
On field test for Detection of Mancozeb in water

Dr. Sheetal Mital

Krishna Institute of Engineering and Technology, Ghaziabad (U.P)

ABSTRACT

The detection of Mancozeb at μg levels in its formulations and polluted water is carried out by already known spot test for dithiocarbamates. The colouring agent used for the analysis is Copper (II) chloride-acetic acid.

KEY WORDS

Mancozeb, spot test, water, dithiocarbamates, Copper (II) chloride-acetic acid

INTRODUCTION

A considerable amount of work is being done to develop non – chemical methods of pest control but still stage has not reached where the use of pesticides can be dispensed with. Efforts were made to minimize the environmental load of pesticides by developing some new pesticides which are bio degradable, high mammalian safety, compatible with non-target organisms and allied traits. Though the crops treated with pesticides invariably contain small amount of pesticides residues, which on continuous ingestion may have adverse effects on the health.

One of the most commonly used pesticide –MANCOZEB, a dithiocarbamate fungicide is widely used on nuts, fruit trees, vegetables and other field crops as a protective leaf fungicide. Several simple and inexpensive analytical methods for the determination have been reported in the literature (Hanada et al., 2002; Yaqoob et al., 2015; Rathore et al., 1984). Therefore, it is important to develop simple and inexpensive on field methods for detection and determination of mancozeb.

EXPERIMENTAL

APPARATUS

Test Tube, Reagent Bottle, Sprayer.

CHEMICALS

Mancozeb (75% WP) Jaishree Agro Industries Pvt. Ltd., India. All other reagents & chemicals used were of analytical grade.

PREPARATION OF SOLUTION

Stock solution of the chemicals and reagents were prepared in the solvent given in the parenthesis: 0.75% homogeneous mancozeb suspension is prepared in 1M sodium hydroxide (solvent) and 1% copper chloride solution is prepared using 1% acetic acid as solvent. All other solutions were prepared by the procedure reported in the literature (Vogel 1978)

DETECTION OF MANCOZEB

The test solution (1ml of 0.75%) is taken in a test tube and neutralized with 2ml of 1M acetic acid (buffer solution of pH6), followed by 1 ml of 1% copper chloride –acetic acid reagent and 0.05ml of chloroform. Thereafter the contents are thoroughly mixed, the colour of both aqueous and organic layer were observed at room temp (25° C) and recorded.

Table 1.Detection of Mancozeb in presence of chloroform at different pH

S.No.	Mancozeb µg	pH	Colour	
			AqLa	OrgLa
1	15	4	LBl	VVLB
2	75	4	LGrBl	LB
3	750	4	LGrBl	BtB
4	15	5	LBl	VVLB
5	75	5	LGrBl	LB
6	750	5	LGrBl	BtB
7	15	6	LBl	VLB
8	75	6	LGrBl	LB
9	750	6	LGrBl	BtB
10	15	8.4	LBl	VVLB
11	75	8.4	LBl	LB
12	750	8.4	GrBl	BtB
13	15	10	DBl	-
14	75	10	DBl	-
15	750	10	DBl	B

Table 2.Detection of Mancozeb using different extractants at pH 6

S.No.	Mancozeb µg	Extractant	Colour	
			AqLa	OrgLa
1	15	Amyl alcohol	B1	NC
2	75	Amyl alcohol	B1	VLB
3	750	Amyl alcohol	GrBl	BtYBppt
4	15	Benzene	B1	NC
5	75	Benzene	B1	VLB
6	750	Benzene	GrBl	YBtppt
7	15	Carbontetrachloride	LBl	NC
8	75	Carbontetrachloride	LGrBl	VLB
9	750	Carbontetrachloride	LGrBl	BtYB
10	15	Chloroform	LBl	VLB
11	75	Chloroform	LGrBl	LB
12	750	Chloroform	LGrBl	BtB

Table 3. Detection of Mancozeb in presence of different interfering agents at pH6

S.No.	Functional Group of Interfering Agent	Interfering Agent	Colour of Original Solution	Colour	
				AqLa	OrgLa
1	Acid	Gallic acid	LB	LB	B with DB at junction
2		Isocitric acid	NC	LB1	LB
3		Malic Acid	NC	LB1	LB
4		Succinic Acid	NC	LB1	LB
5		Tartaric Acid	NC	VLGrB1	LB
6	Alcohol	1-butanol	NC	B1	LB
7		1-propanol	NC	B1	LB
8		1-ethanol	NC	B1	LB
9		Methanol	NC	B1	LB
10	Aldehyde	Benzaldehyde	NC	LB1T	LY
11		4-dimethylaminobenzaldehyde	VLB	LB1	LB
12		Vanillin	NC	LGrB1	VLB
13		m-nitro benzaldehyde	LY	LGrB1	LY
14	Amines	Aniline	R	GT	LY with DB ppt
15		Diethylaniline	DR	LB1T	DR
16		Nicotine	DR	YG with B ppt	OB
17		Trimethylamine	NC	LB1	LB
18	Phenol	Catechol	DB	LB	B
19		1 naphthol	B	LB1T	LB
20		2-naphthol	VLB	LB1	LB
21		Orthonitrophenol	O	LGrB1	LO
22		Recorcinol	DB	VLGrB1	LB

DISCUSSION AND CONCLUSION

The analytical method used to test the dithiocarbamide presence in the stable water soluble and water insoluble salts of the unstable dithiocarbamic acid and its N-substituted derivatives is reported in Feigl, 1966. In this method dithiocarbamate group is converted into its cupric salt which is insoluble in organic solvents. A characteristic feature of water-soluble dithiocarbamates and their N-substituted derivatives is that they form brown cupric salts as precipitates, which dissolve in water immiscible organic liquids (extractant) to produce red-brown solutions. This property was utilized for the determination of copper as the diethylthiocarbamate complex and it was remarked (Vogel, 1978) that many of the heavy metals give slightly soluble products (some white, some colored) with the reagent, most of which are soluble in organic solvents (chloroform, carbontetrachloride and butylacetate). The sensitivity of reagent might be improved by the use of masking agents, particularly EDTA. The reagent decomposes rapidly in solution of low PH.

In the present study, the color reaction mentioned above is utilized for the detection of Mancozeb in contaminated water. As the solubility of Mancozeb is slightly lower in water and insoluble in common organic solvents, thus its solution is prepared in Sodium Hydroxide to carry out the above color reaction.

Table 1 shows that the reaction is highly sensitive at pH 6 as the complex is soluble in organic layer, less sensitive at pH 4-5 as the organic layer does not turn red-brown at low concentration and it is also less sensitive at pH 8.4-10 as the copper gives deep blue color in aqueous layer which shadows light brown color in organic layer. Table 2 shows that the chloroform is the best extractant for this test as it gives the maximum color intensity. The data recorded in Table 3 shows that the Mancozeb can be detected by using this color reaction in presence of interfering agents. It is also clear that the test under study can be used for the detection of aniline, diethylaniline, nicotine, etc. as they give distinct colors than that of Mancozeb and these compounds do not interfere at microgram levels. The lower limit of detection for Mancozeb is 15 µg, thus this Spot Test can be utilized for on field detection of it in traces by coupling with a suitable pre-concentration methods.

ABBREVIATIONS USED IN TABLES

V - Very, L-Light, D-Dark, B-Brown, AqLa – Aqueous Layer, Bl-Blue, Bt-Bright, G –Green, Gr-Greenish, OrLa – Organic Layer, ppt-precipitate, R-Red, T-Turbid, Y- Yellow, NC-No Colour

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