DEVELOPING A METHOD FOR THE VALIDATION OF ATMOSPHERIC GLUTARALDEHYDE ANALYSIS

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The Health and Safety Executive (HSE) guidance note EH 40/89 specifies an occupational exposure limit (OEL) for glutaraldehyde of 0.2 ppm. There is however, no official validated procedure for the analysis of atmospheric glutaraldehyde. Instrumental methods such as the infra-red analyser or the photoacoustic ir detector are not sufficiently sensitive and the accuracy and reproducibility of the tentative procedure published by the HSE is yet to be established.

The recommended procedure for the determination of airborne levels of glutaraldehyde uses 3-methylbenzothiazol-2-one hydrazone HCl (MBTH) (Hauser and Cummings 1964). A known volume of air is drawn at a rate of 0.75 L/min through an aqueous solution of MBTH in an impinger. In the presence of ferric chloride, glutaraldehyde reacts with MBTH to form a blue water-soluble cation the intensity of which is measured spectrophotometrically. The variability of the reaction can be determined using standard solutions of glutaraldehyde. However, the intra- and inter-laboratory accuracy of the method can only be established by generating a standard sample of glutaraldehyde in air in the range 0.01-1.0 ppm.

A standard glutaraldehyde atmosphere was created in a 40L PTFE-lined gas sampling bag. Glutaraldehyde solution (200mL; 2%) was poured into the bag through the sampling port, the bag was then inflated with air and the port sealed. After standing for 1 hour a 30L sample of air was analysed.

Replicate analyses on freshly prepared, activated glutaraldehyde solution (2%) gave a mean result of 0.975 ppm with a coeffecient of variance of 9.4% (N=6). Carry-over into a second impinger placed in series to the first averaged 7% (sd=1, N=6). Repeated analysis using the same solution of activated glutaraldehyde (200mL, 2%) over a 24h period showed that the glutaraldehyde levels in the gas samples reduced with time (table 1a). The carry-over however, remained constant ($\bar{x}$ = 7% sd = 0.58) Using 2% glutaraldehyde solution without the activator added the results were very much lower (table 1b) and carry-over into the second impinger was much higher. Unlike the results for the activated solution, the readings did not decrease with time.

Table 1. Repeat analysis of glutaraldehyde atmosphere in gas sampling bag
a) Using activated 2% solution
b) Using 2% solution without activator

	Time (hrs)	Glutaraldehyde Conc (ppm)	Carry-over (%)
a)	0	1.13	6.2%
	1	0.93	6.5%
	18	0.64	7.8%
	20	0.58	7.4%
	22	0.41	7.1%
b)	0	0.19	29%
	1	0.13	29%
	2	0.138	51.5%
	3	0.134	51.5%

Activation increases the pH of the solution and this clearly has a significant effect on the vapour pressure of the glutaraldehyde since sample levels are much greater after activation. The bacteriacidal activity of glutaraldehyde solutions is known to decrease following activation due to polymerisation but their half live is about 7 days (Boucher 1978) and so the results in table 1a are not due to degradation or polymerisation of glutaraldehyde. Variations such as these could however help to explain the very different sensitivity nursing staff exhibit toward glutaraldehyde in the working environment.

Boucher R.M.G. (1978) Respiratory Care 23: 1063-71
Hauser T.R., Cummings R.L. (1964) Anal. Chem. 36: 679