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METHOD OF OBTAINING ALCOHOL SPECIMENS AND APPARATUS THEREFOR

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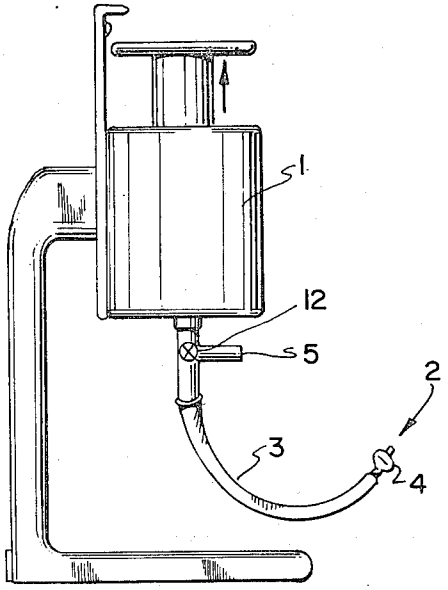


FIG. 1.

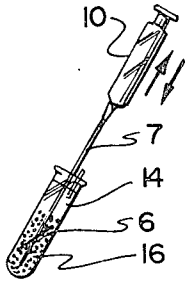


FIG. 3.

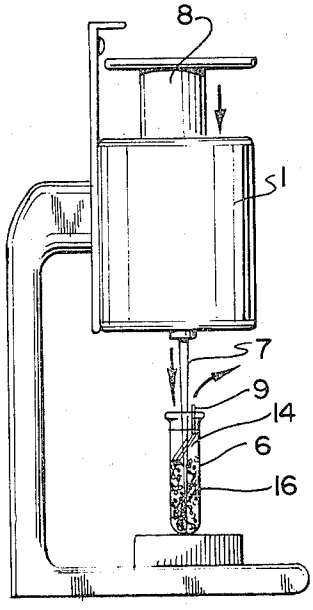


FIG. 2.

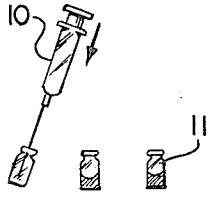


FIG. 4.

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METHOD OF OBTAINING ALCOHOL SPECIMENS AND APPARATUS THEREFOR

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5 Claims

ABSTRACT OF THE DISCLOSURE

A known quantity of deep lung air containing alcohol is delivered from a heated chamber through a narrow introductory tube into a sealed vial. The chamber is heated to prevent condensation of the alcohol. The sealed vial contains a known volume of a solvent for alcohol and a known concentration of internal standard. After a breath sample has been passed through the vial contents the heated chamber is detached from the introductory tube and replaced by a syringe. The solvent and the trapped alcohol are mixed thoroughly in the sealed vial as a result of repeated withdrawal and delivery by the syringe. The solution thus formed in the sealed vial is finally taken into the syringe and dispensed as aliquots into small storage vials for storage and subsequent analysis.

This invention relates to a method of obtaining alcohol specimens and apparatus therefor.

The growing awareness of the involvement of alcohol as a major factor in fatal and other serious automobile accidents has resulted in a demand for practical means whereby law enforcement personnel may measure blood alcohol concentrations in the police office or collect appropriate specimens for subsequent laboratory analyses. Because blood is inconvenient to collect in a non-medical setting and, because a good correlation between the concentration of alcohol in the blood and that in deep lung air has been shown, the procurement of breath specimens has become favoured to establish alcohol concentrations. At present there are instruments which are capable of providing results quickly in a police office or in a clinical emergency ward. However, if a quantitative breath alcohol test instrument is not available or if a second breath sample is desired for a subsequent independent analysis there are, at present, no good and inexpensive means of storing breath samples so that reliable and independent laboratory analyses may be carried out following storage. Some parts of Section 224A of the Criminal Code of Canada have not been proclaimed because of a lack of suitable storage containers and the Government of Canada is anxious to see the development of suitable containers. Most solid adsorbents are unsuitable because poor recovery of alcohol from the adsorbent is experienced and storage of a gaseous breath sample per se is usually unsuitable because surface or other effects result in either losses or poor recoveries of the alcohol content. In many respects the problems are typical of those in the microchemical analytical area wherein surface effects are highly significant. It should be borne in mind that in dealing with alcohol in breath specimens a law enforcement officer or other investigator is dealing with quantities of the order of 50 μg. ethanol per 100 ml. which, if held in a bag or other such container, would be exposed to about 325 sq. cm. of container surface area. Our invention relates to the use of a liquid trapping system for the collection storage and subsequent analysis of breath alcohol.

Plastic bags have been tried for storing breath samples but they have suffered as a result of actual or apparent alcohol loss, leakage at the seams, susceptibility to tampering or the general bulkiness and associated problems. Solids adsorbents in tubes, as for example tubes containing silica gel granules, have been marketed but quantitative recovery of alcohol has been demonstrated to present a problem in such devices. All-glass pipette-style containers have also been designed but the ones marketed to date tend to be bulky, expensive and difficult to manipulate for quantitative analysis—particularly since temperature and pressure changes or equilibria enter as possible sources of error when gaseous specimens are withdrawn from such containers. Moreover, these devices do not lend themselves to dividing a sample into several aliquots which may be distributed, stored, and analyzed independently of one another.

It is one object of the present invention to provide a method of and apparatus for abtaining alcohol specimens from breath samples and with which the above-mentioned disadvantages are lessened.

According to the present invention there is provided a method of obtaining alcohol specimens from a breath sample of known volume comprising, contacting the sample with a known volume of a solvent for alcohol, to trap alcohol therein from the sample, and storing aliquots of the solvent containing trapped alcohol as specimens in hermetically sealed containers.

Further according to the present invention there is provided apparatus for obtaining alcohol specimens from a breath sample accordinng to the above method, comprising a heated collection chamber having a passage therein for collecting a breath sample containing alcohol and preventing condensation of the alcohol, a valve on the passage for retaining the breath sample within the collection chamber, and an introductory tube attachable to the passage and for insertion in a solvent for alcohol in a sealed vial.

The present invention by trapping and storage of breath alcohol in a solvent therefor, is less likely to suffer from the above disadvantages. Preferably, a trapping vial is used, suitably stoppered, containing a known volume of a suitable solvent for alcohol, for example distilled water, in which is dissolved a known quantity of an internal standard, for example iso-propanol, for a gas chromatographic analysis. The vial should preferably contain an inert packing such as small glass beads to increase the trapping efficiency by increasing the overall volume and height over which the solvent is distributed in the vial, and thus the contact between the alcohol and solvent is increased.

In one embodiment the breath sample—deep lung air and not residual or tidal air—is collected in a constant temperature chamber which consists of a cylinder with a piston or plunger. The temperature is maintained constant above normal body temperature to avoid condensation problems. A thermostatically controlled heating jacket surrounds the collection chamber. In this way a known quantity of deep lung air may be collected by venting out the first part of a person's expiration and directing the last part into the collection chamber. For storage purposes this sample is introduced into the bottom of the trapping vial via a narrow introductory tube extending into the vial through its stoppered top. One or more small orifices at the bottom of the narrow introductory tube permit the passage of the sample into the vial contents in the form of small bubbles. The bubbles which are emitted rise through the solvent in the vial, giving up alcohol to the solvent, and the air finally exits through a temporarily placed exit vent at the top. The inert beads in the vial serve to increase the efficiency of alcohol dissolution in the solvent because of the in-

creased height of the liquid column and the obstruction provided against a free rise of the bubbles. Moreover, this trapping vial and contents are preferably prechilled to increase further the trapping efficiency. This chilled medium also cools the introductory tube, resulting in considerable condensation of alcohol in the barrel of the introductory tube. That which escapes condensation in the tube will become dissolved in the solvent in the vial. Prechilling may be accomplished by simple storage of the trapping vials at refrigerator temperature.

After the sample has been bubbled through the trapping vial the collection chamber is detached and a syringe is attached to the top of the introductory tube or needle, which to this point is retained in the vial. The liquid is next drawn back and forth, through the introductory tube, between the vial and the syringe in order to effectively mix the trapped alcohol with the solvent including that which would have condensed in the barrel of the tube. Finally, after mixing, two, three or more aliquots may be injected from the syringe into small storage vials for distribution to the persons concerned, storage, and analysis. At no time need the caps sealing the vessels be removed.

Analysis in the laboratory may be carried out by means of gas chromatography, preferably with flame ionization detection. Because a known quantity of an internal standard is already in the sample a laboratory analysis becomes very simple and fast.

This invention, embodying the trapping and storage of breath alcohol in a solvent, overcomes the problem of alcohol loss on storage and that of poor recovery from a trapping medium since it is stored in a form ready for direct injection into a gas chromatograph. The problem of measuring accurately or manipulating small aliquots for analysis is also overcome since the solution contains an internal standard at the outset. Furthermore, problems related to sample bulkiness are overcome and aliquots may be distributed to different persons, if desired, immediately after a sample is collected, trapped and mixed. Multiple analysis may be carried out, if required, on each aliquot. In this process, the final containers for storage can be small, simple, vials which are easy to mark for identification, and easy to package, handle, and ship for laboratory analysis.

In drawings which illustrate, by way of example, an embodiment of the invention, FIG. 1 is a side view of a collection chamber for the collection of a breath sample,

FIG. 2 is a side view of the collection chamber shown in FIG. 1 being used to trap alcohol in a breath sample therein in a solvent in a vial,

FIG. 3 is a side view of the vial shown in FIG. 2 with the vial contents being mixed by means of a syringe, and FIG. 4 is a side view of small storage vials and injection of an aliquot of the syringe contents into one of them.

The process and apparatus shown in FIGS. 1 to 4 comprises a heated collection chamber in the form of a volume collection chamber **1** into which is introduced the breath sample **2** through tubing **3** and a mouthpiece **4** acting as a saliva trap. A side vent **5** leading from a valve **12** vents the first part of a breath expiration and is controlled by the person taking the sample. After the initial collection of a known quantity of air or breath the valve **12** is closed, and the tubing is replaced with the chilled trapping vial **6**, containing a solvent for alcohol **14** with glass beads **16** submerged therein, and introductory tube or needle **7**. The piston or plunger **8** of the collection chamber is released by opening valve **12** to fall, forcing the sample out through the introductory tube or needle, emitting bubbles to rise through the solvent **14** in the vial **6** and escape through the exit vent **9** after trapping and/or dissolution of soluble volatiles. Then the trapping vial and introductory tube are detached from the collection chamber, followed by the attachment of a syringe **10** to the introductory needle and mixing of the vial contents by repeated withdrawal and delivery of the solution into the vial through the introductory tube. Next, the solution is drawn into the syringe and dispensed into small, capped, storage vials **11**. Subsequent analyses may be carried out by simple injection of portions of solution from a storage vial directly into a gas chromatograph with no further sample manipulation.

What is claimed is:

1. A method of obtaining alcohol specimens from a breath sample of known volume comprising, contacting the sample with a known volume of a solvent for alcohol, to trap alcohol therein, from the sample, and storing aliquots of the solvent containing trapped alcohol as specimens in hermetically sealed containers.

2. A method according to claim **1**, wherein the solvent contains glass beads submerged therein and the sample is passed through the solvent between the glass beads to increase the trapping efficiency.

3. A method according to claim **1** wherein the breath sample is collected in a chamber and is heated therein to prevent condensation of the alcohol in the chamber, and the sample is passed from the chamber into contact with the solvent.

4. A method according to claim **1**, which includes chilling the solvent to increase the trapping efficiency.

5. A method according to claim **1** wherein a known quantity of a standard is included in the solvent for subsequent analysis of the aliquots by gas chromatography.

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ROBERT M. REESE, Primary Examiner

U.S. Cl. X.R.

23—254 R; 73—421.5; 128—2 C; 261—94, 121, 128, 141