ORIENTAL JOURNAL OF CHEMISTRY
An International Open Access, Peer Reviewed Research Journal
www.orientjchem.org

Est. 1984

ISSN: 0970-020 X
CODEN: OJCHEG
2023, Vol. 39, No.(3):
Pg. 759-762

Synthesis, Characterization and Bioassay of Nano Cartap Hydrochloride-An Ecofriendly Insecticide

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http://dx.doi.org/10.13005/ojc/390328

(Received: May 03, 2023; Accepted: June 05, 2023)

ABSTRACT

The common insecticide used in Cabbage and Basmati rice fields is Cartap hydrochloride (CHC). It is a low toxicity insecticide belongs to Neurotoxin. Present study aimed to synthesize a new Nano-insecticide by using polypropylene glycol (PPG) as an encapsulated agent. Nano-CHC is useful for plant disease control. Polypropylene glycol encapsulated CHC size distribution was obtained by PadeLaplace dispersion in the size range in between 60-67nm.The functional group analysis of encapsulated CHC was carried by FT-IR spectroscopy. The structural topology of encapsulated CHC was obtained by scanning electron microscope. The morphological internal structural elucidation of encapsulated CHC can be obtained by transmission electron microscope analysis. The bioactivity study was conducted and shows good efficacy results against *Aspergillus flavus*, *Sclerotium rolfsii* and *Rhizoctonia solani*.

Keywords: Cartap hydrochloride, Polypropylene glycol, Electron microscopy, Bioassay.

INTRODUCTION

Carta phydrochloride is a low toxicity insecticide belongs to Neristoxin.It is used as an insecticide in agricultural sector. Neurotoxin inhibit neuromuscular activity of nicotinic acetylcholine in microorganisms which results in acute respiratory failure[1] In aqueous medium oxidation and degradation of cartap hydrochloride was investigated based on chemical oxygen demand[2]. Field experiments of cartap hydrochloride was conducted and it has significant insecticidal activity on stem borers and leaffolders in basmati rice field[3]. Biological impact of cartaphydrochloride on photosynthesis and nitrogen fixation was investigated. At lower concentrations (20ppm), photosynthetic and nitrogen fixation rate was enhanced[4]. Orius insidiosus is an important predatoty bug which is used as a biological agent to control various insects. Carta phydrochloride has toxological activity against this bug[5]. Carbon mineralization and Microbial biomass content of soil was elevated by the application of cartap hydrochloride in agricultural fields[6]. The environmental persistence and mammalian toxicity of cartap hydrochloride is low[7]. The enzymatic activity of transminase and phosphotase in liver and muscles of fish was reduced by the consumption of carta phydrochloride[8]. Nanotechnology has an immense role in the field of agriculture. The best application of nanotechnology in the field of agriculture sector is nano formulatons. At present researchers are using two techniques namely nano capsules and nano spheres. In nano capsules researchers are following a theme known as encapsulation[9]. Nanofoodtechnology has a significant growth in the past five years. Genetically modified organisms(GMO'S) right now used as nano food stuffs. In the field of nanopesticides the pesticide particles has a significant theme known as controlled sustainable release property[10-11].

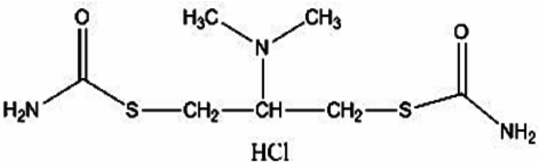

Fig. 1. Structure of Carta phydrochloride

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MATERIALS AND METHODS

Reagents: Polypropylene glycol was procured from E. Merck. Double distilled water was used throughout the experimental process. CHC was liberally gifted by Raghavendra Agro, Ltd. Preparation of Nano-CHC: Commercial wettable CHC was taken in a mortar and it was grounded with pistle.0.5 g of CHC was taken in a mixture of 200 mL of water and 200 mL of polypropylene glycol. The solution mixture was subjected to sonication for 30 minutes. This results the dispersion of the CHC particles in polypropylene glycol. The solution mixture was subjected to stirring for 7 h at 2000rpm.

Instrumentation: The size distribution of nano-CHC was obtained by vasco, cordouan Dynamic light scattering technique(DLS). Bruker spectrophotometer (FT-IR) was used to identify the organic functional groups in nano cartap hydrochloride. The structural topology of nano cartap hydrochloride was obtained by using zeiss 18-evo scanning electron microscope. Nano Cartap hydrochloride morphological elucidation was obtained by jem, jeol 2100, Tokyo, Japan transmission electron microscope.

RESULTS AND DISCUSSION

Nanopesticides in general recognized as the best and apt alternative to manage pests.

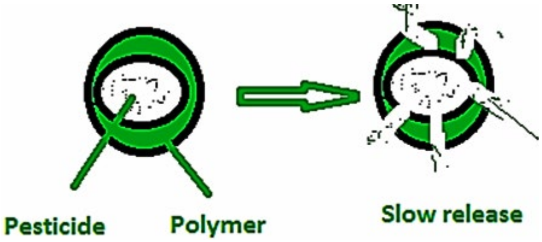

Fig. 2. Action of Nanopesticide

DLS analysis: Polypropylene glycol encapsulated CHC was obtained by Laplace pade dispersion. One milli litre of Nano-CHC was suspended in 5 mL of water. The resultant hydro dispersed suspension was analyzed with DLS at 25-40^{0}C. The formation of nanopesticide and size ranges in between 60-67 nanometers. shown in Figures 3).

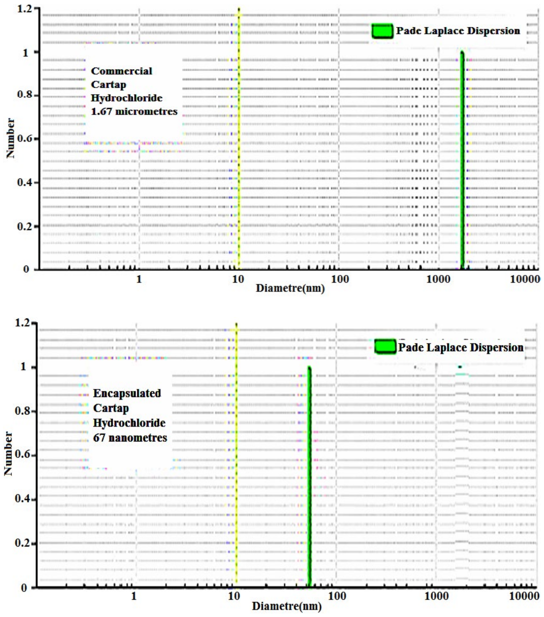

Fig. 3. Size distribution of polymer encapsulated and commercial CHC

FT-IR analysis

The functional group analysis of nano-CHC can be obtained by FT-IR spectroscopy. The interferograms produced by interferometer of various repeated scans with respective finger print region will depict us about the functional group analysis. The FT-IR spectra of polypropylene encapsulated Nano-CHC is shown in Fig. 4. FT-IR Spectra will depicts us that the chemical structure of the compound was not changed. The N-H stretching, C-H stretching and bending, N-O symmetric stretch, C-N stretching, C-S peak and various functional peaks in the finger print region in the FT–IR spectra will reveal the fact that the chemical structure of the compound was not changed.

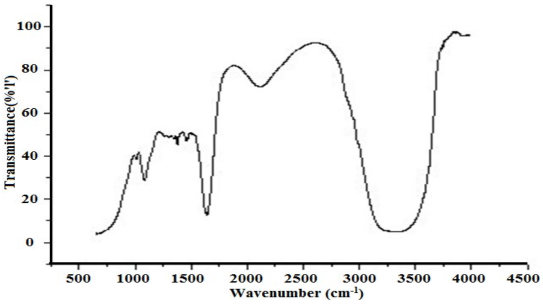

Fig. 4. FT-IR spectra of Nano-CHC

Electron microscope analysis

SEM analysis: The SEM image of Nano-CHC shows that the agglomerations of particles are much less in this method of preparation. The scanning electron microscope image was obtained at 20 micrometer zoom and electron beam of 15 kv energy was used.

Transmission Electron Microscope: The morphological internal structural elucidation of nano-CHC can be obtained by transmission electron microscope analysis. Field-emission gun was used to produce an electron beam. TEM measurement was prepared by deposition of nano-CHC on a carbon coated copper grid. The electron microscope images were shown in Figure 5 and 6.

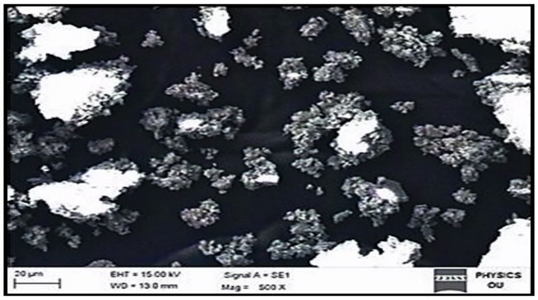

Fig. 5. SEM image of Nano-CHC(PPG encapsulated)

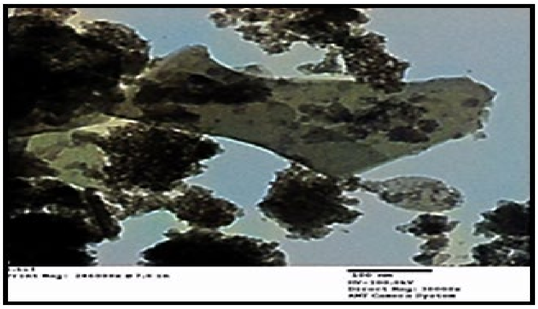

Fig. 6. TEM image of Nano-CHC(PPG encapsulated)

Antifungal activity

Fungi used in the bioaasay activity are *Aspergillue flavus*, *Sclerotium rolfsii* and *Rhizoctonia solani.* The bio assay of Nano-CHC as shown in figures was obtained by using disc diffusion technique. In the investigation throughout de ionized water control was prepared. Fungal isolates were cultured on the potato dextrose agar plates.The potato dextrose agar plates were incubated at 37°C for 10 days which induce conidia. Sample was prepared at 5, 10 and 15ppm (100-folf diluted with de-ionized water) into which filter paper discs were inserted, inoculated on to the petridishes and incubated at 37°C for 2-4 days. The diameter of zone formed will depict the bio assay of nano cartaphydrochloride. Nano-CHC illustrates superior antifungal observations when compared with commercial CHC which can be clearly depicted in the Figures 7 and 8.

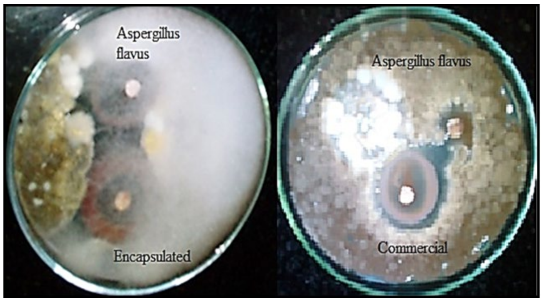

Fig. 7. Nano-CHC and commercial CHC inhibitory zones

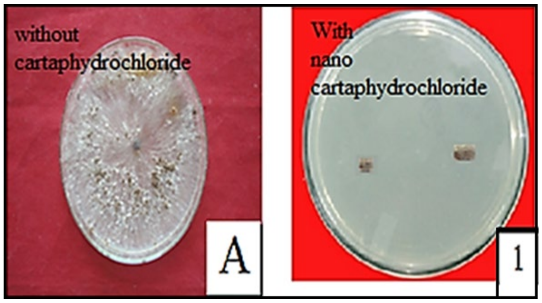

Fig. 8. A: Growth of *Rhizoctonia solani* in our lab cultures without the application of CHC 1: Maximum Inhibition of *Rhizoctonia solani* after the application of nanoCHC(polypropylene coated)

CONCLUSION

The preparation and characterization of Nano-CHC was carried out for eradication of plant diseases. Nano-CHC encapsulated particles were characterized by Fourier transforms infrared spectroscopy (FTIR) and Scanning electron microscopy (SEM). The bioactivity study was conducted against *Aspergillus flavus*, *Sclerotium rolfsii* and *Rhizoctonia solani*. Nano-CHC illustrates superior antifungal results when compared with commercial CHC and hence it is concluded that nanopesticde is better over the conventional pesticide.

ACKNOWLEDGEMENT

We are Thankful to the Management, Faculty of Chemistry, GITAM University for their support and encouragement given to us.

Conflict of interest

The authors declare that no conflict of interests.

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