IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

FORMULATION OF HEXAMINE INSECTICIDE STICKS

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Abstract: Insecticides play a critical role in controlling the spread of insect-borne diseases and preserving crop health. These chemical substances are specifically formulated to kill or manage insect populations. Over the years, various types of insecticides have been developed, including organophosphates, carbamates, pyrethroids, and neonicotinoids, each with unique modes of action, physiological targets, and efficacy. Despite the advantages that insecticides offer, it is imperative to recognize the potential consequences on non-target species, the environment, and human health. It is therefore crucial to follow recommended label instructions and employ integrated pest management practices for the judicious use of insecticides. This review article provides an in-depth examination of the various types of insecticides, including their modes of action, physiological targets, environmental and human health impacts, and alternatives. The aim is to furnish a comprehensive overview of insecticides and to emphasize the significance of responsible and sustainable utilization.

Index Terms - Insecticides, pest management, environmental sustainability, carbamates, organophosphates, neonicotinoids, organochlorines, biological control, resistance, biopesticides.

I. INTRODUCTION

The definition of insecticide is any toxic substance that is used to eradicate and control insect populations (these include ovicides and larvicides for eggs and larvae, respectively). Such compounds are primarily used to control pests that infest cultivated plants, or to eliminate disease-carrying insects in specific areas. The earliest documented insecticide compounds were substances such as sulfur, heavy metals, salts, and even plant extracts (e.g., Chrysanthemum cinerariifolium formerly known as Dalmatian pyrethrum) [1,2,3,4]. The use of elemental and/or natural compounds for pest control started at the very dawn of agriculture and has continued, in some cases, to be used to the present day. The first record of insecticide usage dates ≈4500 years ago by Sumerian people, who used sulfur compounds in order to kill insects and mites. Additionally, ≈3200 years ago, the Chinese were using mercury and arsenical compounds to control body lice [5]. Botanical preparations are also amongst the first recorded pest controllers. For instance, the discovery of C. cinerariifolium insecticidal activity may have been accidental. A book about these common flowers tells us the story of a German woman of Dubrovnik who picked the flowers for their beauty, and after they withered, she noticed that dead insects had gathered around the plant's remnants, suggesting a possible connection between C. cinerariifolium and its ability to kill insects [4]. These flowers, formerly classified as pyrethrum flowers, contain up to 1.5% of a substance named pyrethrin, which is an active insecticidal compound [3]. This ingredient was used as an insecticide in ancient China and in the Middle Ages in Persia, and it was brought to Europe shortly after by Armenian traders, being sold as "Persian dust" (around ≈200 years ago). This powder was produced from dried flowers of Chrysanthemum roseum, and

the major constituents of these dried extracts were pyrethrin I and II, which compose some of today's household sprays [6].

1.1. Insecticides: Importance and Increasing Demand

From ancient times to the present day, the use of pesticides such as insecticides has become an essential and strictly necessary agricultural component in order to assure crop yields and minimize post-harvest losses [27]. With a continuously increasing population, in addition to deteriorating environmental conditions (based on irrefutable and growing evidence of climate change coupled to increasing levels of pollution), the task of achieving long-term development without causing environmental harm has never been greater. In a world where aliment production must grow by 70 to 100% by 2050, in order to meet the food demand of a population of more than 9 billion people, agriculture is one of the major challenges for sustainable development [28].

1.2. Prominent Insecticides and Their Adverse Effects

Environmental contamination is the main problem associated with these poisonous compounds, and they may be harmful to other organisms, including humans, rather than just exclusively killing insects. Many insecticides are short-lived and decompose quickly or are fully metabolized by the animals that ingest them, but some are persistent and, when administrated in higher quantities, could be devastating for ecosystems, as they travel across the food chain. When insecticides are applied to crops, much of it reaches the soil and consequently contaminates groundwater reserves from direct application or, in worst case scenarios, as runoff from treated areas. Furthermore, when poorly used, insecticides could create some levels of resistance amongst an insect population. They could also eliminate the natural predators that once held them back.

The nonspecific nature of the currently used broad spectrum of chemicals makes them more likely to have such unintended effects on the abundance of both harmful and beneficial insects.

1.3. Major Known Targets for Insecticidal Activity

To fully comprehend how an insecticide works, it is necessary to have knowledge about its particular target(s) within an organism. Typically, this is a crucial protein or enzyme. Consequently, insecticides are usually classified based on their structure and mode of action.

Most insecticides act on :-

(1) the insect's nervous systems,
(2) metabolic targets, and
(3) growth regulators and others.

1.3.1. Molecules Disrupting Insect's Nervous Systems

The primary target observed for most insecticides is the peripheral nervous system (PNS) and central nervous system (CNS).

2. SYSNTHESIS OF HEXAMINE FROM FORMALDEHYDE: -

It is prepared by a condensation reaction between formaldehyde and ammonia. Chemical Required is Formaldehyde – 57ml & Ammonia Solution – 90ml

CONDENSATION REACTION:

Synthesis of hexamine from formaldehyde

Measure formaldehyde solution Take 57ml of 30% formaldehyde solution in a beaker.

- Add ammonia solution Add 90ml of 24% ammonia solution until the solution becomes slightly alkaline.
- Heat and cool the solution Heat the mixture in a water bath for 5 minutes and then allowed it to stand for15 minutes.
- Filter the solution Filter the solution through the filtration membrane.
- Evaporate the solution Evaporate the solution on a direct flame using a china dish to a thick paste.

- Formation of crystal Collect the crystals and dry them.
- Recrystallization Carry out recrystallization with water or alcohol (colorless as well as odorless crystals).

PREPRATION OF HEXAMINE INSECTICIDES STICKS

- Firstly we take a required quantity of Hexamine.
- Then we mix cellulose as a binder.
- Then we add iron powder as a coloring agent.
- Add lemon oil for producing fragrance and then we add alcohol as a solvent.
- Prepare dough of above mix ingredients.
- Make sticks through Direct Hand compression.
- Kept all the sticks for drying.
- Hexamine insecticide sticks are prepared.

Fig 1. Hexamine insecticide sticks

4. Conclusion

The development of insecticides has played a critical role in modern agriculture by providing effective control of pests, thereby ensuring food security and improving crop yields. As the world's population continues to grow, it is imperative that agriculture remains productive and sustainable. However, the increasing resistance of pests to existing insecticides, as well as concerns over their environmental impact, highlights the need for continued research and innovation in this field.

meet this challenge, future insecticide development is likely to focus on several key areas, including eco-friendly alternatives such as biopesticides and insect growth regulators, effective resistance management strategies, precision agriculture technologies that minimize the use of insecticides, combination products that target multiple modes of action, and the discovery of novel modes of action that will lead to the development of more effective and safer insecticides.

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