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A new philosophy in fabrication pesticides (Abamectin) and Essential oils (Orange oil) into nano-form

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Abstract

A new philosophy and new formulation of pesticide nanoemulsion Abamectin and limonene have been tested for its adult activity against *Tetranychus urticae* Koch. The presence of Abamectin and limonene in the formulation was confirmed by Transmission Electron Microscope and Gas Chromatography-Mass Spectrometer. The dose-response data of *T. Urticae* indicated that the Abamectin and limonene TC were more toxic to the pest than its commercial one. Arranged the toxicity values of some treatment based on LT_{50} values tested against *T. urticae* in descending orders as follows abamectin1.8%, nano Abamectin TC, nano Abamectin 1.8%, and Abamectin TC. Nano Abamectin TC is the second level but is the lowest dose with high absorption and fast toxicity. It was shown that nano orange oil TC was the most effective essential oil and Thymus oil was the least effective oil. LC 50 values were 11.21%, 12.17%, 16.11% and 19.17 % for nano orange oil TC. Orange oil 6%, nano Orange oil 6%, and Orange oil TC respectively after 96hr post-treatment. Time of Absorption on Plant Leaves per minutes was the lowest time in leaves absorption nano orange oil (10.33,15.16,21.14,21.25,23.12,33.09,39.13 and 48.08 respectively) for (nano orange oil TC, nano Abamectin TC, orange oil TC nano orange oi l6% nano Abamectin 1.8% Abamectin 1.8% orange oil 6% Abamectin TC respectively).nano orange oil was more absorption than orange oil TC by 21%. Our findings indicated that nano shape in TC form and then make pesticide formulation was more effective and more absorption in plant leaves against *T. Urticae* than Abamectin and limonene in normal shape and formulation nano shape conversion. The required concentration for controlling *T. urticae* decreased more then. because active ingredients became more speared in formulation This approach might be successful examples for decreasing the resistance of this pest to pesticides and reduce environmental pollution.

Keywords : fabrication pesticides, Abamectin, Essential oils, Orange oil, nano

1. Introduction

The development of novel plant defense formulations has extensive been very active of research because such problems associated with commercial pesticides must be overcome. **[1].** Researchers are currently conniving formulations similar to conventional formulations, but with improved features, that is, more soluble, slower releasing, and not prematurely degradable using the benefit of materials at the nanoscale. Nanomaterials used as a pesticide or as a carrier material have **[1]**and Bordes **[2]**,exhibited useful properties such as stiffness, permeability, crystallinity, thermal stability, and biodegradability over commonly used pesticides **[3].** The nanocarrier materials spread regularly over the leaves and onto the soil surface; thus, they are simply taken up by chewing insects. [1,3] They have also absorbed into the cuticle wax (lipid) layers of insects via a physisorption development and break down the water defense barrier, resulting in insect loss from desiccation. The large surface area of nano pesticides increases the target species/groups and reduces the amount of pesticide vital for pest control. **[4]**Abamectin is usually considered to be non phototoxic under standard use even in sensitive ornamental plants **[5],**Environmental Impacts of Nano encapsulated Pesticides. Conventional pesticide formulations suffer from multigate problems due to their widespread, repeated, and random application, which causes a main impact on the environment. Therefore, a precise pest management system is required to decrease the toxicity of pesticide use and

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minimize any environmental risk. The break done by available pesticides has necessitated the search for new pesticide alternatives to reduce their usage. Therefore, technical development is always a very strong issue in the pesticide industry. Of the most recent technologies, encapsulation of pesticides or pesticide active ingredients with nano-materials was found to be the mainly effective. Nano encapsulation technology has the advantages of safer handling and more effective use of pesticides with less exposure to the environment, guaranteeing eco-protection. They facilitate the eco-protection system to pesticides by, dropping the quantity necessary for effective pest control and, second, enhancing their sensitivity to target and non-target organisms. Reducing the Amount of Pesticide Use and Residues. Nano encapsulated pesticides showed enhanced environmental stability, controlled release, targeted activity, and physical strength than other formulations. Various nano encapsulated formulations such as nanoemulsions also can increase the solubility and permeability of pesticides**[5]** Nanoencapsulation materials can potentially defend them from immature filth such as volatilization, photolysis, and fast disappearance. Some pesticides are extremely mobile and are missing through leaching and drainage, which eventually causes water pollution. As a result, the requirement for frequent and indiscriminate application of pesticides is compact**.[6]** Nano-encapsulated pesticides have also exhibit enhanced pest control efficacy at inferior doses compare to marketable formulations. A nano-encapsulated pesticide possesses an upper surface area and, depending on the particle size, the pesticide doses can be reduced. **[7]** Plant cell walls act as a barrier for entry of any external agent include nano-particle into the plant system. Cell plasma membrane allows less than 5 to 20 nm nanoparticles **[8].** This research aims to make a comparison between converting materials or pesticides in the form of Technical concentration and full preparation into nano-form and notes what can this conversion in toxicology against mites pests and absorption from plants. Conclusion

2.Experimental

2.1 Laboratory experiments

conducted to determine the toxicity of Pesticides were applied in Applied Center of Entomonematodes, Faculty of Agriculture, Cairo University, Giza, Egypt, and department of analysis Central Agricultural Pesticides Laboratory (CAPL), Agriculture Research Centre, Ministry of Agriculture, Giza, Egypt. All samples were characterized by Transmission Electron Microscopy (TEM) as a base tool for scaling the particle's size, structure, and shape, and the plasmonic effect was detected by UV-VIS spectroscopy. The nature of the pesticide was investigated using IR-Spectroscopy., mites carried out to Laboratory were reared on *Acalypha wilkesiana* to insecticides before and after convert to nano shape. The mites were kept at a suitable temperature and humidity. two pesticides were converting to nano shape firstly Abamectin 1.8% and Abamectin TC Molecular formula (C95H142O28) and orange oil 6%EC and orange oil TC with Molecular formula (C10H16).

2.2 Preparation of nanocapsules

polyethylene glycol nanocapsules were prepared using oil in water (o/w) emulsification, using a modified version of the method described by [9]The PEG- Abamectin and orange oil nanocapsules were prepared by the miniemulsion polymerization method. Firstly, samples were emulsified in distilled water 1:1 (v/v) using Tween 80 by stirring for 10 minutes. The emulsion was dropsied in polyethylene glycol 3% solution in a ratio of 1:1 (v/v) under continuous mechanical stirring at room temperature. The emulsion was sonicated 60 min using ultrasonic cleaner set, modelWUC-DO3H 290W, and 60 Hz, and then sonicated for 3min using a high energy ultrasonication probe (model VCX750, 750W, 20 kHz). The loaded nano-capsule suspension was equilibrated overnight. Nano-capsules were obtained as a dispersion in an aqueous solution. then making form TC shape (abamectin, and lemonen) with recommended dose to be ready to use in application and add surfactant 100 and after that making formulation in a form (Microemulsions ME) to TC nano conversation.

Clean *Acalypha wilkesiana* leaves were dipped for 5 minutes in each compound concentration and left to dry at room temperature then put in Petri-dishes. seven replicates were carried out for each concentration and others were dipped in distilled water for the same period as a control. fifteen adult females were added to each treated, control dishes, and preserved at room temperature.; Mortalities were recorded after 24 hr **[9]**The classification of a pesticide's side-effect (mortality/reduction in beneficial capacity) was based on the parameters provided by the International Association for Biological and International Regulation (IOBC): harmless 0-25%, slightly harmful harmless 0–25%, slightly harmful 25–50%, moderately harmful 50–75%, harmful > 75%.

3.2 Statistical analysis

All data are presented as means ±SE. Data were subjected to analysis of variance (ANOVA) using SAS software. The least significant among treatments were compared using Tukey’s multiple range tests.

Differences among means were considered to be significant at $p \leq 0.05$.include artwork, tables, elaborate equations or references to other parts of the paper or to the reference listing at the end. The reason is that the Abstract should be understandable in itself to be suitable for storage in textual information retrieval systems.

3. Results and Discussion

This system allows only simple, slow-release rather than a responsive release based on an environmental condition such as light, temperature, soil, PH, humidity, and enzyme **[11].** Nanoparticles enter into insects through physical contact, ingestion, and inhalation. In physical contact nanoparticles penetrate the exoskeleton, binding the nanomaterials to sulfur from protein or phosphorus from DNA in intracellular space, leading to denature of organelles and enzyme resulted in cellular fraction and cell death **[10,11]** to make confirmation that Abamectin and orange oil convert to nano shape we make analysis and measurements by transmission electron micrographic image The images depict spherical and well-dispersed nanoparticles with a size range of 23-35 nm. [12,18] noted the properly magnified bar size of 20nm making the image visualization very clear [18].HR-TEM has been reported to be the best method of morphology determination [19].

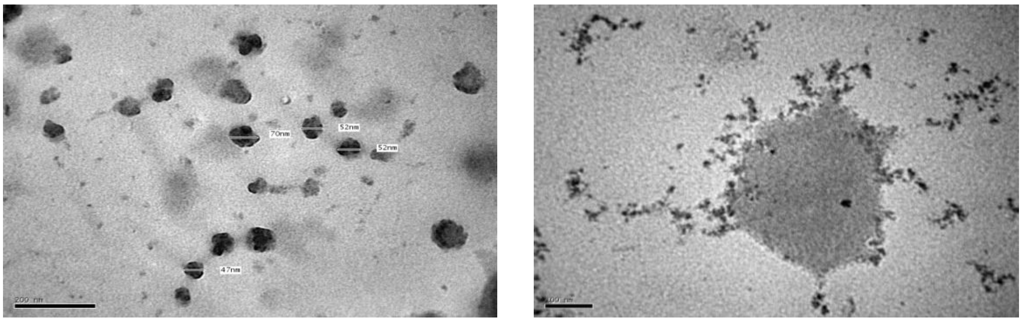

Fig 1: transmission electron of Abamectin TC particles after converting to nano size

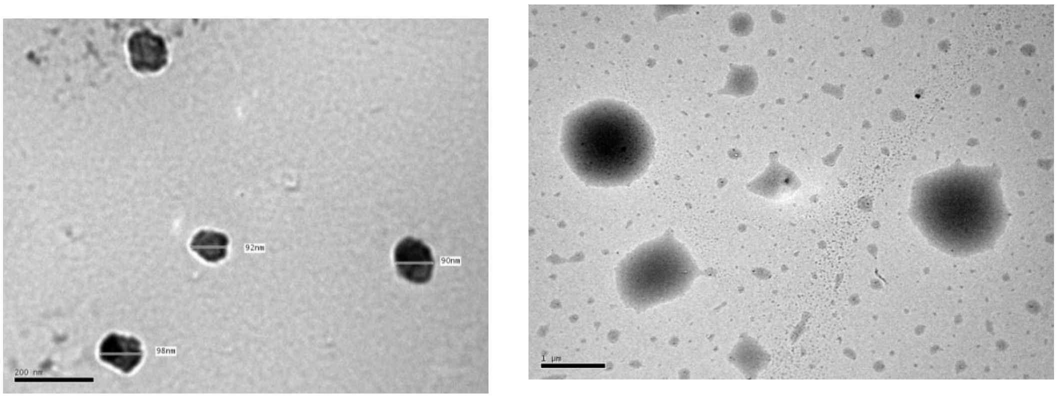

Fig 2: transmission electron of abamectin 1.8% particle

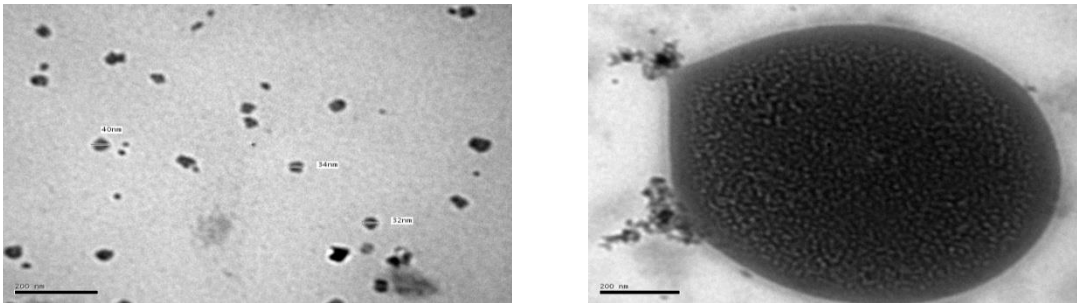

Fig 3: transmission electron of orange oil TC particles

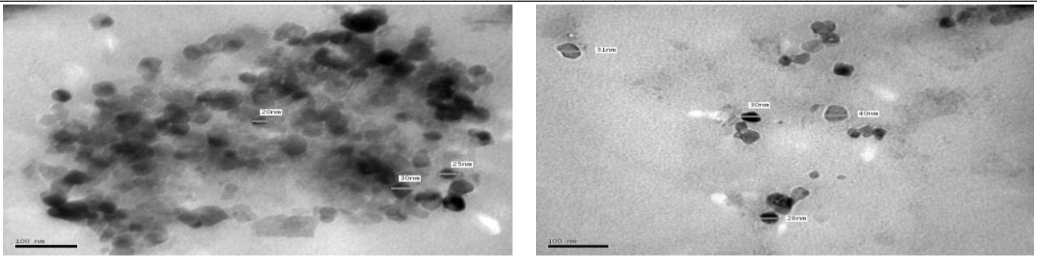

Fig 4: transmission electron image of orange oil 6% particles

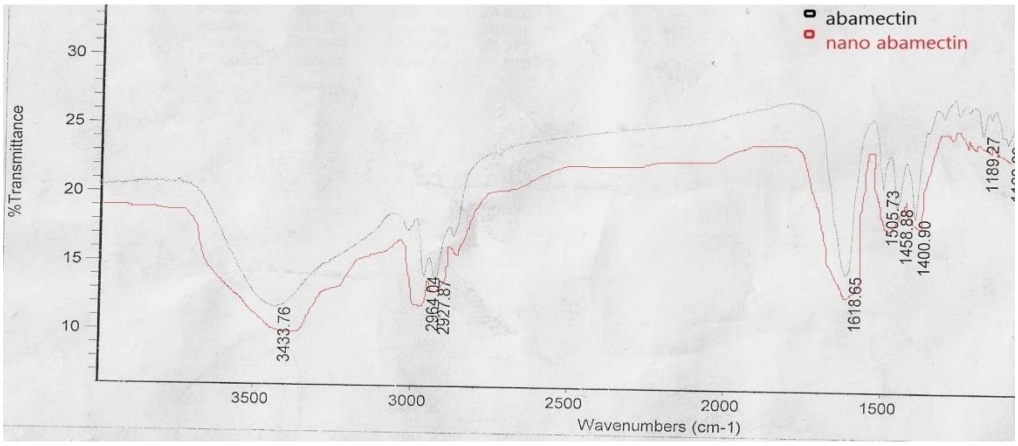

Fig 5: FT-IR analysis spectra for nano abamectin and normal abamectin 1.8%.

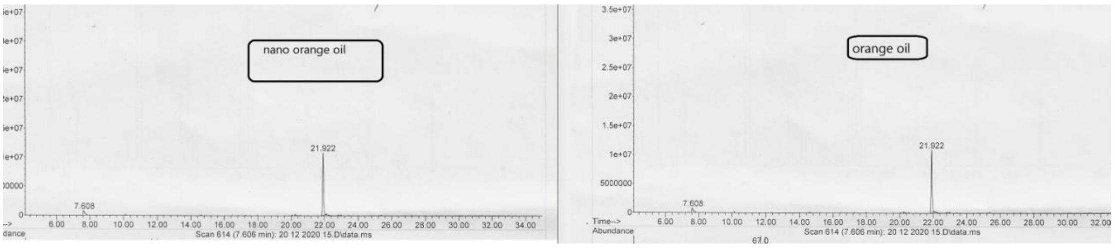

Fig 6: GC-mass analysis for nano orange oil and orange oil (limonene)

3.1 Preliminary Bioassay Tests of (Abamectin1.8% and TC), (nano Abamectin **1.8% and TC).**

To determine the most effective material converted to the nano form, the toxicity effect of four (abamectin1.8% and TC),(orange oil 6% and TC) were tested against the adults. Their toxicity against *T.urticae* is given in Table 1. It was shown that Abamectin TC was the most effective essential oil and thymus oil was the least effective oil. LC 50 values were 9.02%, 10.05%, 10.75% and 22.37 % for abamectin1.8%, nano Abamectin TC, nano abamectin1.8% and Abamectin TC respectively after 96hr post-treatment. The relative resistance values were 2.48, 1.01, 1.115, and 2.48, respectively. 1.91, 1.43, 1.18, and 1, respectively. The present findings agreed with those recorded by [22]. They arranged the toxicity values of some treatment based on LC50 values tested against *T.urticae* in descending orders as follows abamectin1.8%, nano Abamectin TC, nano abamectin1.8%, and Abamectin TC. nano Abamectin TC is the second level but is the lowest dose with high absorption and fast toxicity

3.2 Preliminary Bioassay Tests of (orange oil 6% and TC),(nano orange oil 6% and TC).

To determine the most effective material converted to the nano form, the toxicity effect of four (nano orange oil 6% and TC),(orange oil 6% and TC) were tested against the adults. Their toxicity against *T.urticae* is given in Table 2 and fig 2. It was shown that nano orange oil TC was the most effective essential oil and thymus oil was the least effective oil. LC 50 values were 11.21%, 12.17%, 16.11% and

19.17 % for nano orange oil TC. orange oil 6%, nano orange oil 6%, and orange oil TC respectively after 96hr post-treatment. The toxicity range values were 100, 99.78,89.15, and 86,33 respectively., orange oil 6%, nano orange oil 6%, nano orange oil 6% TC, and orange oil TC, respectively. The present findings agreed with those recorded by **[22,24].** They arranged the toxicity values of some treatment based on LC50 values tested against T.urticae in descending orders as follows.

Table 1: Toxicity and toxicity index (RR) of nano and normal emulsions of orange essential oil on the movable stages of *T. urticae* using spray technique.

Line name	Slope	RR	Upper limit	Lower limit	LT_{50}	LT_{90}
abamectin 1.8%	1.45	1	15.842	1.729	9.02	68.996
nano abamectin 1.8%	1.583	1.015	16.838	2.961	10.757	64.983
abamectin TC	1.632	2.48	28.125	15.108	22.374	98.31
nano abamectin TC	1.994	1.115	16.538	2.761	10.057	64.783

LT_{50} – Time induced 50% mortality; TI – toxicity index, TI = [(LT50 or LT90 of nano or normal abamectin TC)/(LC50 or LC90 of normal abamectin 1.8%)]. High toxicity when TI was less than 1. Toxicity increase [%] = (TI of orange oil 6%– TI nano abamectin TC) × 100. Resistance ratio (RR) = LC50 of resistant strain/LC50

Table 2: Toxicity and relative resistance (RR) of nano and normal emulsions of orange essential oil on the movable stages of *T. urticae* using spray technique.

Line name	LT_{50}	LT_{90}	Slope	RR	Index	Upper limit	Lower limi
orange oil 6%	12.17	77.15	1.057	1	100	12.842	1.729
nano orange oil 6 %	16.11	77.31	1.244	1.002	99.788	16.538	2.761
orange oil TC	11.21	86.53	0.778	1.122	89.153	28.125	15.108
nano orange oil TC	19.17	89.36	0.77	1.158	86.337	16.538	2.761

LT_{50} – Time induced 50% mortality; TI – toxicity index, of nano or normal orange oil TC,)/(LC50 or of normal orange oil 6%)]. High toxicity when TI was less than 1. Toxicity increase [%] = (TI of orai 6%– TI nano orange oil TC) × 100

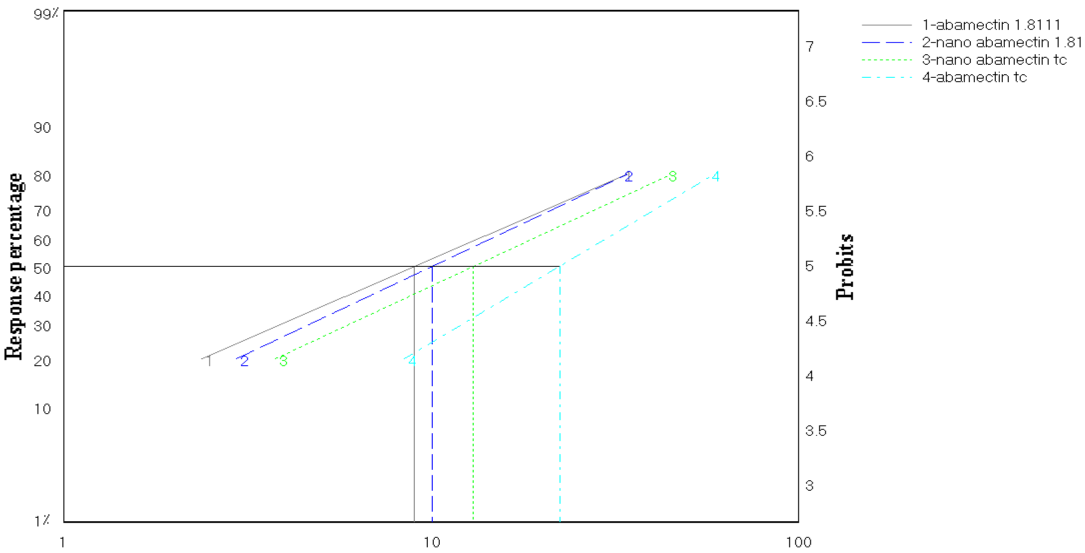

Fig 7: mortality response lines for *T. urticae* exposed to different concentrations of nano and normal emulsion of abamectin .

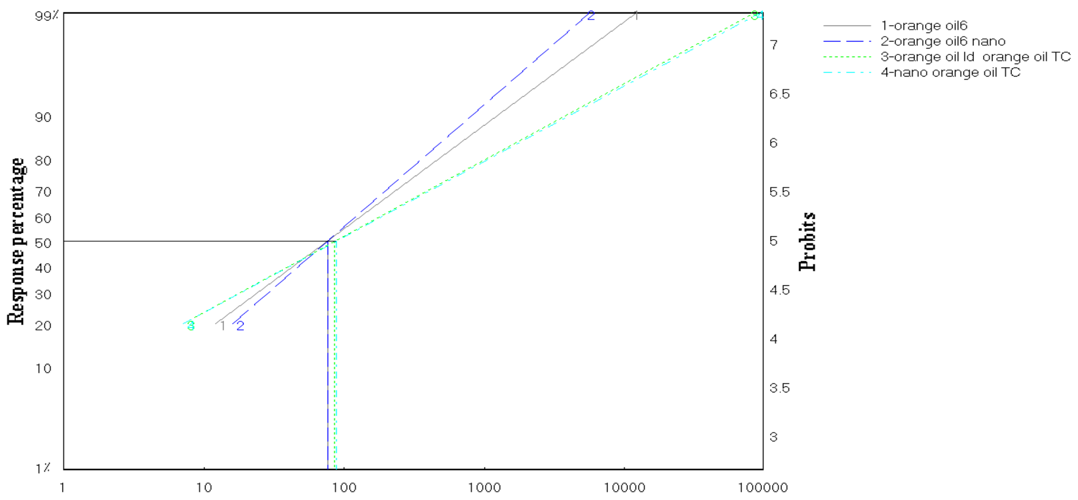

Fig 8: mortality response lines for *Tetranychus urticae* exposed to different concentrations of nano and normal emulsion of orange essential oils using the residual technique. Toxicity Lines, nanoemulsion.

in fig 9 shows that Time of Absorption on Plant Leaves per minutes was the lowest time in leaves absorption nano orange oil (10.33,15.16,21.14,21.25,23.12,33.09,39.13 and 48.08) for (nano orange oil TC, nano Abamectin TC, orange oil TC nano orange oi l6% nano Abamectin 1.8% Abamectin 1.8% orange oil 6% Abamectin TC respectively).nano orange oil was more absorption than orange oil TC by 21%. to make confirmation that material convert to nano shape Some common paradigms of insecticides explored using this nanotechnology approach was essential oils, including neem oil **[21-23].** Nanoscale carriers or nanoencapsulation materials can enhance the bioavailability of active substances and reduce toxicity, improving the timed release of active substances and enabling the precise targeting of active substances by encapsulating the bioactive compounds**[24].**

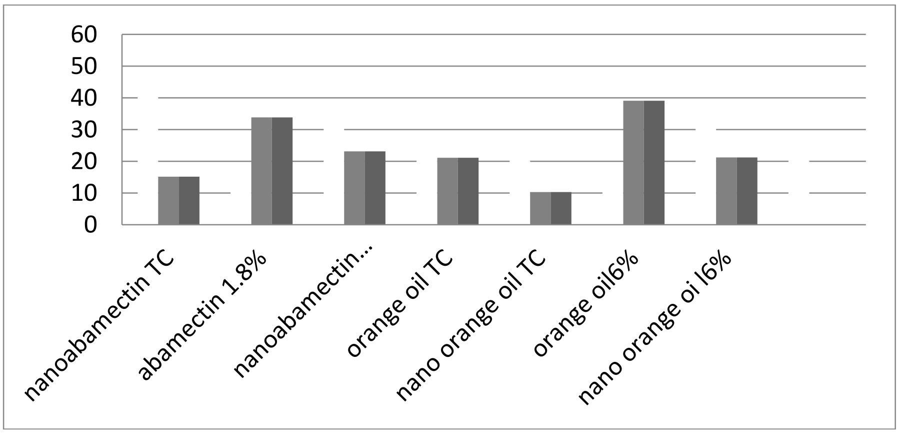

Fig 9:Time of Absorption On Plant Leaves per minutes

Nanoencapsulation is defined as the packaging of solid, liquid, or gaseous material in miniature, a sealed capsule that could release its content at controlled rates under specific conditions. The coated material is called core and the coating material is called shell, carrier, or encapsulant and parallel with**[25]**who's confirmed that Nanomaterials used as a pesticide or as a carrier material have exhibited useful properties such as stiffness, permeability, crystallinity, thermal stability, and biodegradability over commonly used pesticides. The nano encapsulated pesticide formulations exhibited better stability over time due to steric and electrostatic interaction of different phases in the colloidal system. Conventional pesticide formulations showed poor stability and disintegrated during storage. The nano-based pesticide formulations have exhibited their potential to remain stable for a longer storage period[26] prepared nanoemulsion formulations of β-cypermethrin stabilized by polymeric surfactants. The formulations exhibited good stability, even after 24 h of dilution in comparison to commercial microemulsion, due to the steric interaction between the polymeric inner surfaces with pesticides. study agreement with **[27- 28]** confirmed The electrostatic interaction between several polymers showed better efficiency in stabilizing the nanoemulsion formulation than the single polymers used milling technologies in the presence of grinding media (polymer beads) and surface-active agents to obtain stable nano suspensions of various fungicides and insecticides with particle sizes of around 148−314 nm. The level of residual toxicity is influenced by their shelf-lives, chemical stability, and bioavailability to the plant and living beings. However, the development of new pesticide formulations obtained from encapsulation with nanomaterials is the possible solution to minimize the residual toxicity. our study agreement with Nano dispersion of pesticide emamectin benzoate enhances its bioavailability, thus decreasing pesticide pollution.**[29]** Nano dispersion of pesticide emamectin benzoate enhances its bioavailability, thus decreasing pesticide pollution. Two species of mint resisted *T. urticae* infestation by increasing their secondary metabolites which are considered to be the plant defense, but *M. Viridis* is more resistant against T. urticae than *M. Piperita* **[30,31,33]**

4.Conclusion

study making a comparison between converting materials or pesticides in the form of Technical concentration and full preparation into nano-form and notes what can this conversion in toxicology against mites pests and absorption from plants. This method could dramatically reduce production costs compared to the commonly used wet-milling and high Advances of a new philosophy of converting technical material (TC) into a normal formulation :

1- converting one litter or kilo of an active ingredient is the same in cost for one ton of fully nano pesticides formulation

2- The diffusion of the active ingredient in the product added in the usual form is more efficient than the completely transformed pesticide preparations.

3- In terms of the degree of toxicity, the degree of toxicity is equal to one or more of the normal pesticides and completely nano-transformed pesticides.

sensitive pesticides in the environment.

5. Acknowledgments

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