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Short Communication

Determination of Trace Amount of Zinc (II) in Drinking and Irrigation Water

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Zinc is a common metal, which is released into the environment through industrial and mining operations. It is essential for body growth because the activities of insulin and several body enzymes are dependent on zinc (De, 1994). The highest desirable concentration and maximum permissible limit for zinc in drinking water are 5 and 15 mg L^{-1}, respectively (Goel, 1997). However, concentrations above 5 mg L^{-1} can cause a bitter astringent taste and opalescence (milkiness) in alkaline water (Lenore *et al.*, 1998). High concentrations of zinc can cause nausea, renal damage, gastrointestinal problems, diarrhoea, cramps, etc. (Das, 1990; Kumar and Kakrani, 2000). In irrigation water its recommended maximum concentration is 2 mg L^{-1} (Anonymous, 1972) and the tolerance limit is 15 mg L^{-1} (Goel, 1997). Zinc is toxic to many plants at widely varying concentrations.

Zinc generally enters the domestic water supply as a result of deterioration of galvanized iron and dezincification of brass (Lenore *et al.*, 1998). It may also be present in some corrosion-preventive additives and in industrial wastes. The solubility of zinc varies with pH. In some areas where mining is done, this metal has been found in natural waters in very high concentrations. A study of the mine water received from Hindustan Zinc Limited, Rajpura Dariba Mines, Udaipur (Rajasthan), showed zinc concentration as high as 80 mg L^{-1} (Anonymous, 1980). In view of the toxic effects of zinc in water, its presence is to be tested along with other physico-chemical parameters.

The present investigation describes a rapid field test for determination of trace amounts of zinc (II) in water. The method involves addition of five drops of dithizone reagent (0.2% solution in CCl_4), along with optimized amount of sodium thiosulphate (0.005 g) and citric acid (0.01 g) to 10 ml water sample under test. No change in color within 2-3 minutes indicates absence of zinc (II) in water sample, while change of color from green (reagent color) to purple red after shaking (within 2-3 minutes) indicates presence of zinc (II) in varying concentrations (5-10 mg L^{-1}), which is determined by comparing with color chart having standard color shades with respect to known concentrations indicated therein (Table 1). For preparation of color chart standard zinc sulphate solution (AR) was prepared in different dilutions and colors developed at various concentrations (after adding reagents) were taken as reference colors. The

Table 1. Comparison of Zn quantified with color chart and with the standard technique

Zinc (mg L^{-1})	Method	
	AAS Technique (mg L^{-1})	Proposed field method
<5.00	<5.000	Very light purple red (not very distinct)
5.00	5.002	Light purple red (distinct)
6.00	6.015	Purple red
7.00	7.001	Light purple
8.00	8.011	Purple
10.00	9.960	Dark purple

concentrations of standard solutions were also verified using Atomic Absorption Spectrophotometer (Ediger, 1973). All the colors developed under experimental conditions are stable for more than half an hour if concentration of zinc is above permissible limit.

Laboratory and field trials have been successfully conducted on about 100 water samples of varying zinc concentrations and the results were in close agreement with those obtained by standard techniques. The test is selective for zinc (II) because citric acid lowers the pH of water sample to 4.0-5.5. At this pH sodium thiosulphate almost completely prevents the reaction of As, Hg, Au, Bi, Pb, Cd, etc., while permitting that of zinc to proceed (Fischer, 1929; Feigl, 1972).

Comparison of proposed field test with existing methods (Barnes, 1951; O'Conner and Renn, 1963; Feigl, 1972; Rodier, 1975; Lenore *et al.*, 1998) reveals that the proposed method is simple, selective, rapid, economical, sensitive and quantitative too, and can be easily performed by a field worker or a person of normal scientific temper. Hence it can be a good addition to existing water testing field kits (Ramgopal *et al.*, 1983).

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