

TABLE I

Effect of time on separation of Fe(III), Co(II) and Ni(II)

Solvent composition : 85 ml acetone + 5 ml HCl (32%) + 10 ml methyl isobutyl ketone

Time min.	R _f Values			Separation
	Fe (III)	Co (II)	Ni (II)	
15	1.0	0.85	0.17	Good
30	1.0	0.81	0.15	Better
45	1.0	0.67	0.13	Best
60 to 90	1.0	0.64	0.08	do.

The presence of impurities like Zn (II) and Al (III) interferes with the separation of Fe (III), Co (II) and Ni (II), since they move with Fe (III). However, the presence of Cu (II) does not interfere. From the foregoing account it can be concluded that this method which involves methyl isobutyl ketone as one of the components of the solvent system renders quick and satisfactory separation of these three ions.

These three ions have been determined in micro quantities after their separation on paper strips using solvent extraction and colorimetric techniques. The experimental values in micro grams for Ni (II), Fe (III) and Co (II) were found to be 45.2, 18.4 and 44.4 against theoretical values, 48.7, 20.7, and 48.1 respectively.

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1. Leaderer, M., *Nature*, 1948, 162, 776.
2. Frierson, W. J. and Ammons, M. J., *Discussions Faraday Soc.*, 1949, 7, 183.
3. Lewis, J. A. and Griffiths, L. M., *Analyst*, 1951, 76, 388.
4. Reeves, A. W. and Crumpler, T. B., *Anal. Chem.*, 1951, 23, 1576.
5. Walton, H. F., *J.C.E.*, 1965, 42 (9), 477.
6. Bhatnagar, R. P. and Poonia, N. S., *Anal. Chem.*, 1962, 34, 1325.
7. Singh, E. J. and Dey, A. K., *Ibid.*, 1961, 178, 356.

A SIMPLE POTENTIOMETRIC METHOD FOR THE ESTIMATION OF BHC

GENERALLY, for the estimation of lower concentration of BHC (1, 2, 3, 4, 5, 6-Hexachlorocyclohexane, commonly called benzenehexachloride), a widely used insecticide, gas chromatographic¹ or colorimetric² methods are commonly employed. But most of the laboratories do not have the costly gas chromatograph equipped with either an electron capture detector or a microcoulometric detector. The other methods, usually employed for the estimation of this compound in its technical and commercial formulations^{2,3,4}, are not very sensitive to low concentrations as that found in its aqueous solutions. As such, at present it is difficult to estimate traces of BHC in solutions. The potentiometric method described below is sensitive, simple and can be adopted even for residue analysis. The method is based on the hydrolysis of BHC under alkaline condition, to trichlorobenzene and inorganic chloride. The inorganic chloride thus released is estimated using a chloride ion-specific electrode. The concentration of chloride is taken as an index of the concentration of BHC. The procedure for the new method is given below.

Partition the BHC to hexane phase from a known volume of its aqueous solution, by repeatedly extracting its aqueous solution with 10 ml portions of *n*-hexane. Similarly, the hexane extracts of any other substance containing BHC can be used for analysis. The combined hexane extracts are transferred to a 50 ml test tube and the contents are evaporated to dryness on a water-bath at 60° C. Moisten the residue in the tube with 2 ml of distilled water, treat with 2 ml of 0.5 N ethanolic potash and keep the tube on a water-bath at 55°–60° C, till the contents are almost evaporated. Cool and extract the residue with 2 ml portions of water, finally making the extract to 10 ml. Mix well and determine the concentration of chlorides in the solution using a chloride ion-specific electrode (Beckman Silver-Silver chloride electrode or any other make similar electrode). The electrode potential is measured on a potentiometer (pH meter) having an expanded scale (Corning model No. 12 pH meter or its equivalent). Determine the concentration of BHC in the sample by referring to a calibration curve previously prepared by adopting the same procedure with 1 to 10 mg of BHC.

This method has been found quite satisfactory for solutions containing more than 0.1 ppm of BHC. Although the aqueous solubility of this compound is small, its concentration in water solutions can be estimated even in such small quantities, by partitioning the compound from a large volume of the solution to hexane phase, and then further con-

centrating the hexane solution. The same method can also be used for the estimation of residues of BHC in soils and plants, however, a suitable clean up procedure has to be adopted for such purposes before it is potentiometrically estimated to get rid of other chlorine containing compounds. The electrode potential should be measured on a sensitive instrument (preferably an expanded scale pH meter with mV markings), which can accurately show response to change of even one millivolt.

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1. Adams, R. S. and Paulina, L., *Soil Sci. Soc. Am. Proc.*, 1971, 35, 78.
2. Association of Official Analytical Chemists, *Methods of Analysis*, 11th Edition, Washington, D.C., 1970.
3. Zweig G., *Analytical Methods for Pesticides, Plant Growth Regulators and Food Additives*, Academic Press, New York, 1963. 1.
4. De. S. K., *Practical Agricultural Chemistry*, Narayan Publishing House, Allahabad, 1965.

HYDROCYANIC ACID CONTENT OF CASSAVA (*MANIHOT ESCULENTA* CRANTZ) PEEL, AS AFFECTED BY FERTILIZER APPLICATION

CASSAVA (*Manihot esculenta* Crantz) a native plant of South America is being widely cultivated in the tropics. In Tamil Nadu and Kerala it is cultivated mainly for its tubers, a large quantity of which is utilised in industry for the manufacture of products like cassava flour, sago starch, etc. The peel from the tubers which is a waste product of the industry is used as a livestock feed. But one of the major deterrents to its use as a feed is the presence of poisonous hydrocyanic acid (HCN) in it. It contains a cyanogenic glucoside "linamarin" and an enzyme "linase". When the enzyme linase is brought into intimate contact with the linamarin as a result of mincing or injury to the tissues, the HCN is liberated which at higher dose causes instantaneous death to livestock by arresting cellular oxidation. Garner (1957) observed that an intake of plant material equivalent to HCN intake of 4 mg per kg body weight was lethal. Jennings (1970) reviewed and reported that cumulative or chronic poisoning by HCN from cassava has been associated with many illnesses including nervous diseases, goitre, etc. In this communication, the HCN content of the peel of a few promising types

of cassava and the effect of NPK fertilizers on it are reported.

Thirty promising cultivars of cassava were grown to maturity and pulled out from the soil. The peel was separated from the flesh and analysed immediately for its HCN content by adopting the colorimetric method of Indira and Sinha (1969). The results of analysis for HCN revealed that minimum amount of HCN was found to be in Kadayanallur and Noor rathal cassava varieties (125 mg/kg of fresh peel) and the highest amount of HCN was found in S-3 variety (1475 mg/kg). The mean value of HCN in the peel of different varieties of cassava was 599 mg/kg which is about fifteen times higher than its concentration of 41 mg/kg in the fresh edible portion of the tuber. There was large variation among the varieties for HCN content (CV 62%).

A significant positive relationship was found to exist between the HCN content of the edible portion of the tuber and of the peel ($r = 0.781$). However, Sinha and Nair (1968) reported that there was no relationship between cyanogenic glucoside content in the rind and the flesh.

The effect of nitrogen, phosphorus and potash fertilizer application on the HCN content of peel of three varieties of cassava was also studied. It was observed that nitrogen application increased significantly the HCN content of the peel (756 ppm) at 150 kg.N/ha. This result is in consonance with that of Harms and Tucker (1973) who reported that the HCN content of Sudan grass was increased by increasing N application. Application of fertilizer P and K did not have any significant effect on the HCN content of cassava peel.

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1. Garner, R. J., 1957, *Malay Agric. J.*, 1971, 48, 77.
2. Harms, C. L. and Tucker, B. B., *Agron. J.*, 1973, 65, 21.
3. Indira, P. and Sinha, S. K., *Indian J. agric. Sci.*, 1969, 39, 1021.
4. Jennings, D. L., *Field crop Abstr.*, 1970, 23, 271.
5. Sinha, S. K. and Nair, T. V., *Indian J. agric. Sci.*, 1968, 38, 958.