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Simultaneous determination of copper and zinc by anodic stripping voltammetry in *Allamanda catharitica* L.

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Simultaneous determination of ultra-trace concentrations of copper and zinc in *Allamanda cathartica* L., a medicinal plant, by anodic stripping voltammetry in differential pulse mode on a hanging mercury drop electrode is described. The minimum amount that can be determined by voltammetry is found to be 0.42 for Cu and 0.36 μg dm^{-3} for Zn. Interferences of foreign ions have been studied. The accuracy of the method is demonstrated by analysing the NBS materials.

Anodic stripping voltammetry in differential pulse mode has a wide application in the determination of trace metal ions[1] because of its low detection limits and relative freedom from matrix effects. Simultaneous determination of Cu and Zn in biological materials has been reported[2]. The application potentiality of this method was demonstrated by the analysis of a medicinal plant (*Allamanda catharitica* L.) leaf sample and NBS materials.

Results and Discussion

Typical differential pulse anodic stripping voltammogram of Cu and Zn is shown in Fig. 1. Under the chosen conditions, calibration graphs for Cu and Zn showed good linearity upto concentration of 40 ng cm^{-3} Cu and 80 ng cm^{-3} Zn. The proposed method has been found to be useful with the detection limits of 0.42 for Cu and 0.36 μg dm^{-3} for Zn.

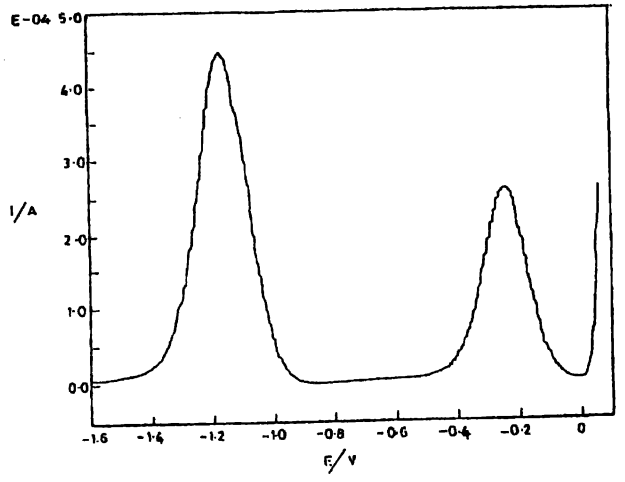


Fig. 1. Differential pulse anodic stripping voltammogram of Cu and Zn (40 μg dm^{-3}); pH = 8.0; deposition potential, −1.20 V; scan rate, 10 mV s^{-1}; pulse amplitude, 25 mV; drop time, 3 s.

The following elements (μg cm^{-3}) did not interfere in the simultaneous determination of 20 Cu and 40 μg dm^{-3} Zn : Pb^{II} and Ni^{II} (350); Fe^{III} (300); Mn^{II} (200); Co^{II} (250); Cd^{II}, Cr^{III} and Se^{IV} (200). The analytical results agreed satisfactorily with certified values (Table 1).

Table 1. Analytical results for copper and zinc in various samples

Sample	DPASV	
	Cu (mg kg^{-1})	Zn (mg kg^{-1})
A. cathritica leaves	22.22 ± 0.1	67.75 ± 0.4
	(21.85)[a]	(67.72)[a]
NBS samples :		
Citrus leaves	16.2 ± 0.4	28.6 ± 0.9
(NBS 1572)	(16.5 ± 1.0)[b]	(29.0 ± 2.0)[b]
Tamato leaves	10.6 ± 0.3	61.7 ± 1.4
(NBS 1573)	(11.0 ± 1.0)[b]	(62.0 ± 6.0)[b]

[a] Values by AAS method. [b] Certified values.

The method is sensitive and rapid and can be used to estimate copper and zinc in environmental samples.

Experimental

All stripping voltammetric measurements were made with a Metrohm unit coupled with E 506 polarecord and E 612 VA scanner. A three-electrode system consisting of hanging mercury drop as a working electrode, saturated calomel as reference electrode and a platinum wire as auxillary electrode was used. The voltammetric analysis was performed at the following settings : deposition potential, −1.20 V; deposition time, 180 s; rest period, 30 s; modulation amplitude, 25 mV; scan rate, 10 mV/s; drop size, 1.4 s. A Metrohm 623 pH meter and a Perkin-Elmer 2380 atomic absorption spectrophotometer were used.

All reagents were of A.R. grade. A standard stock solu-

tion containing Cu and Zn (1 mg ml^{-1}) was diluted as required to give the working solutions. A NH_4OH-NH_4Cl buffer solution (pH 8 0) was used. The metal ions for interference studies were prepared from their oxides dissolved in either HCl, HNO_3 or water

Procedure : An aliquot of the sample solution (10–200 μg dm^{-3}) containing Cu and Zn was taken in a electrolytic cell, a supporting electrolyte NH_4OH-NH_4Cl buffer of pH 8.0 was added and oxygen was removed by passing nitrogen for 5 min. Then the blank polarographic curve was recorded Calibration curves were obtained by successive additions of Cu and Zn solutions

Pretreatment of the leaf sample . Finely powdered leaf sample (~1 g) was digested in conc HNO_3 (10 ml) for 3 h at 50°, and the solution evaporated almost to dryness. The mass was cooled, the residue dissolved in 2 *M* HNO_3 (10 ml), diluted to 100 ml with triple-distilled water and estimated for Cu and Zn

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