Nanotechnology as ecofriendly techniques: A review on application in pesticides

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Abstract

Green nanotechnology has two goals: the production of nanomaterial that is environmentally friendly and does not cause harm to public health, and the production of materials that provide solutions to environmental problems. In recent years, the interest of researchers in this technology has increased due to the many solutions that are safe and secure for humans, animals and plants. This technique is in the control of insect pests that cause significant economic and medical damage. In this article review, we will discuss the role played by nanotechnology in pest control.

I. INTRODUCTION

Nanotechnology has been described as one of the fastest growing technologies in the world and has been called the next technical revolution in various fields because of its great advantages [1]Such materials in various industrial, medical and agricultural fields [2,3]The advantage of this technology lies in the unique properties of these nanoparticles. . Agricultural applications occupy a high place in the priority of nanotechnology and are expected to revolutionize the various agricultural fields, including plant protection, detection of pesticide residues and removal of negative effects, thereby reducing environmental pollution and reducing the costs of applications as well as improving the properties of soil for water retention and the production of nano-fertilizeres [4,5].Other applications that relate in improving plant and animal production [6]This presentation deals with the nature of nanotechnology and its characteristics and applications in agricultural production and the roles they can play in finding appropriate solutions to agricultural problems with reference to the most important challenges that may face this technology and appropriate solutions in facing the most important challenges.

Properties of Nano-materials

Materials at the nanoscale acquire new traits and properties that were not even present in their parent material. An inverse relationship exists between the volume of the material and its surface area, where the active surface area increases at the nanoscale level, and as a result stimulates strong reactions and thus increases the number of atoms on the surface. [7]It is known that the atoms of the surface of any substance is responsible for the process of chemical reaction with other atoms because they have unrestricted electrons, while the electrons within the material are constrained and therefore do not participate in the chemical reaction. On this basis, nanoparticles or particles acquire new mechanical, optical, electrical and biological properties. For these reasons, plant nutrient absorption improves and resistance to biotic stresses , as well as increasing the efficiency of Nano- pesticides and other agrochemicals while reducing the amount of materials used in applications[8]

Types of nanomaterial

The nanoparticles are divided into two main groups: organic nanoparticles (including carbon nanoparticles (fluorines)) and the second group is inorganic nanoparticles (including magnatic nanoparticles) and nanoparticles of noble metals (gold and silver). There is a growing interest in inorganic nanoparticles because of their distinctive properties, uses and functions in various medical, agricultural and industrial fields [9].One dimension nanoparticles fall under this category.All materials with a dimension of less than 100 nanometers fall into this category.This category of nanomaterials is named because they have only one nanoscale, such as thin film. Used in the packaging of food products to prevent pollution and damage, and also classified into two-dimensional nanomaterials (Two dimension nanoparticles), which are required to contain two dimensions ranging between 100-1 nanometers such as nanotubes, including carbon nanotubes, nanofibers and wires Nanoparticles The third category is three-dimension nanoparticles, which represent nanomaterials with three nanoscale dimensions of less than 100 nm, such as nanospheres, including fullerens containing 60 carbon atoms and Dendrimers. (A type of polymers used in the delivery of medicines and pesticides) as well as quantitative points Quantum dots (a small material inside contains very small droplets of free electrons are semiconducting crystalline nano-semiconductor sizes ranging from (10-2) nanometers [10].These materials are at the top of the world production list in general due to their multiple uses in modern technological fields and applications**.**

Nano-pesticides

Nanopesticides are defined as any product consisting of nanometer-sized components, whose properties are associated with this range of volumes. Nanopesticides are composed of organic active substances, polymers and inorganic materials such as metal oxides in various forms of particles or molecules.

Types of Nano- pesticides

1. Nanoparticles pesticides Nano- emulsion

They are very fine emulsions of transparent color ranging in size from 20 to 200 nm consisting of aqueous phase and a fatty phase and surfactant emulsion factor such as nanoparticles of geranium oil, which is highly effective against potato moth tuber *operculella*

Phthorimia, achieving rates of killing up to 80% with stability and stability at Field conditions compared to non - nanoscale extract [11]**.**

2. Pesticides Nano capsules

Nanoparticles can be defined as active substances within nanoparticles. These capsules are made from natural polymers such as chitosan or synthetic polymers such as polyethylene glycol (PAG). They are in many forms, such as nanospheres, used in the manufacture of nanocapsules for carbaphyl [12],and nanocapsules such as polyethylene glycol, which was used in the packaging of the active substance pesticide Delta Mthrin [13]as well as nano-gel such as lignin polymer used for packaging The active ingredient of Aldicarb [14]as well as Micelles such as polymer polyethylene di methyl ester, which was used in the packaging of the active substance carbofuran [15].

3. Nano suspensions

They are nanoparticles ranging in size from 1 to 100 nm in the form of aqueous suspensions used in the form of aqueous solutions in pest control such as silver, silica, cadmium nanoparticles and others. In a study evaluating the effect of cadmium, silver and titanium nanoparticles against cotton leafworm, the concentration was 2400 ppm, the latest killing rates ranged from 93, 56 and 73% after 9 days [16].

Nanoparticles as Nano -sensors to detect pesticide residues

Numerous studies and research have developed new nanotechnology-based methods for detecting pesticide residues. These methods are characterized by high accuracy and speed and do not require many samples as well as high sensitivity and detection rates faster than other methods that rely on chromatographic and immunological tests [17].Nano biosensors as the intimacy or synergies between nanotechnology and sensors have evolved into the design of efficient nanoparticle-based sensors. The nanosensor will interact with biomolecules in the target and Gold nanoparticles with a size of 30 nm were among the Nano-sensors that were developed to detect residual or ganochlorine pesticides with sensitivity of up to 27 nanograms, as gold nanoparticles when bonded With the substrate occur color changes used in the detection of pesticide residues and the development of the color signal helps to detect visible easily. This Nano sensor is a suitable technique for detecting many toxins in food and environmental samples because of its efficiency and speed in the detection of pesticide residues [18]Vinayaka et al. [19]indicated the possibility of using cadmium nanoparticles to detect bushy residues 2,4, D and sensing up to more than 250 ng. Ramanthan et al. [20]pointed to the use of silicon nanoparticles to detect paracson residues and sensitivity. It reached 34 micrometers.

Pesticide degradation

The use of nanoparticles to destroy chemical pesticides and their residues is a promising application. Studies have shown that pesticides (Atrazine, Molenate and Chlorpyrofos) are the most sensitive pesticides for degradation by iron nanoparticles (100 nm) [21]. These particles also showed efficacy in destroying cyclodine pesticides, which are resistant to various decomposition factors. The use of nanoparticles for polymers stabilizing iron sulphates of 200 nm helps in the destruction of lindane, one of the organochlorine compounds contaminated to drinking water and food [22].

4. Improving the properties of biological control agents

Nanotechnology can improve the properties and effectiveness of bio -control agents used in the control of various pests. Nanotechnology Increased tolerance of biopharmaceuticals to unsuitable storage conditions. Avermactin bioavailability has been increased to 30 days instead of 6 hours and protected from UV rays by encapsulating the active ingredient with liquid capsules. Silica nanoparticles, as observed increase in the efficiency of fungal preparations such as *Baeuvaria* and *Metarhizum* and *Paecilomyces* by packaging nanoscale-saving capsules moisture as well as protecting it from environmental influences [23,24]

5. Plant pathogenic fungi control

Nanotechnology is one of the most promising methods in the control of plant diseases.Experiments show that silica nanoparticles can be used to detect bacterial spotting *axonopodis Xanthomonus* and gold nanoparticles have been used to detect wheat disease caused by *indica Tilletia*.In a related context, it was found that the use of zinc nanoparticles led to prevent the formation of conidia and conidia of fungi Botrytuscinerea at a concentration of 3 mmol per liter [25]

Conclusion

Green nanotechnology plays an important role in promoting environmental sustainability of processes that produce factors, including the manufacture and use of green nanotechnology products to support sustainability. As well as to reduce the potential risks to environmental and human health associated with the manufacture and use of nanotechnology products, and to encourage the replacement of existing products with new, more environmentally friendly nanoparticles in the life of organisms.

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