Proc. Indian natn. Sci. Acad., **55**, A, No. 6, 1989, pp. 918-921.

COLORIMETRIC DETERMINATION OF MALATHION WITH METHYLENEGREEN

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(*Received 4 July 1988; Accepted 14 February 1989*)

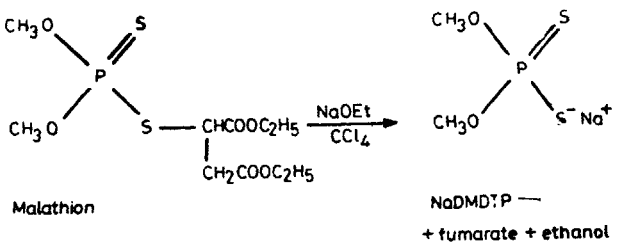
A colorimetric method for the determination of melathion with methylene green is described. Malathion is decomposed with alkali into sodium dimethyl dithiophosphate (DMDTP) and fumarate. The DMDTP is complexed with a methylene green and extracted into chloroform. Absorbance of organic layer is measured at 645nm.

Key Words : Malathion; Methylenegreen; Chloroform; Extraction : Determination

INTRODUCTION

NORRIS *el al.*[1] introduced first spectrophotometric method for the determination of malathion. In this method malathion is decomposed by alkali to sodium dimethyl dithiophosphate (NaDMDTP), fumarate and ethanol.

The NaDMDTP is converted to a yellow copper complex extracted into carbon tetrachloride and determined spectrophotometrically. The colour of the complex fades very quickly. Hence, Roussow,[2] Hill[3] and Wayne *et al.*[4] have tried to overcome the drawback but unsuccessful. Clark and Qazi[5] reported a modified spectrophotometric method for the determination of malathion. They employed bismuth instead of copper for complexation of DMDTP and stated that the Bi-DMDTP complex is more stable than the Cu-DMDTP complex. The absorbance of the Bi-DMDTP complex lies in the ultraviolet region (325nm). Clark and Qazi[6] further modified their method by a ligand-exchange reaction in which the Bi-DMDTP complex is transformed into a bismuthdithizone complex, which absorbs in the visible region (495nm), Although the further modified method of Clark and Qazi[6] has improved the sensitivity and the absorbance is in the visible region, it requires larger number of reagents and one more stage of extraction



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for the ligand-exchange reaction. Hence, the authors have attempted to extract DMDTP with cationic dye the absorbance of which lies in the visible region. Methylenegreen which is insoluble in chloroform forms soluble complex with DMDTP that can be quantitatively extracted into chloroform. In this paper, the authors report a colorimetric method for the determination of malathion with methylenegreen.

Experimental

Materials and Methods

Malathion standard solution, (19.8μg ml^{-1}) was prepared by dissolving 0.2008g mass of 98.6 per cent standard malathion solution (American Cyanamid) in 100ml of carbon tetrachloride and diluting 1 ml of this solution to 100ml. Malathion, 50 per cent emulsifiable concentrate, (19.8μg ml^{-1}) was prepared by dissolving 0.3960g mass of the 50 per cent m/m emulsifiable concentrate (Cyanamid India) in 100ml of carbon tetrachloride and diluting 1ml of this solution to 100ml. 0.1 per cent methylenegreen solution was prepared in distilled water. 1 per cent sodium solution in ethanol was prepared by dissolving 1g of freshly cut sodium in 100ml of ethanol. This solution is prepared daily. Buffer solution *p*H 6 was prepared by adding 50ml of 0.1M Acetic acid to the 20ml of 50 per cent sodium acetate and mixing well. Glaxi Excelar (India) carbon tetrachloride and chloroform were used in the investigation.

Apparatus

U3400 UV-visible NIR spectrophotometer.

Procedure

10ml of Carbontetrachloride 2ml of standard or 50 per cent emilsifiable concentrate malathion, 1ml of sodium in ethanol solution were taken in a 50ml separating funnel and the solution swirled gently for 1 minute. 5ml of distilled water was added followed by vigorous shaking. The layers were separated and organic layer was discarded. The aqueous layer washed with 5ml of carbontetrachloride. 2ml of buffer solution was added followed by 1ml of methylenegreen and 10ml of chloroform and the solution was shaken vigorously for 1 minute. The chloroform layer was collected and absorption was measured at 645nm.

Results and Discussion

The absorption spectrum of 2ml of standard malathion solution (with an excess of methylenegreen) extraced into 10ml of chloroform was shown in Fig. 1. Results show that methylenegreen forms a complex with Dimethyldithiophosphate which is produced by decomposition of malathion with sodium in ethanol solution. λ_{max} of Methylenegreen–DMDTP complex is 645nm and the complex is stable for 24 hours. Results relating to the mole ratio of methylenegreen and DMDTP are reported graphically in Fig. 2. These results demonstrate that the mole ratio of

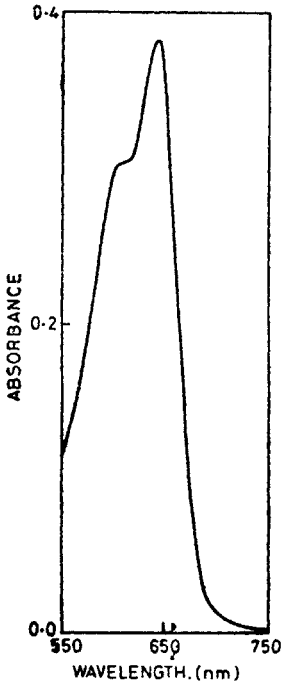

FIG 1 Absorption spectrum of methylenegreen—DMDTP complex

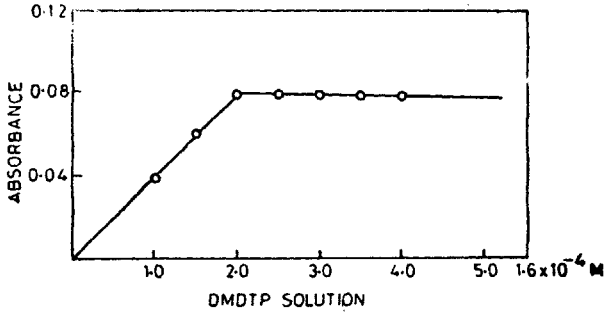

FIG 2 Mole ratio of methylenegreen and DMDTP

methylenegreen and DMDTP complex is 1 : 2, methylenegreen was used for the extraction of DMDTP.

The method is applicable to the determination of malathion formulations. Technical grade malathion and 50 per cent emulsifiable were analysed and the percentage recoveries are reported in Table I. These results demonstrate the suitability of the method for the determination of malathion in formulation with a minimum detection limit of 40μg.

TABLE I

Determination of malathion in standard solutions

Sample No.	Malathion standard solution 98.6%			Malathion 50% emulsifiable concentrate		
	Taken μg	Found μg	Recovery %	Taken μg	Found μg	Recovery %
1	39.6	39.7	100.3	39.6	39.5	99.7
2	79.2	79.9	100.9	79.2	79.4	100.3
3	118.8	119.3	100.4	118.8	119.5	100.6
4	158.4	159.2	100.5	158.4	160.9	101.6
5	198.0	199.3	100.7	198.0	202.4	102.2

ACKNOWLEDGEMENT

The authors are thankful to the Council of Scientific and Industrial Research, New Delhi for providing financial assistance.

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