DESIGNED SENSORS TO MEASURE MODIFIED GOLD ELECTRODE PARAOXON USING CADMIUM OXIDE NANOPARTICLES AND ACETYLCHOLINESTERASE

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ABSTRACT

In this study, we modified gold carbon electrode with cadmium oxide nanoparticles and acetylcholinesterase possible to detect and measure the concentration of toxin Paraoxon possible through electrochemical and studied electrochemical behavior of protein structures. Cadmium oxide nanoparticles were synthesized by chemical method in a laboratory and then-ray diffraction studies of the particles by using (XRD) on this claimis endorsed that our nanoparticles of cadmium oxide.Spectrum Uv - vis the adsorbed metal oxide nanoparticles showed nm380 area.Using a range of XRD, TEM and studied thatwas confirmed by the spectra. We are synthetic nanoparticles and zinc oxide nanoparticles showed absorption spectrophotometer in the region. The nanoparticles were characterized by TEM, XRD .we have a spherical shape. SpectrumUv - vis absorption of cadmium oxide nanoparticles showed nm380 area. Direct Electrochemistry acetylcholinesterase in the modified gold electrode can be achieved easily and applying analytical peakd appears clear. Enzyme inhibition is paraoxon concentration range of the mole. Enzyme inhibition by paraoxon linear function of its concentration in the range of concentration 10^{-8}-10^{-6}molar. Thiselectrochemical process in phosphate buffer solution (PBS) is done at pH =7.This Biosensor can be used to determine paraoxon because it is preparation and properties of good comfort.

Keywords: Enzyme acetylcholinesterase, Cadmium oxide nanoparticles,Modified Goldelectrode, pesticide paraoxon

INTRODUCTION

Because of their high efficiency, pesticides as insecticides are widely adopted in modern agriculture [1]. Unfortunately, these compounds had high acute toxicity; they were harmful to human health and the environment [2]. So rapid detection and reliable quantification of pesticide have become increasingly of importance for public security and health protection [3, 4]. Compared with traditional methods for the determination of pesticide residues, electrochemical immunosensors exhibit the following advantages, such as rapid response, simple instrumentation, easy operation, high sensitivity, selectivity and high compatibility with advanced micromachining technologies and nanotechnology [5-8].Generally, pesticides are widely used in modern agriculture due to its high performance can be used as an insecticide. Unfortunately, the acute toxicity of these compounds, with the greatest risk to both human health and the environment suggest, therefore, for the safety of human health and environmental protection objectives, the development of technologies necessary for sensitive and rapid detection of pesticide residues is organophosphorus compounds, ester, amide or acid derivatives common Phosphoric acid the range (more than 50,000) of chemical

agents and biological nature constitute. The compounds in agriculture, industry, horticulture, veterinary and used homes. Organophosphate compounds are completely or almost completely and quickly through the skin, mouth, respiratory and gastrointestinal mucosa is absorbed and distributed in the body is too large. Types of lipophilic compounds also pass through the skin. Because of the easy access and high toxicity of these compounds, the incidence of accidental poisoning and suicide is extensive, accounting for nearly one hundred poisoning each year in the world. In Iran, the compounds are one cause of poisoning deaths [8-12]. Paraoxon (O, O-diethyl-p-nitrophenylphosphate) was purchased from SigmaChemical Co. and purified as already described [13].Various methods are for making nanoparticles of various materials and controlling the size, composition and uniformity there [14-17]. Nanoparticles are used in the fields of biomedical, pharmaceutical, drug carriers, diagnosis and solar screens. Anti- corrosive or anti-written and self-cleaning wall of metal oxide nanoparticles, such as titanium oxide, zinc, aluminum, iron and silicate is made [18].Much progress has been made in this area over time and various forms of zero-

dimensional nanostructures, and even cauliflower-shaped unidirectional cadmium oxide were produced [19].For the production of cadmium oxide nanostructures in different shapes and dimensions, should be used in different ways. Due to its ionic nature coupled with its wide band gap, low electrical resistivity and high transmission in the visible region, CdO nanoparticles have been found to be a suitable candidate for application in various fields such as optical, photovoltaic cells, gas sensors, solar cells and front panel displays [20-23].Electrodes modified by placing a representative on the purpose of the introduction of the revised business. So, this is a deliberate switching electrode surfaces can eliminate many of the problems of the electro-analytical and analytical basis for new applications and devices provide different feels. Electrode surface modification makes it possible to allow direct control of the chemical nature of the surface. Compounds that are established on the electrode surface, the material properties of the traders fast electrons in the outer shell, are selected catalyst to catalyze reactions of substrates depending on the desired optical properties of molecules or ions from the solution to search and collect them for measurement, control corrosion, semiconductors, and the like [23-28].Acetylcholine, unique transport all skeletal muscle synapses. In addition, the autonomic nervous system nodes and branch target organs parasympathetic autonomic nervous system is found. Since acetylcholine, was found outside the central nervous system and is easily visible and study, it has attracted a lot of attention.Compared to other concepts in electrochemistry electrode, determined face of a chemically modified electrode as a very thin film on the electrode surface to give a series of chemical, electrochemical, optical, electrical, transmission and videos electrodes are attached to or covered [29-36]. In this article we try to have a sensor for measuring electrode modified with gold Paraoxonusing cadmium oxide nanoparticles and acetylcholine design

INSTRUMENT AND MATERIALS

Three electrodes consisting of a working electrode (gold and copper oxide nanoparticles modified with AChE), reference electrode (saturated calomel electrode), the counter electrode (platinum electrode) with a diameter of 4 mm is used. Cyclic voltammetry experiments were performed by using a potentiometer galvanometer Dutch Palm Sense 4.connected to the computer that has the software GPES 4/9. The software records the input data and draw out the desired peaks. Each experiment,

the corresponding concentration three times, and each time tricycle are complete.

Preparation of CdO Nanoparticles

In one experiment, first sample solution with acetic acid and cadmium sulfate withConcentrations of 0.06and 0.03molar respectively, using 40 mg acettrimethyl ammonium bromideas surfactant in $1dm^3$water distilledhas been prepared. The second solution is NaOHseeds 0.09 M and 25 mL of ethanol 70% and distilled twice in a $1dm^3$water were prepared. Then , the first solution was added to the solution with continuous stirring and the resulting precipitate filtered using Whatman filter paper and it is in 80°C in a hot air oven to dry for about an hour .Then dried precipitated silica plant, transported and burned about two hours at 400 ^{o}C.Then using X-ray diffraction and absorption are determined Ultraviolet visible spectroscopy. Then the resulting nanoparticles with 2500mA Brucke D / MAX with X-ray diffraction radiation (λ = 1/540 56 Å) Cu Kα and the operating voltage of 40 kV were tested 250mA. Samples of the player in toluene solution using two beams of visible ultraviolet spectrometer measurements were determined.

RESULTS AND DISCUSSION

The unique properties of nanomaterials are strongly dependent on the chemical composition, particle size, surface structure and interactions between particles forming them. The mechanical properties of a large sample are needed. This is a big problem. Three main methods for finding and analyzing are characteristic properties of nanomaterial, including x-ray, electron microscopy and scanning probe microscopy. Materials characterized by x-ray photoelectron spectroscopy and X-ray diffraction method by electron microscopy, including transmission electron microscopy and scanning electron microscopy. Other methods based on electron beam diffraction electronused such as reflection high-energy and energy resolution spectroscopy for the target.

Characterization of cadmium oxide nanoparticles synthesized

X-ray diffraction for cadmium oxide nanoparticles

X-ray diffraction pattern for cadmium oxide nanoparticles is diffraction peaks in the 2θ been absorbed. Prominent peak to estimate the grain size of the sample using the Scherrer equation (Scherrer) D = Kλ / (βcosθ) are used where K is constant and equal to (0.9) λ is the wavelength and A $^\circ$) (Cu Kα) 1.5418 = λ), β is the full width half

maximum of the diffraction angle is θ.The seeds size of the pattern using the ratio of the peak intensity of (100) particle size of cadmium oxide is estimated 47.8nmand increase the sharpness of the XRD peaks show that the particles are crystalline in nature. Reflections are clearly seen, being close to the reference patterns of cadmium oxide nanoparticle (See. Figure 1).

Study cadmium oxide nanoparticles using scanning electron microscope (SEM)

Figure 2 Scanning electron microscope image shows cadmium oxide nanoparticles. As well as with magnification scanning electron microscope image shows a variety of cadmium oxide nanoparticles. Due to the reduction of surface area to volume ratio, the smaller nanoparticles can act as stabilizers are very important during procedures.

Synthetic nanoparticles are spherical in terms of morphological and scanning electron microscope image shows cadmium oxide nanoparticles show that the nanoparticles are synthesized 40-45nm Debye-Scherrer formula is a good fit were used the x diffraction ray (XRD, respectively.

Ultraviolet absorption spectra of cadmium oxide nanoparticles

This light indicates that the particles of quantum effects show. There is formation of nanoparticles depending on the surfactant CTAB surfactant and organic solvent to paste the synthesized nanoparticles can help. The result of this operation, the stabilization of the particles and the formation or development of core particles to achieve a high degree of uniformity can be done (Figure 4).

Effects of cadmium oxide nanoparticles on the electrode surface and back electron transfer from Colin thiosulfate

Cadmium oxide nanoparticles have a very high surface to volume ratio, and this factor has caused the particles have a large impact on the exchange of electrons between In the exchange of electrons between the thio urea choline and glassy carbon electrode play. Voltamogram a gold electrode in the form of raw materials and an expression of this is that no redox peaks for a Voltamogram there. In the form of a glassy carbon electrode modified with Voltamogram b of cadmiumoxide nanoparticles. (See. Figure5).

Effect of different scanning speeds on the modified gold electrode cyclic voltammetry/ cadmium oxide nanoparticles / AChE

In a second study the electron transport properties of modified gold electrode acetylcholinesterase on cadmium oxide nanoparticles were investigated with scanning speeds on cyclic voltammetry effect

of acetylcholinesterase was investigated. In Figure 6 (A,B) is a linear dependence between the anodic scan rate can be observed so that the redox peak currents increase linearly with the scan rate. The oxidation peak current (ipa) is proportional to the scan rate. Scanning speeds are used to the full height of the lowest peak of the highest peak in the 100, 200, 300, 400, 500, 600, 700 and 800 mV on the second. The correlation coefficient is equal to 0.99 for the anodic peak. This phenomenon refers to the fact that the process of rejecting one redox species adsorbed on the electrode surface is controlled and stabilized expression of AChE is constantly on the electrode surface.

Effect pH on electron transfer between acetylcholinesterase and cadmium oxide nanoparticles modified goldelectrode

In this study, the effect of pH on the electron transfer between the enzyme acetyl cholinesterase immobilized the modified gold electrode with cadmium oxide nanoparticles were studied. Figure 7 Effect of pH on the ˚E glassy carbon electrode modified with cadmium oxide nanoparticles shows. These measurements indicate that the stabilization of acetyl cholinesterase on the electrode modified with nanoparticles of cadmium oxide, are highly dependent on the ph. The results observed in this experiment, shows modified a linear relationship between the formal electrode potential and pH of between 5 and 11. And changes in this area are the reversible. Any increase in the pH of the solution causes a positive shift in the potential of the anode electrode was modified. Thevalue ˚of 'E observed for pH electrode with respect to the linear equation y = - 0 / 042x + 0/57 and correlation coefficient of this line is equal tor =0.991 and the slope is about-42mV.
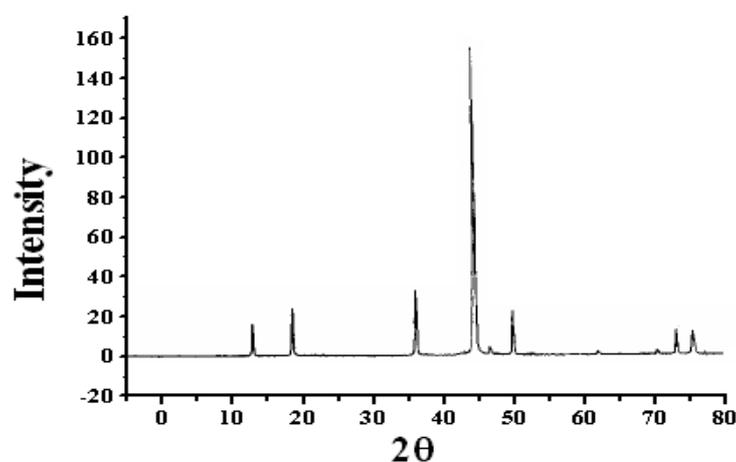

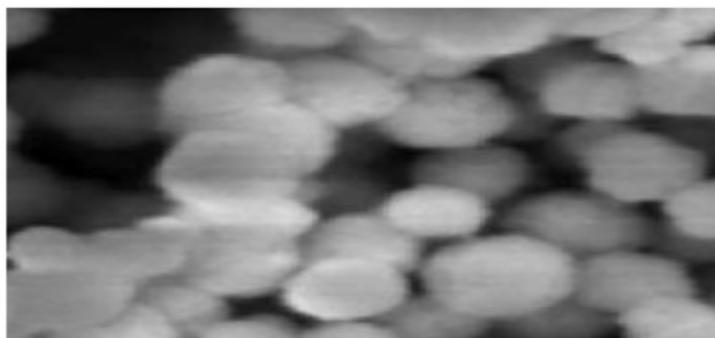**Fig 1.X-ray diffraction patterns of cadmium oxide nanoparticles**

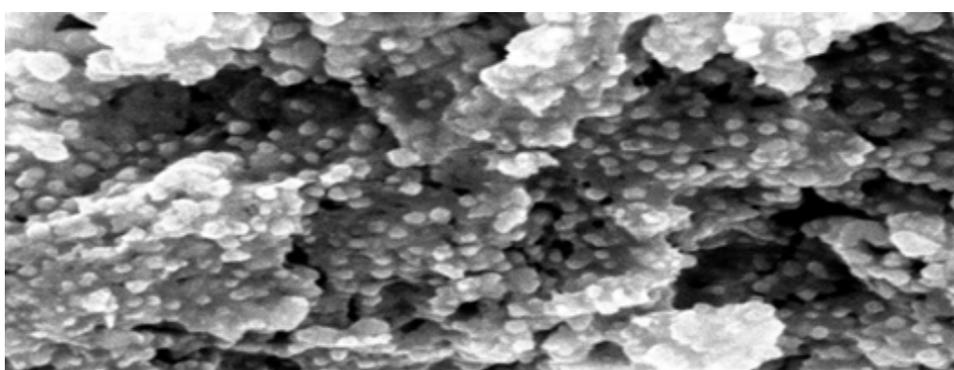**Fig 2.SEM image of prepared cadmium oxide nanoparticles**

Fig 3.Electron micrograph SEM of cadmium oxide nanoparticles synthesized by a magnification of 1500 times
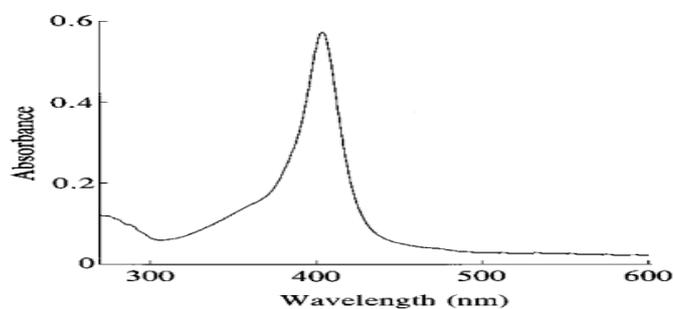

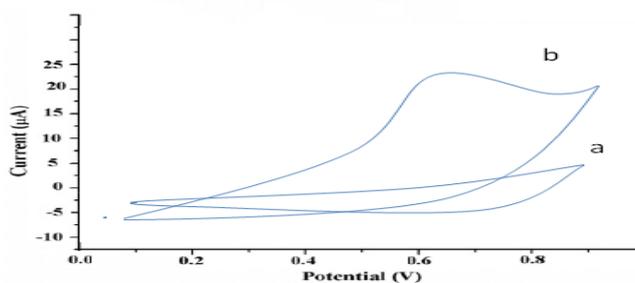**Fig 4.Ultraviolet absorption spectra of cadmium oxide nanoparticles**

Fig5.(a) uncorrected modified gold electrode cyclic voltammetry (b) represents a gold electrode modified with cyclic voltammetry cadmium oxide nanoparticles with acetylcholinesterase in phosphate buffer 0.1 M at pH =7 (scan rate of 100 mV s).
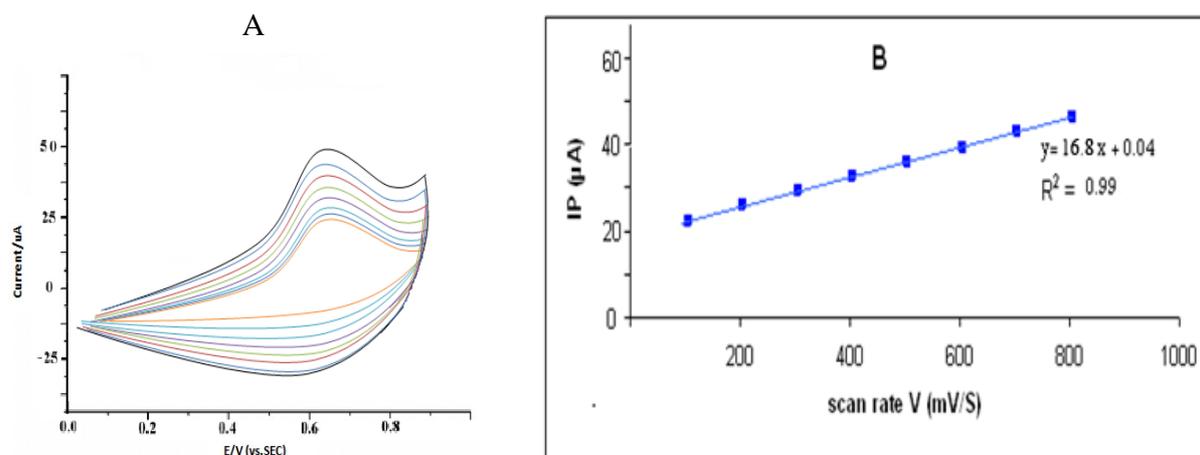
A

Fig6.Scanning speeds were low from the highest peak to the peak height of 100, 200, 300, 400, 500, 600, 700 and 800 and mV per second; and (B) a linear dependence of the anodic peak current (blue line) scan rate.
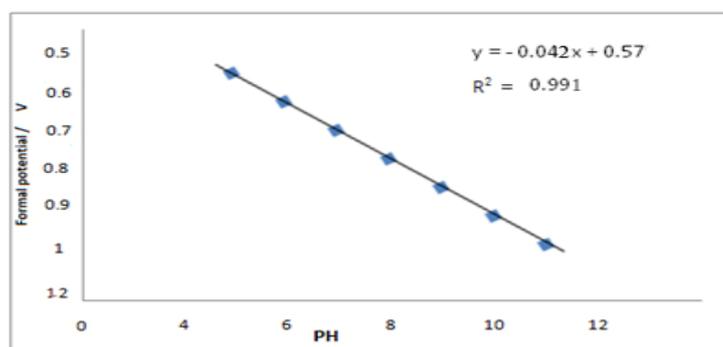

Figure 7 Effect of pH on the formal potential of AChE / cadmium oxide nanoparticles / modified gold electrode. 1.0 M phosphate buffer solution concentration and scan rate of 200 mV s

CONCLUSION

Nanoparticles can be engineered with distinctive composition, size, shape, and surface chemistry to enable novel techniques in a wide range of biological applications. The unique properties of nanoparticles and their behavior in biological milieu also enable exciting and integrative approaches to studying fundamental biological questions. This review will provide an overview of various types of nanoparticles and concepts of targeting nanoparticles. We will also discuss the advantages and recent applications of using nanoparticles as tools for drug delivery, imaging, sensing, and for the understanding of basic biological processes.In this study, we synthesized cadmium oxide nanoparticles by chemical

methods in the laboratory. Spectrum UV - vis absorption of cadmium oxide nanoparticles showed 380nm area. Properties for nanoparticles synthesis determined using X-Ray, UV and TEM . Direct Electrochemistry acetylcholinesterase in the glassy carbon electrode can be achieved easily and peaks specific and analytical appears. The electrochemical process in phosphate buffer solution (PBS) and pH =7 done. The preparation and properties of good comfort, this biosensor can be used to determine paraoxon. Recommended strategies for research on this topic, using a gold electrode or electrodes, graphite or carbon paste electrode was glassy carbon electrodes in place.

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