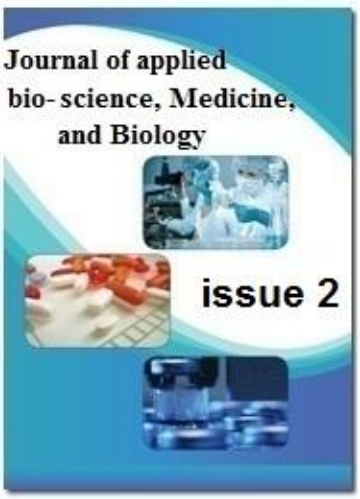
Original research



Diazinon adsorption by albumin nanoparticles

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Abstarct:

Diazinon is an organophosphate insecticide which acts by acetyl cholinesterase inhibition, with adverse effects on human nervous system, respiratory system, and cardiovascular system, among others. Because of the human and environmental hazards of this pesticide, it is one of occupational risks among farmers in developing countries. The aim of this lab trial was to assess possibility of diazinon adsorption by bovine serum albumin (BSA) nanoparticles in acidic milieu. Four concentrations of diazinon were prepared and passed through filter papers containing 5 different amounts of BSA nanoparticles. Diazinon concentration in the filtrate was measured by UV visible spectrophotometer at 405/492 nm, 450/630 nm and 340 nm, and then absorption percentages were calculated. The adsorption rate was improved with increasing diazinon concentrations. With higher nanoparticles concentrations, absorption rate was increased, too. Maximum adsorption at 405, 340 and 450 am were 86.2%, 86% and 85.3%, respectively. This study showed that charged albumin nanoparticles in acidic condition can effectively adsorb emulsified diazinon, and it can be used in membrane filters. Efficacy of this method in the field must be evaluated in future studies.

Key words: Diazinon, Nanoparticles, Adsorption, Albumin, Organophosphate

Introduction

Population growth and increasing demand for food, particularly agricultural products, Farmers to bring their products has increased, While the increase in crops and consequently leads to the increased use of pesticides. Pesticides in agriculture during the past fifty years have been an essential part of the world where demand for production and distribution, improving quality and efficiency of agricultural pesticides are increasing day by day is increasing and the main concern of the World Health Organization and the undue use of the agricultural industry (1).

Organophosphates are the most important class of insecticides that have the most applications in industry and agriculture. Toxicity of these compounds is a global problem and incidence of pesticide in developing countries has doubled over the past 10 years (2). In this regard, it is sufficient to know that the Environmental Protection Agency, 80% of hospital admissions due to pesticides, organ phosphorus poisoning is cited (3). These compounds are the third leading cause of death due to poisoning and toxicity are discussed in Iran (2). Most reports on the effects of organophosphate nerve agents and is known to affect the nervous system (5). Diazinon is an Organophosphate insecticide Contact whit the chemical composition of synthetic and has broad-spectrum insecticide of the early 1950s as insecticides against insect pests and used homes and controlling insects and animals that are resistant to chlorinated pesticides, other uses are considered. This is a non-systemic insecticide and has the property of Kill mites and also in agriculture for pest fruit, sugar cane and is used for ornamental plants, etc. (6, 7). Gardens and agricultural fields in the northern provinces of Iran Diazinon are widely used to eliminate the pests. Rice fields in order to prevent damage due to stem borer, farmers make use of diazinon (8) (9). Recently, the use of pesticides in the greenhouse farms has increased very significantly.

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Research shows that may during spraying diazinon Through the skin, mucous membranes, eyes, as well as oral and inhaled directly or through contaminated water enter Human body and other organisms and effects serious numerous complications caused(4)

The poison of an irreversible bond with the enzyme acetyl cholinesterase at nerve endings and the inhibition of this enzyme can function. Inhibition of this enzyme results in its accumulation in the central nervous system which results in impaired function of the nervous system and the peripheral organs such as airways and lungs (10)(11). So that the most common cause of fatal poisoning with respiratory muscle paralysis has been reported (12). Because of the rapid distribution of the toxin into the water supply on non-target organisms as well as the general influence of invertebrates, mammals, birds, and fish (especially aquatic species), Of those toxins that lead to extraordinary environmental hazards (13). It is likely that the toxicity of diazinon in different animals and a wide range of biochemical effects in non-lethal doses leave behind. Weight loss in the sex organs, decreased mobility, increased sperm abnormalities and death of its negative effects (14) and may cause cell damage, genetic and environmental causes (15).

Individuals and entities that are exposed via toxin, which are the direct and indirect exposure to diazinon, like workers in farms and gardens are exposed to direct pesticide spraying or working in a factory of Toxin production and people who by spraying pesticides are at risk for severe contacts as well persons or animals that are indirectly exposed to contaminated air or water contaminated with this toxin is used. Thus, due to the high consumption of these toxins as insecticides in agriculture and elsewhere, Exposure to these toxins in humans and other organisms is almost unavoidable And can be unintentional or accidental when spraying working with these pesticides And even if they remain in the environment and the objects in the environment Causing their effects.

Despite these problems, yet diazinon pesticide use is high in the third world countries. Therefore, the development of agriculture, the uncontrolled use of pesticides, lack of knowledge the correct use of pesticides and other cases Reduces absorption of pesticides used in agriculture with synthesis of nano membranes is a major requirement in this field.

Materials and Methods

Materials

1 - Bovine serum albumin manufactured by Sigma, Germany

2 - 70% ethyl alcohol manufactured by Razi, Iran

3 - Diazinon by 60%: EC modern factory Aynsktysaydz, India

4 - nitric acid N5 Aznaq Chemical Company, Iran

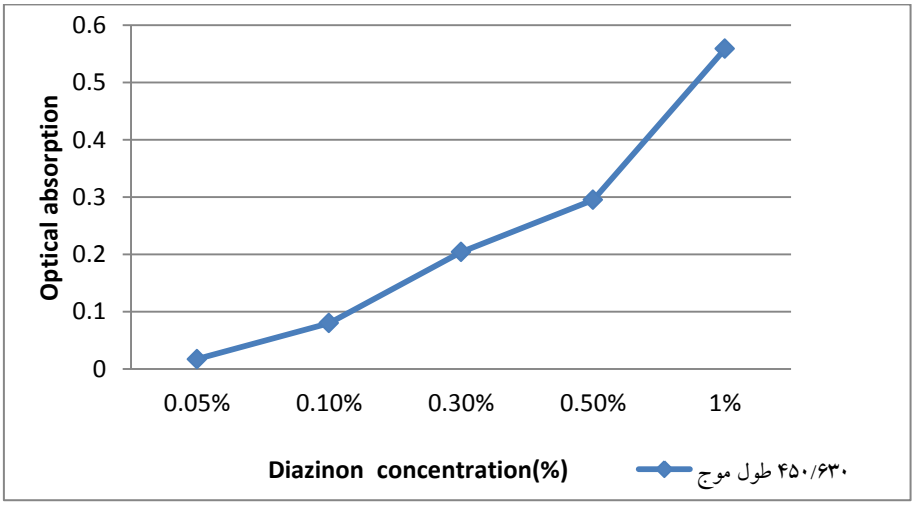
5 - Whatman No. 42 filter manufactured by Whatman, USA

Methods

The first question that came to mind was in this study that farmer what form of diazinon is used and what concentration of diazinon will be using for various products. The initial survey was conducted in the field, Diazinon was detected as a suspension and concentrations of between 1 and 5 per thousand used. Then to close of the real and simulated Test conditions with the current situation in the field Suspension of diazinon at concentrations of 0/1, 0/3, 0/5 and 1 percent was used.

1 - Create a standard curve of different concentrations of diazinon in light absorption at different wavelengths

In the first stage different concentrations of diazinon resulting in light absorption at different wavelengths in wavelengths of 405 to 492, 405 to 630, 450 to 492, 450 to 630, 492 to 630, and in the spectrophotometer that containing wavelength in the ultraviolet region (340 nm), measured and standard curves were plotted to determine best wavelengths be selected for further study. At Finally three wavelengths that whit in concentrations of diazinon had the best curve were selected that shown in the following. Selection criterion in standard curve, a linear relationship between different concentrations of diazinon and optical reading machine.



Graph (1) standard curve of different concentrations of diazinon and their optical wavelength 450 nm / 630 nm

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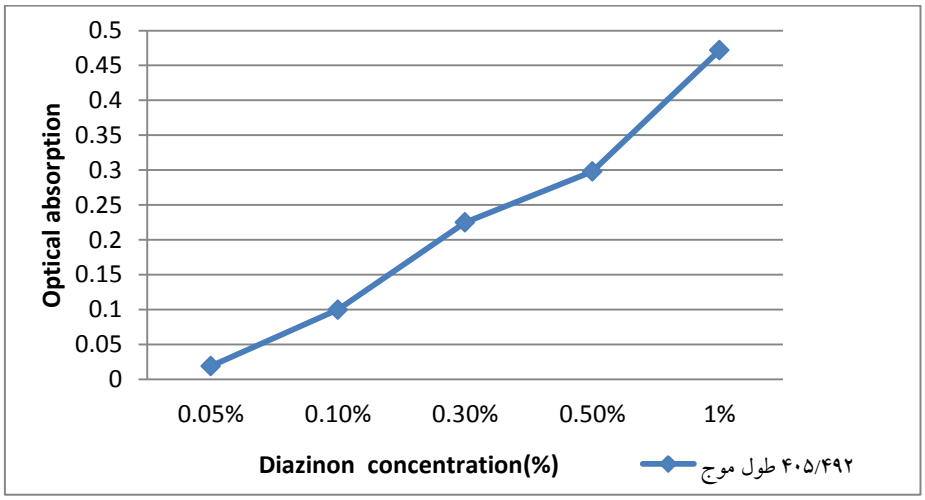
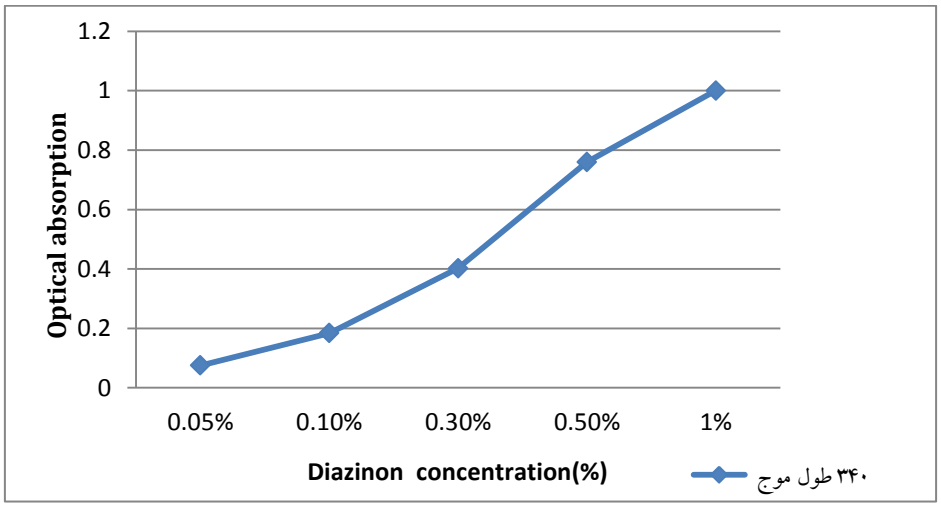


Graph (2) standard curve of different concentrations of diazinon and their optical wavelength 405 nm / 492 nm



Graph (3) standard curve of different concentrations of diazinon and their optical wavelength 340 nm

2- Bovine serum albumin nanoparticles synthesis and preparation of various concentrations of that

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Diazinon solution used by farmers is containing emulsifiers that this substance is caused dissolve nonpolar diazinon in the water and is as a bridge interface between water molecules and diazinon. Emulsifiers having a polar head groups (positive or negative) and a hydrophobic tail is the sequence and in the presence of water molecules will micelle or liposome. Since the majority of emulsifiers used in agriculture (such as diazinon emulsifier used in the test) has Negative polarization so the nanoparticles used in this study must have a positive charge that by ionic forces, adsorption micelle and negatively charged liposomes. Protein nanoparticles used in this study and the positive charge on the protein nanoparticles were easily create acidic conditions.

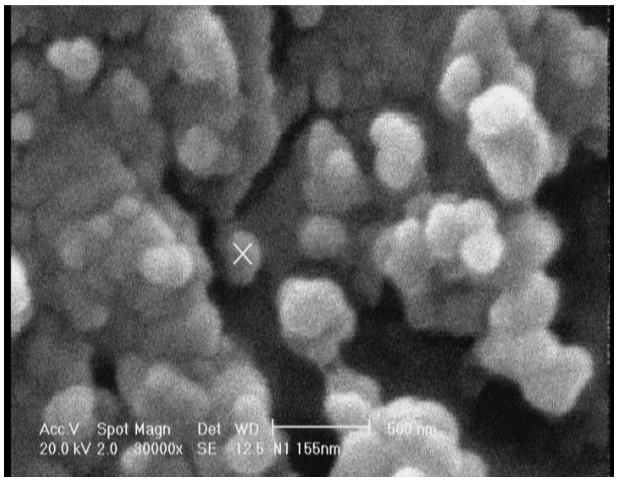

Figure (1) images of nanoparticles prepared from bovine serum albumin using a scanning electron microscope with magnification 30000

3 - Coating of nanoparticles on Whatman filter

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To investigate the effect absorption of diazinon has emulsifier with bovine serum albumin nanoparticles, nanoparticles Should be covered well on the surface or admission neutralize that used a paper towel, cotton and filter Whatman, But because of the lack of consistent results in tissue paper and cotton bed, Whatman filter was used. Whatman No. 42 filter cut into four parts and each part is immersed in 500 ml suspension of nanoparticles in 4 concentration and then incubated at 37 ° C were transferred to dry completely, So 4 filter paper was created with 4 nanoparticles concentration Then Whatman paper coated with bovine serum albumin nanoparticles Made the funnel and placed on the test tube carefully.

Figure (3) Whatman filter loaded with different concentrations of nanoparticles

4 - Evaluation of Diazinon absorption by filters impregnated with nanoparticles

Then, 1 ml of each concentration of diazinon on filter (Whatman filter paper marking) coated was added. This was done for different filters containing different amounts of nanoparticles.

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Then the solution was removed from the filter was transferred to a 2 ml microtube and solutions were transferred to the wells of the 96 home micro plate for to investigate optical finally. Using a standard curve that was created in the first part, Concentration corresponding to the absorbance of each standard curve was determined and then Diazinon absorption by the following formula to different concentrations of diazinon And bovine serum albumin nanoparticles was calculated.

$A / 100 \times (B - A)$

A: Before initial concentration of diazinon pass filter

B: Secondary diazinon concentration after passing through filter

Results

After passing various concentrations of diazinon absorption was measured after passing through a filter, in this research statistical analysis T-Test with software SPSS 16.0 to compare the mean absorbance values before and after the passage of albumin nanoparticles were impregnated filter was used. And amount of difference with $p < 0.05$ were considered as significant level. This study showed that in all three wavelength states used, Significant differences between the values before and after absorption of diazinon impregnated nanoparticles pass through the filter every 4 nanoparticles concentration was found. as shown in the diagram (4), (5) and (6) is determined, The maximum absorption wavelength of 630 to 450 was 85/3 for 1% concentration for diazinon and filter contains 1/0 g ml nanoparticles obtained and The maximum absorption wavelength of 405 to 492 was 86/2 for 1% concentration for diazinon and filter contains 1/0 g ml nanoparticles obtained

and The maximum absorption wavelength of 340 was 86 for 1% concentration for diazinon and filter contains 1/0 g ml nanoparticles obtained also The minimum absorption for each wavelength used was 50%.

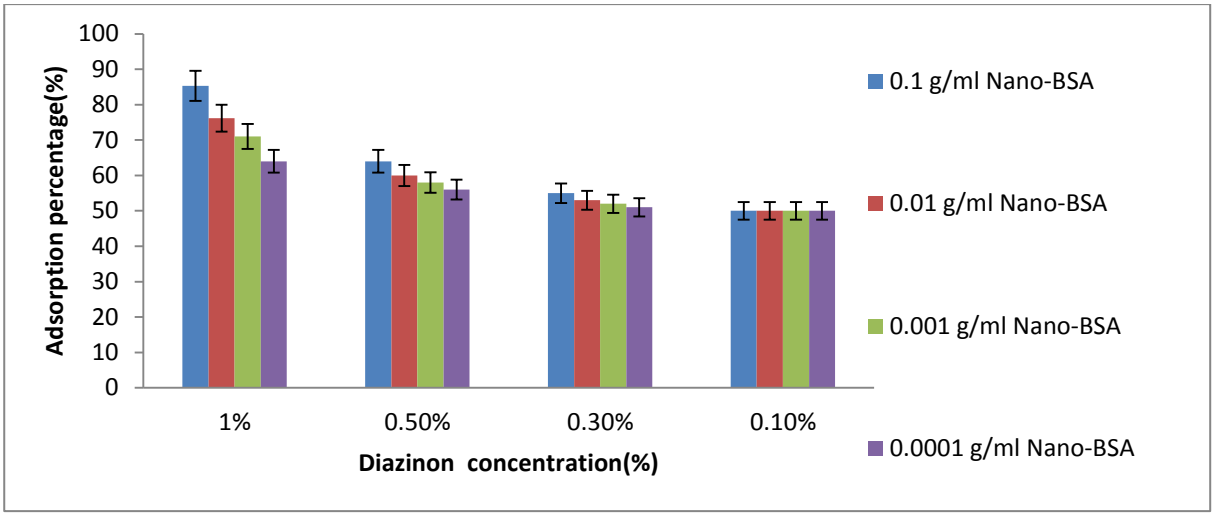

Figure (4): The rate of absorption of different concentrations of diazinon after passing through filters containing different concentrations of bovine serum albumin nanoparticles at wavelengths of 450/630 nm.

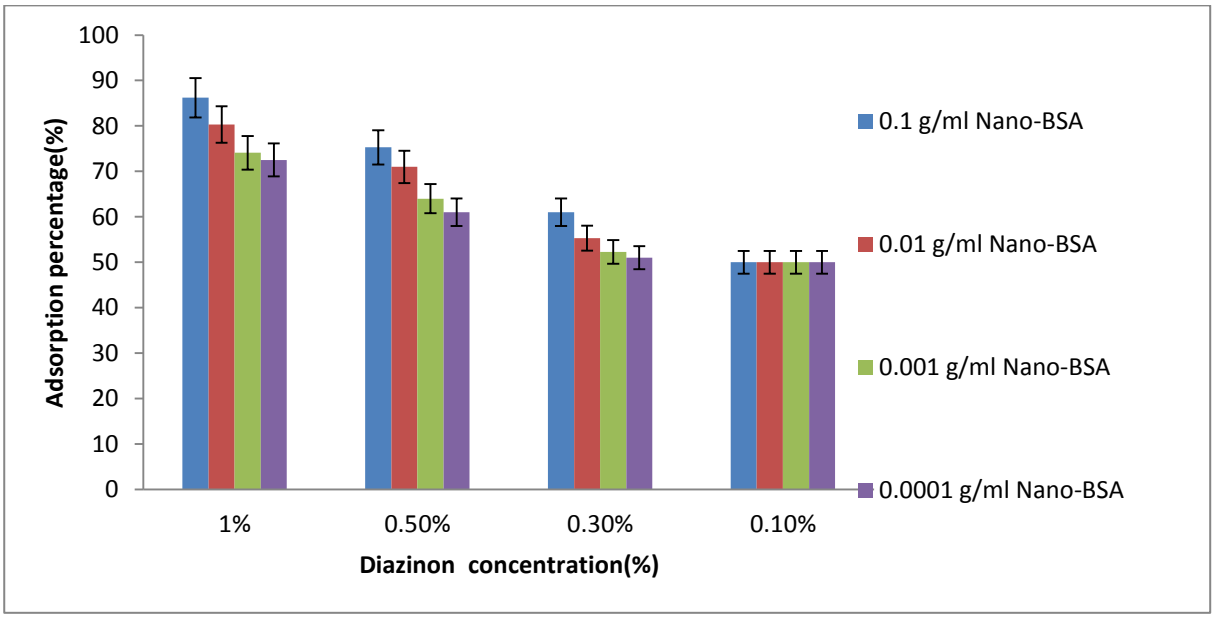

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Figure (4): The rate of absorption of different concentrations of diazinon after passing through filters containing different concentrations of bovine serum albumin nanoparticles at wavelengths of 405/492 nm.

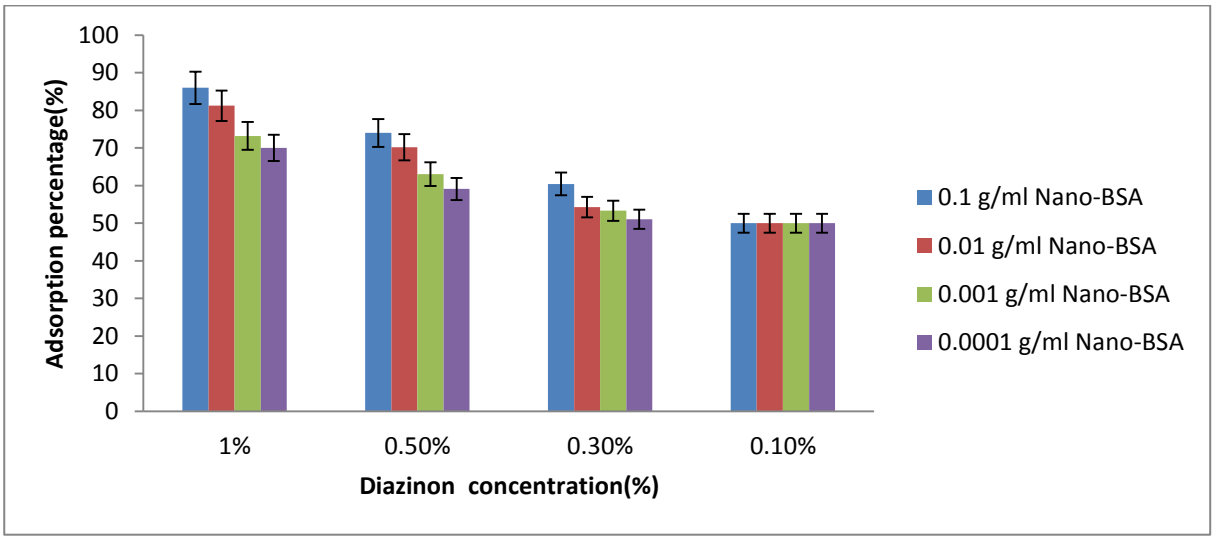

Figure (4): The rate of absorption of different concentrations of diazinon after passing through filters containing different concentrations of bovine serum albumin nanoparticles at wavelengths of 340 nm.

This research also showed that in all three states the wavelength used, significant differences were found between the values of absorption of diazinon before and after pass through impregnated nanoparticles filter for the three high concentrations of diazinon. And because of the limit of detection in the method used in this study, no significant difference was found in 0.1% diazinon in any groups.

The results of this study in Table No (1), (2) and (3) Specify the fact that for different concentrations of diazinon whatever diazinon concentration will be more, capable of absorbing nanoparticles will are more too. Also direct relationship is between the amount of nano-particles on the filter surface and diazinon absorption. That, this effect is due to increasing the interact between molecules of emulsifiers diazinon and charged nanoparticles.

Table (1): The rate of absorption of different concentrations of diazinon after pass through filters containing different concentrations of bovine serum albumin nanoparticles at wavelengths of 450/630nm

Nano concentration / Diazinon concentration	0/1	0/01	0/001	0/0001
% 1	85/3	76/2	71	64
% 0/5	64	60	58	56
% 0/3	55	53	52	51
% 0/1	50	50	50	50

Table (2): The rate of absorption of different concentrations of diazinon after pass through filters containing different concentrations of bovine serum albumin nanoparticles at wavelengths of 405/492 nm

Nano concentration	0/1	0/01	0/001	0/0001

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Diazinon concentration				
% 1	86/2	80/3	74/1	72/5
% 0/5	75/3	71	64	61
% 0/3	61	55/3	52/3	51
% 0/1	50	50	50	50

Table (1): The rate of absorption of different concentrations of diazinon after pass through filters containing different concentrations of bovine serum albumin nanoparticles at wavelengths of 340 nm

Nano concentration / Diazinon concentration	**0/1**	**0/01**	**0/001**	**0/0001**
% 1	86	81/2	73/2	70
% 0/5	74	70/2	63	59/2
% 0/3	60/4	54/3	53/3	51
% 0/1	50	50	50	50

Discussion

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Diazinon is Categories pesticides that widely used among farmers And the human and environmental hazards of these pesticides, during recent years, one of the important occupational risk among farmers in developing countries is Exposed to pesticides. Eyes, respiratory system, nervous system, cardio - vascular and cholinesterase are target organs by diazinon and will create acute toxicity in animals and humans. This substance is also suspected to teratogenic and mutagenic. This substance Increase the mobility of sperm chromosome and a decrease in ovarian weight will be cause necrosis. Reduction in blood indices, mean corpuscular volume, mean corpuscular hemoglobin, packed cell volume, hemoglobin and red blood cells due to diazinon in humans and has been found Chalbash sturgeon fish. Influence on rat liver and increased lipid peroxidation in erythrocytes and also can cause toxic effects on Blood cells, spleen, thymus and lymph nodes in mice.

The aim of this study was to design an appropriate filter with the absorption of the poison with the help of nanotechnology. In this study, bovine serum albumin nanoparticles were used for high capacity and ability of engineering. It is noteworthy that Most of the Nano absorbent used to absorb different pesticides cannot be used directly to humans and very toxic and harmful to human Like a study conducted by police anil Kumar and et al in 2010 for the photocatalytic degradation of pesticides and also the study of amiri-Far and et al in 1388 with the subject of Survey detoxification of organophosphorus compounds was used nanoparticles of magnesium oxide and also the study of daneshvar and et al on Tabriz University in 1384 with the subject of Removing insecticide diazinon from contaminated waters was used manganese oxide nanoparticles synthesized by radiation UV-C, and other similar studies in the absorption of pesticides that direct use of this nanoparticles are very toxic and dangerous for humans. Thus we consider this problem and using bovine albumin nanoparticle if so it can be used to create masks for humans. Also in the research and other similar

studies of pesticides such as diazinon contaminated environments has been absorbed (mostly contaminated water), and in fact it can be cited as a treatment program in case in this study, diazinon Before entering and distribution on the field (prevention phase) can be absorption and in addition to Masks were used by farmers, sprayers, livestock and poultry breeders and workers mask in factories producing diazinon, that all part of human consumption. And can be used in the outlet vent the air in Greenhouses and mushroom production centers to absorb the remaining toxins in the exhaust air. And also can be used as an absorbent column for the absorption of diazinon in the Wastewaters (such as agro-industrial centers which are drained) and even running water contaminated with the pesticides used. It is suggested in another independent study effects of other polymeric nanoparticles and other contaminant pesticides in the areas of agriculture and the environment within this wayand a more rigorous approach like HPLC and GC be assessed. And also influence the absorption of nanoparticle synthesis tested in the field.

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