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Letter to the Editor

Simultaneous determination of methanol, ethanol, acetone, isopropanol and ethylene glycol in plasma by gas chromatography

Sir,

We would like to present some data on the simultaneous determination of methanol, ethanol, acetone, isopropanol and ethylene glycol in plasma by gas chromatography (GC). Quantitations of methanol, ethanol, acetaldehyde, acetone and isopropanol with a single column have been reported in the literature [1,2]. However, none of these simultaneous procedures included the analysis of ethylene glycol, which is a principal component of most automotive antifreeze solutions and involved in 40–60 fatal overdoses annually in the U.S.A. [3]. Several techniques have been developed for the analysis of ethylene glycol in serum or blood [4–8].

Simultaneous determination of methanol, ethanol, acetone, isopropanol and ethylene glycol was performed on a Varian Model 2100 series gas chromatograph (Varian, Walnut Creek, CA, U.S.A.) equipped with dual columns, dual flame ionization detectors and a linear temperature programmer. A glass column (180 cm × 4 mm I.D.) was packed with Porapak Q, 50–80 mesh (Waters Assoc., Milford, MA, U.S.A.). The oven temperature was calibrated with a Wahl Digital Heat-Prober™ thermometer (Wahl Instruments, Culver City, CA, U.S.A.).

The column was conditioned at 100°C for 1 h; the temperature was increased to 210°C at 2°C/min and then maintained at this level for 24 h with the detector end of the column disconnected and nitrogen carrier gas flow-rate set at 40 ml/min. The instrumental conditions for calibration and assays were as follows: nitrogen, hydrogen and air flow-rates were 30, 30 and 300 ml/min, respectively; the injection port temperature was 210°C; the detector temperature was 240°C; the column was temperature-programmed from 100 to 210°C at 2°C/min; the electrometer setting was 10^{-12} A/mV with an attenuation of 1–32 depending on the compound of analysis. Calibration curves were constructed by plotting the ratio of the peak height of the compound to the peak height of the internal standard against the concentration (mg/dl) of the compound. An Omni Scribe Model B 5217-1 recorder (Houston Instruments, Austin, TX, U.S.A.) was used to record the chromatograms.

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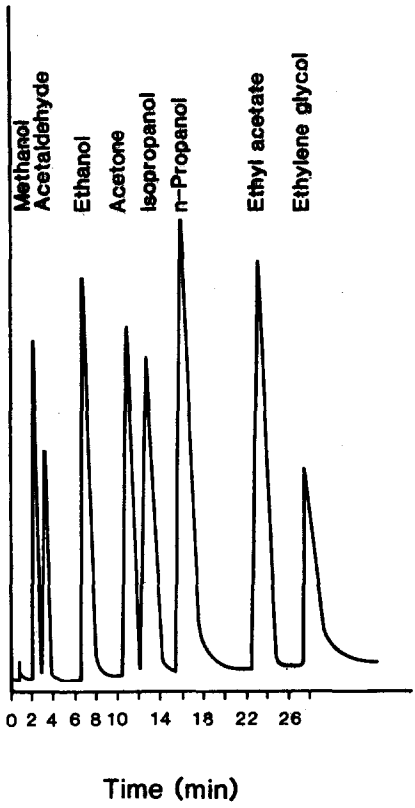

Fig. 1. Chromatogram of 2 μl of a standard solution of methanol, acetaldehyde, ethanol, acetone, isopropanol, *n*-propanol, ethyl acetate and ethylene glycol at a concentration of 10 nmol/ml for all solvents.

A 100-μl volume of internal standard solution containing *n*-propanol (75 nmol/ml) and ethyl acetate (18.1 nmol/ml) was added to 0.5 ml of serum. The mixture was vortexed for 10 s and then transferred to the EMIT Freelevel Filter unit from Syva Company (Palo Alto, CA, U.S.A.), followed by a 2-min equilibration. The serum was centrifuged at 2000 *g* for 5 min, and 1.0 μl of the clear filtrate was injected into the gas chromatograph for analysis. A series of working standard solutions ranging from 1.0 to 100 nmol/ml were prepared by appropriate dilutions of methanol, ethanol, acetone, isopropanol and ethylene glycol. Quantitation of the solvents was made by relating the peak-height ratio of each solvent and the internal standard in the unknown sample to that of a standard of known concentration.

The chromatogram shown in Fig. 1 represents a separation of methanol, acetaldehyde, ethanol, acetone, isopropanol, ethylene glycol and the two internal standards (*n*-propanol and ethyl acetate). All the peaks were completely resolved under these GC conditions. Standard curves for each solvent based on the peak-height ratios to the two internal standards were linear over the concentration range 1.0–100 nmol/ml. The detection limits were 0.1 nmol/ml for methanol,

ethanol, acetone and isopropanol, and 0.4 nmol/ml for ethylene glycol. The within-day and day-to-day variations at concentrations of 1.0–100 nmol/ml were less than 8.8%. Methanol and ethylene glycol intoxication is often encountered in emergency cases. This method allowed the simultaneous determination not only of both methanol and ethylene glycol, but also of other organic solvents such as ethanol, acetone and isopropanol. This procedure provides selectivity and sensitivity and no interference from 30 solvents studied.

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