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Note

Limitations in the specificity of Porapak Q columns in the gas chromatographic analysis of ethanol in body fluids

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Analysis for ethanol in blood is commonly carried out by gas chromatography (GC) using a column with a polyethylene glycol liquid phase[1]. This laboratory uses a modification of the method of Curry *et al.*, in which the samples are tested by two analysts using separate gas chromatographs each fitted with a column filled with a different type of packing. Both gas chromatographs are Varian Aerograph Models 600 D fitted with flame ionization detectors. One instrument has a 2 m × 3 mm I.D. glass column packed with 10% polyethylene glycol 600 on 60–80 mesh Chromosorb W, acid washed, DMCS treated, operated at a temperature of 67° with a nitrogen carrier gas flow-rate of 20 ml/min. The other instrument uses a 1.25 m × 2 mm I.D. stainless-steel column packed with Porapak Q and operated at a temperature of 180° with a nitrogen carrier gas flow-rate of 35 ml/min.

Recently a post-mortem blood sample was analysed by our laboratory which, according to the analysis performed on the Porapak Q column, contained 37 mg per 100 ml of ethanol. However, when the same sample was analysed using the polyethylene glycol 600 column a peak with a very short retention time was noted but nothing with a retention time similar to ethanol was found. Fig. 1 shows the chromatographic trace obtained from the post-mortem blood sample compared with that normally obtained from a blood alcohol sample when analysed on the Porapak Q column.

The unknown compound was identified by gas chromatography–mass spectrometry (GC–MS) as diethyl ether and this identification was confirmed when diethyl ether was found to have the same retention time as the unknown on both columns.

Aqueous solutions of approximately 100 mg/100 ml concentration of seven compounds (acetaldehyde, acetic acid, acetone, chloroform, ethyl acetate, methanol, and propan-2-ol) were tested under similar conditions to those used for blood alcohol analysis. The results of these tests showed that in addition to not separating ethanol from diethyl ether the Porapak Q column did not separate ethyl acetate from propan-1-ol, while the polyethylene glycol 600 could not separate propan-2-ol from ethanol and had difficulty resolving methanol and chloroform from ethanol. Because of the differences in the relative retention times (with respect to propan-1-ol) obtained for the compounds studied with this particular Porapak Q column compared to those obtained by another group of workers[2] several columns were made up from different batches of Porapak Q. In all cases columns made with porous polymer from the same

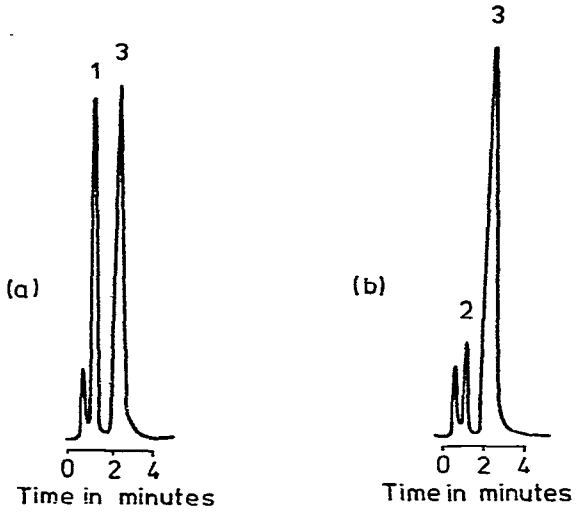

Fig. 1. GC traces of dilutions of (a) a blood sample from an intoxicated driver and (b) a post-mortem blood sample containing an unknown volatile. 1 = Ethanol; 2 = unknown volatile; 3 = propan-1-ol.

container and conditioned in the same manner gave similar results, but the relative retention times of some volatiles, particularly diethyl ether, often varied markedly when different batches of column packing were used. Similar variations of greater than 50% in the relative retention volumes of water have been reported[3] in the literature for different batches of porous polymer.

If both Porapak Q and polyethylene glycol 600 columns were used in conjunction, all the volatile compounds examined had retention times that were obviously different, under routine conditions, from ethanol and propan-1-ol on at least one column. This is not always true if only one of the preceding types of column is used for the analysis.

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