DIFFERENTIAL PULSE POLAROGRAPHIC DETERMINATION OF ADRENALINE AT THE GLASSY CARBON ELECTRODE

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The polarographic determination of adrenaline at the dropping mercury electrode is impractical due to dissolution of mercury at positive potentials. Solid electrodes with a greater anodic range have been little used for routine analysis due to difficulties with electrode surface reproducibility. However, Cantin & others (1974, 1975) have successfully determined adrenaline in various formulations by D.C. polarography at the rotating platinum electrode. The present study uses the glassy carbon electrode for the rapid determination of adrenaline in various formulations, employing the more sensitive differential pulse mode in a quiet solution.

Investigations were carried out using a PAR 174A Polarographic Analyser and a three-electrode system. Well-defined and reproducible peaks at +0.55V vs S.C.E. were obtained in 1M H_2SO_4. The glassy carbon surface was periodically cleaned by polishing with aluminium oxide (particle size 0.5μm)to minimise the background current. Typical polarographic conditions were:- initial potential +0.4V, pulse amplitude 25mV, scan rate 5mV s^{-1}, sensitivity 1mA - 10μA as required. Calibration graphs of peak current vs adrenaline concentration were linear over the range 10^{-1} - 10^{-5}M. Regression analysis typically gave a slope of 0.345, intercept 5.55 and correlation coefficient 0.997.

Due to the ease of oxidation of adrenaline, formulations generally contain an antioxidant, usually sodium metabisulphite. Cantin & others (1975) found an enhanced polarographic wave for adrenaline in the presence of sulphite, thought to result from a sulphite wave coinciding with that of adrenaline. It was found necessary to destroy sulphite present prior to analysis. At glassy carbon, a similar peak current enhancement occurred but no peak was observed for sulphite alone. The peak current for a 10^{-4}M adrenaline solution increased with increasing metabisulphite concentration up to 0.05% sodium metabisulphite, above which it remained constant, suggesting that peak current enhancement was due to a regeneration catalytic current. Accordingly, standard adrenaline solutions used in the analyses contained sodium metabisulphite in the appropriate concentration.

Having established linearity of peak current response to adrenaline concentration, the adrenaline content of Adrenaline Solution B.P. was determined by adding, successively, 50μl of unknown and standard solutions to 10ml of 1M H_2SO_4 in the polarographic cell. Six replicate analyses were carried out and the results compared with a standard method. The mean recovery was 98.55%, standard error 0.55 and confidence interval 1.09 at the 99% level. Adrenaline in inhalant and eye drop formulations was similarly determined. The adrenaline content of a commercial local anaesthetic formulation containing 1 in 400,000 adrenaline was determined by diluting 5ml of the injection to 10ml with 2M H_2SO_4 and comparing the peak current with that following a standard addition of adrenaline. Results compared favourably with the B.P. method and no prior separation of the local anaesthetic was necessary, thus considerably reducing the analysis time.

Cantin,D. & others (1974). Analusis, 2 , 654-657.
Cantin,D. & others (1975). Ibid., 3 , 5-10.