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## **Study of Nano-Particle based Pesticides as an Alternative to Conventional Pesticides**

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### **Abstract:**

*Recent development in nano –science have opened up new direction in chemistry to allow the synthesis of new nano-materials which could not be obtained by conventional means. This shows application in various fields. Nano particles have been used as a physical approach to alter and improve the effect in the properties of some types of synthetic chemical pesticides or in the production of bio-pesticides directly. This paper aims to study the use of nanopesticides in an eco-friendly way. The present paper examines the toxicity due to chemical pesticides within the environment and it discuss the type of toxicity possible. The paper also argues that the application of eco-friendly, pesticides and Nano- based pesticides should be feasible. It concludes that to minimize the hazardous effect of pesticides , attempt should be made to develop plant based pesticides as a safe alternative and for better result.*

**Key words:** nano-materials, pesticides, bio-pesticides, nano -pesticides.

### **INTRODUCTION:**

The era of synthetic organic pesticides started around 1940 and since then their number has grown into the thousands. They are used mainly for agricultural purpose. The synthetic Organic pesticides are the best classified according to their chemical properties, since this more readily determines their persistence and behavior when introduced into the environment. Pesticides are designed to control pests and animals, including humans. Even fairly safe pesticides can irritate the skin, eyes, nose or mouth. Extensive use of pesticides in agricultural and forest area can contribute to the presence of the toxic material in surface and ground water and ultimately in water supplies.

Nanotechnology has become one of the most promising new technologies in the recent decade because the nanoparticles often exhibit novel characteristics like extra ordinary strength, more chemical reactivity and possess a high electrical conductivity. Naturally the word nanotechnology evolved due to use of nanometer size particles (size of 1 to 100 nm) Nanotechnology is about to emerge in the world of pesticides and pest control. Nanoparticles help to produce new pesticides, insecticides & insect repellants.

Nanoencapsulation is a process through which a chemical such as an insecticides is slowly but efficiently released to a particular host plant for insect pest control. Nanoencapsulation with nano particles in form of pesticides allow for proper absorption of the chemical into the plant unlike the case of large particles .(scrinis and Lyona 2007) .Release mechanisms of

nanoencapsulation include diffusion, dissolution, biodegradation and osmotic pressure with specific pH (Vidhyalakshmi et al 2009) To remove harmful effects on the non – target organisms, encapsulation of the active ingredient with other materials such a polymer can allow sensitive ingredient to be physically enveloped into a protective matrix in order to protect core materials from adverse reaction due to factor like air or light. Nano-pesticides hold promise for reducing the environmental foot print left by conventional pesticides. As EPA has noted, “These novel products may allow for more effective targeting of pests, use of smaller quantities of a pesticides and minimizing the frequency of spray-applied surface disinfection. Nano pesticides of fungicides and insecticides and compared their efficacy with the conventional product. Nano-hexaconazole was characterized by SEM, TEM and FT-IR etc. and it was found to be less than 100 nm in size. Nano-hexaconazole is five times more effective in controlling pathogen and nanosulfur is ten times more effective for control of mites as compared to its WDP formulation.

#### **USES OF NANOPARTICLES IN AN ECO – FRIENDLY WAY:**

The advantage of using plant for the synthesis of nanoparticles is that they are easily available, safe to handle and possess a broad variability of metabolites that may aid in reduction. Gold Nanoparticles with a size range 2-20 nm have been synthesized using the live alfa alfa plant (Torreaday et al 2002). The agricultural productivity enhancement involving nanoporous zeolites for slow release and efficient dosage of water and fertilizer , nanocapsules for herbicide delivery and vector and pest management and nanosensors for pest detection (Scrinis and Lyons 2007) Nanoparticles help to produce new pesticides, insecticides and insect repellants (Owolade et al. 2008). It has been observed that nanoparticles loaded with garlic essential oil is efficacious against tribolium castaneum Herbst (Yang et al 2009). Research on nanoparticles and insect control should be geared toward introduction of faster and eco-friendly pesticides in future (Bhattacharyya et al 2009)

#### **Nano tech – based pesticides Approach to control toxicity –**

All pesticides are hazardous if misused no matter what their toxicity. So some new approaches are needed to gauge safety. Nanotechnology has become one of the most promising new technologies in the recent decade because the nano particles often exhibit novel characteristics like extraordinary strength , more chemical reactivity & possess a high electrical conductivity.

The word “Nano” is developed from the Greek word meaning “dwarf” In more technical terms the word “ nano” means  $10^{-9}$  or one billionth of something e.g. a virus is roughly 100 nm in size . Naturally the word nanotechnology evolved due to use of nanometer size particles (size of 1 to 100 nm).

Nanotechnology also has the potential to improve the environment both through direct application of nanomaterial to detect , prevent & remove pollutant , as well as in directly by using nanotechnology to design cleaner industrial processes & create environmentally responsible product.

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Unlike some other application of nanotechnology which are further along in development, application for pesticides are in their infancy.

#### **LAWS OF NANO IN THE ENVIRONMENT:**

There are a number of potential uses of nano in the environment and agriculture. Two good examples are uses in pesticides and fertilizers. There are various laws which seek to ensure that pesticides and fertilizers do not adversely affect human, animal or plant health or the environment. None of the laws mention nano but this does not mean that nano-based pesticides and fertilizers escape regulation. These laws are thought to be broad enough to cover nano- as well as conventional- type of products concerns have been raised, however that even though current laws apply to nano-based pesticides though nano version may infect be quite different

#### **Inadequate safety assessment:**

There are no proper assessment tools to determine whether nanomaterials are safe to use. In a report published by the European Food Safety Authority, it is argued that conventional toxicology and risk assessment methods can in general be applied to engineered nanomaterials, but they will need to be adapted and refined as more information become available.

#### **CONCLUSION:**

Nano-pesticides can be used as a better alternative to conventional pesticides. Use of nanoparticles for delivery of anti-microbiological or drug molecules will be at its helm in near future for therapy of all pathological sufferings of plant. Nanomaterials as gold nanoparticles and silver ion which can be easily synthesized and exploited as pesticides . Natural pesticides have several advantages unlike conventional pesticides these “Killer Spices” do not requires extensive regulatory approval and are readily available. An additional advantages, is that insects are less likely to evolve resistance – the ability to shrug off once effective toxins; they are also safer for farm workers, who are at high risk for pesticide exposure. But new pesticides also have short coming since essential oils tend to evaporates quickly & degrade rapidly in sunlight farmer need to apply pesticides to crops more frequently than conventional pesticides . Therefore new ways of making natural

pesticides longer – lasting & more potent has to be found. As there is little knowledge about the toxic effect, fate and biodegradation of these nano-pesticides, the mechanism by which they work is yet to be found.

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