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NOTES

Carbaryl Metal Chloride Complexes and Their Persistence

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In the present note the authors described the synthesis of carbaryl-metal complexes and the role of complexation on persistence of insecticide and the deficiency of micronutrients.

Carbaryl *i.e.*, 1-naphthyl-N-methyl carbamate is a very widely used general purpose insecticide and is used against red banded leaf roller[1], cabbage loopers[2], corn earworm[3] and Mexican bean beetle[4]. It is a biodegradable insecticide but it gives persistent residue in soil. Its application causes deficiency of minerals, so it seems that carbaryl forms complex with metal ions in the soil. We have prepared complexes of carbaryl with chlorides of manganese, cobalt, nickel and copper to study its coordination properties and hence the role of complexation on persistence of insecticide and the deficiency of micronutrients.

Carbaryl (Gujarat Agro Industries) was crystallized from the commercial sample using methanol (Glaxo) as the solvent. Manganese(II) chloride, cobalt(II) chloride, nickel(II) chloride and copper(II) chloride (B.D.H.) were dehydrated by refluxing with thionyl chloride, washing with petroleum ether and dried in vacuum desiccator. The salts were analysed for chloride before use.

Preparation of Complexes

Carbaryl/manganese chloride complex was prepared by refluxing carbaryl (2 g) and anhydrous manganese chloride (1.5 g) in methanol. The solution was concentrated to get the crystals of the complex.

Carbaryl/cobalt chloride, carbaryl/nickel chloride and carbaryl/copper chloride complexes were prepared by the same procedure using the 1 : 1 stoichiometric amounts.

Carbaryl and metal chloride when refluxed in methanol solution reacts to form 1 : 1 solid coloured complex (Table 1). The colour of the complexes changes during melting point determination indicating decomposition. The complexes were found to be highly soluble in methanol and ethanol whereas the solubility in other solvents was less.

The specific conductance of carbaryl and its complexes with transition metal salts were determined in methanol. It was found that the specific conductance of the complexes was comparatively higher than the corresponding value for the

carbaryl solution. This indicates that these complexes are ionic in nature and give ions in solution, whereas carbaryl molecule is non-ionic in nature.

TABLE 1

Complexes/Colour	M. pt. (°C)	% Analyses Found (Calcd)	
		M	Cl
$MnCl_2 \cdot L$ (Flesh)	~ 94	17.33 (16.81)	21.3 (21.7)
$CoCl_2 \cdot L$ (Greenish Blue)	~142	18.20 (17.82)	21.6 (21.5)
$NiCl_2 \cdot L$ (Greenish Yellow)	~141	18.30 (17.82)	20.9 (21.5)
$CuCl_2 \cdot L$ (Brownish)	~103	19.12 (18.92)	20.5 (20.2)

L = Carbaryl.

The infrared spectrum of the complex shows strong bands[5,6] at 3330 cm^{-1}, 1720 cm^{-1} and 1545 cm^{-1}, corresponding to N–H (st), C = O (st) and C–N (st). Corresponding absorptions in carbaryl are at 3320 cm^{-1}, 1710 cm^{-1} and 1540 cm^{-1}. C–N str. frequency[7] moved up slightly in the complexes indicating a possible coordination from N atom of the molecule.

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