out of the reaction region sweeps out any gas which adsorbed on the inner walls of the tube 15 of the injector, thus reducing "clear-out" time between samples.

The sample receptacle 16 and tube 15 may be made of glass and the receptacle may be heated to, for example, 150^{o}C by any suitable heat source (not shown).

The septum may be made of resilient material. Preferably it is made of Teflon (trade mark) or may be a Teflon facing on any suitable backing support member.

CLAIMS

1. A method for injecting a sample of material to be tested into an ion mobility sensor (IMS) comprising arranging an outlet tube projecting from one end of a sample receptacle into a sample inlet of said IMS, said sample receptacle enclosing a portion of said outlet tube and having an open other end opposite said one end and an inlet for a carrier gas, said method further comprising placing a sample of said material into a syringe, said syringe having a hollow needle passing through a septum, placing said septum against the open end of said sample receptacle so that said septum closes the end of said sample receptacle and said needle enters said outlet tube, passing carrier gas into said sample receptacle to thereby convey at least part of said sample into the IMS, and then removing said syringe and septum.

2. A method as claimed in claim 1 and further comprising heating said sample receptacle.

3. A method as claimed in claim 2 wherein said sample receptacle is heated to about 150^{o}C.

4. A method as claimed in claim 1, 2 or 3 wherein said sample receptacle and outlet tube are made of glass.

5. A method as claimed in claim 1, 2 or 3, wherein said septum is formed of a resilient material.

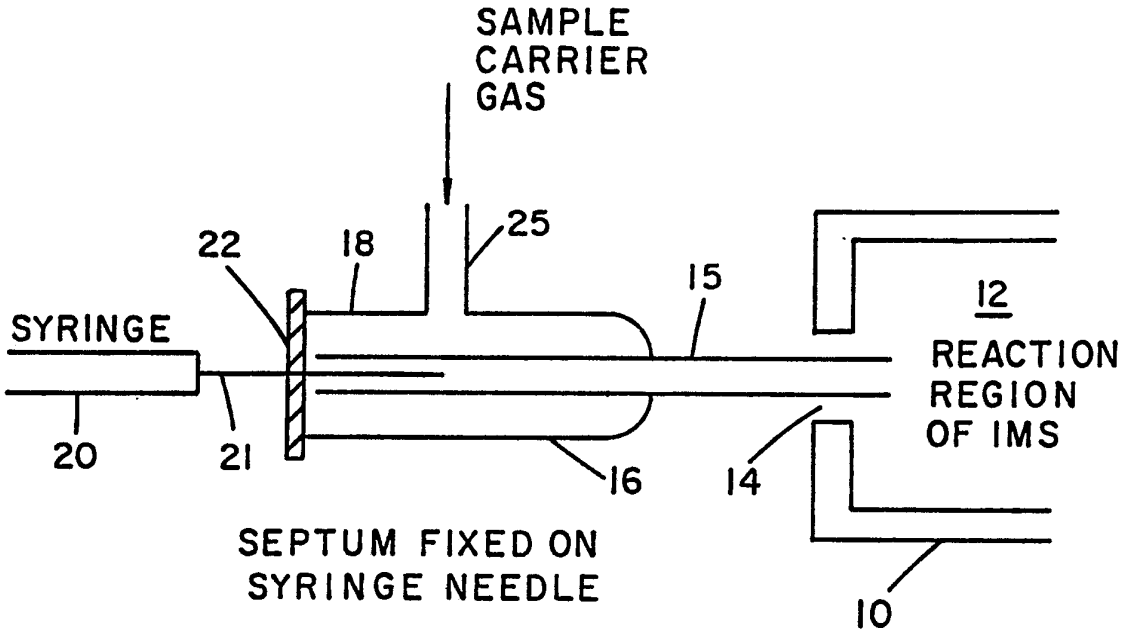
6. A method as claimed in claim 5 wherein said resilient material is Teflon (trade mark).

7. Apparatus for injecting a sample of material to be tested into an ion mobility sensor (IMS) comprising a sample receptacle having an outlet tube projecting from one end and adapted to be inserted into a sample inlet of an IMS, said receptacle enclosing a portion of said outlet tube and having an open other end opposite said one end and an inlet for a carrier gas, said apparatus further comprising a syringe for injecting sample material into said receptacle, said syringe having a needle projecting through a septum adapted to close said other end of said receptacle whereby said sample receptacle can be closed only long enough for sample injection after which it is open so that it does not receive contaminants from said septum.

8. Apparatus as claimed in claim 7 wherein said receptacle and outlet tube are made of glass.

9. Apparatus as claimed in claim 7 or 8 wherein said septum is formed of resilient material.

10. Apparatus as claimed in claim 7 or 8 wherein said septum is formed of Teflon (trade mark).


SAMPLE
CARRIER
GAS
22
18
25
15
12
SYRINGE
REACTION
REGION
OF IMS
20
21
16
14
SEPTUM FIXED ON
SYRINGE NEEDLE
10

INTERNATIONAL SEARCH REPORT

International Application No PCT/CA 91/00005

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: H 01 J 49/04, G 01 N 27/64

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[5]	G 01 N 1/00, G 01 N 27/00, G 01 N 30/00, H 01 J 49/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 4239967 (T.W. CARR et al.) 16 December 1980 see figures 1,2; column 3, lines 44-56; column 4, lines 38-41 --	1,2,5,7,9
A	Analytical Chemistry, vol. 54, no. 9, August 1982, American Chemical Society, (Easton, Penns., US), J. Greter et al.: "Septumless injection port for capillary gas chromatography", pages 1646-1647, see page 1646, lines 1-29; figure 1 --	1-3,5,7,9
A	EP, A, 0198154 (ALLIED CORPORATION) 22 October 1986 see page 8, lines 6-21 -- ./.	1,7

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
8th April 1991	22. 05. 91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	M. PEIS M. Peis

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US, A, 3581573 (J.E. PURCELL et al.) 1 June 1971 see column 1, lines 20-34; column 2, lines 38-73	1,2,5-7,9, 10

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. CA 9100005 SA 43276

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 29/04/91 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4239967	16-12-80	CA-A- 1126879	29-06-82
EP-A- 0198154	22-10-86	US-A- 4839143	13-06-89
US-A- 3581573	01-06-71	DE-A- 1812164	14-08-69
		GB-A- 1234599	03-06-71