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# Effect of using zinc oxide nanoparticles isolated from (pumpkin seeds) to modify the properties of the drug Valsartan

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**Abstract**

Nanoparticles have been widely used as carriers for controlled drug release, including Valsartan, due to increased drug concentration at the site of action, longer retention times, improved bioavailability and biodistribution, reduced side effects, and reduced drug accumulation. Nanoparticles are a good choice for drug administration due to their large surface area, small size, and ability to improve drug permeability in biological barriers while maintaining their pharmacological properties. Nanoparticles can be categorized as organic, inorganic, or hybrid. The present study examined the effects of zinc oxide nanoparticles extracted from pumpkin seeds on on Cetyl Trimethylammonium bromide [CTAB] -loaded valsartan, once and sodium dodecyl benzene sulfonate [SDBS]) is, where again, blood pressure is undoubtedly one of the most prevalent medical conditions in adults and the elderly. The results showed a decrease in the percentage of element [Zinc]. When the percentage of Zn was measured in hypertensive rats after dosing with the extracts, it was found to have increased. This indicates that the drug containing the surfactant and the nano-extract is highly effective in lowering blood pressure using less expensive and environmentally friendly materials.

## Introduction:

Pumpkin seeds come from the spherical, thick, hard, ribbed orange or yellow skin of the C. pepo. Numerous flat, oval, elliptical seeds with a creamy white shell and a dark green tint are found inside each fruit. The seed has a fibrous texture, slight sweetness, and a nutty flavor [1]. Contains a huge number of dark green, flat, oblong, elliptical seeds with a creamy white shell. The seed has a fibrous texture, slight sweetness [1]. The United States, a Central American native, produces more pumpkins than Mexico, India, and China combined. Pumpkin seeds are a good source of trace minerals, such as magnesium, zinc, copper, and selenium [2]. Seed oil is a great source of polyunsaturated fatty acids, tocopherols, and beta-sitosterol [3]. Pumpkin seeds have antimicrobial potential because the peptides in the seeds contain alpha- and [4]. The

seeds have also demonstrated an anti-diabetic effect by raising insulin levels, lowering blood glucose levels, and improving glucose tolerance [5], and lower the diastolic blood pressure. For postmenopausal women, this alleviates menopausal symptoms. A phytoestrogen derived from the seeds called, has demonstrated cardioprotective properties by decreasing cholesterol, preventing damage to cell membranes, and removing free radicals [6]. Green nanoparticles made from pumpkin seed extracts are both cost-effective and safe for the environment. through their loading onto silver nanoparticles [7].

Despite their small size, pumpkin seeds are a great source of important nutrients. Magnesium, zinc, and good fats can be obtained in great quantities from a small amount of food. Pumpkin seeds are therefore linked to a number of health advantages. These advantages include enhanced prostate and heart health as well as defense against certain cancers. You can easily include these seeds in your diet in addition to this [8]. Colloidal surfactants, or solid molecules, stabilize these emulsions. Pickering emulsions have several advantages over conventional molecular surfactant stabilized emulsions, including strong adhesion resistance, long-term stability, good biocompatibility, and adjustable characteristics. The impact of particle characteristics on emulsions, such as particle kinds, has been our main emphasis in recent years. concentration, size, and form, encompassing emulsion applications in materials science, medication delivery, biological research, the food and cosmetics industries, and vaccine adjuvants [9]. Therefore, to enhance medication absorption, maximize bioavailability, and lower the necessary therapeutic doses, advancements in water solubility and encapsulation efficacy are needed [10].

There are a number of possible strategies to improve the effectiveness of medications that are soluble in water, including the use of surfactants [11]. Significant hypertension is a common and crippling ailment in different parts of Asia [12]. Asia has some of the world's highest absolute levels of hypertension and comparatively low rates of hypertension control [13]. Asian populations have genetic similarities as well as shared development and management of disorders linked to hypertension are also impacted by regional variability [14]. The majority of hypertensive patients also have other risk factors, such as diabetes, , cigarette smoking, and a family history of. less than half of hypertensive patients are able to effectively regulate their blood pressure [15]. Emotions, sleep, food consumption, physical activity, salt intake, and some medications cause blood pressure to rise and fall multiple times throughout the day. However, it quickly returns, and persistently high blood pressure is referred to as chronic hypertension [16]. Antihypertensive medications, which were developed in the latter half of the 20th century, are the mainstay of treatment for hypertension [17]. Cetyl Trimethylammonium bromide (CTAB). Cationic surfactants are cationic surfactants These are substances that contain a positively charged head group accompanied by a negative ion, such as the negative chloride ion Cl- or the negative bromide ion Br-, an example of which is the organic bromide salt (CTAB) Cetyl Trimethylammonium bromide [18]. An essential surfactant called sodium dodecyl benzene sulfonate (SDBS) is utilized as an industrial additive and cleaning agent to eliminate undesirable compounds that have been found in the aquatic environment [19].Therefore, surfactants can be defined as organic substances that spontaneously aggregate or adsorb on the surface or are substances that have the ability to form what is known as micelles that are in the form of supermolecular macromolecules through their aggregation in solutions [20]. Surfactants consist of two parts: -The first part is called the tail part, which is a hydrocarbon chain that has a strong affinity towards solvents that are organic, and is also called Lyophobic, but if water is the solvent, it is called Hydrophobic, i.e.

hydrophobic. The second part is called the head part, which is a non-polar ionic group or a non-polar ionic group that has a strong affinity for polar solvents, and is also called Lyophilic, while if water is the solvent, it is called Hydrophilic [21-23].Surfactants in aqueous solutions, when adsorbed on the surface, decrease the surface tension because they weaken the bonding forces between the solvent molecules because the bonding forces between the solvent molecules are weak and weaker than the force of attraction between the solvent molecules [24-25].

The nonpeptide angiotensin receptor antagonist valsartan specifically prevents angiotensin II from attaching to the angiotensin II type 1 receptor. From 1997 to the present, extensive research on hypertension, heart failure (HF), and post-myocardial infarction (MI) has shown the effectiveness, safety, and tolerability of valsartan [26]. Enhancing results in CKD and CV illness. Over the once-daily dose range of 80–320 mg, valsartan has dose-dependent efficacy in lowering both systolic and diastolic blood pressure in hypertension; studies have shown that doses as high as 640 mg/day are both safe and effective. Single-pill, fixed-dose combination therapy with valsartan plus hydrochlorothiazide can improve BP control with a more consistent 24-hour BP-lowering profile [27].

Zinc's significance was established for plants in 1869, experimental animals in 1934, and humans in 1961[28]. A transporter-mediated mechanism facilitates the absorption of zinc in the small intestine [29]. The transporters are not saturated for absorption under typical physiological conditions. Because zinc is also eliminated in the intestine, it is challenging to estimate the percentage of zinc that is absorbed. When given to fasting subjects in aqueous solutions, zinc is effectively absorbed (60–70%) [30].

Aim of Study, the possibility of using plant extracts due to their abundance in nature, easy accessibility, cheapness and high results in terms of increasing the body's immunity to currently available anti-hypertensive drugs, developing a biological drug to evaluate valsartan and measuring the efficacy of a prepared mixture of zinc nanoparticles and plant extracts in the presence of valsartan and experimental surfactant

## Materials and Methods

How to Make Extract from Pumpkin Seeds

1. Before weighing the pumpkin seeds with their dry shells (40 g), wash them five times with anionic distilled water, then dry and grind them.
2. Fill a 300 ml (400 ml) saucepan with pumpkin seeds and 400 ml of distilled water. Boil for 30 minutes at 40 degrees Celsius.
3. Strain the solution from the seeds and place the solution in a freeze dryer set to -60°C for 24 hours to obtain the plant extract in powder form. Figure 1 shows the pumpkin extract before and after processing

**Fig 1:** pumpkin extract before and after preparation

**Combining different weights of Cetyl Trimethylammonium bromide (CTAB) solution (Valsartan) with pumpkin seed extract (Ps)**

Four solutions of different weights of pumpkin seed extract (0.2, 0.3, 0.4, and 0.5mg) were mixed with the highest viscosity mixture (4/6) of CTAB and Valsartan, respectively, to produce a mixture of 10 ml for each weight. The volumes retrieved from the prepared solutions for both medications are shown in Table 1.

**Table 1:** Volumes extracted for both materials with varying cardamom weights

| | **L1** | **L2** | **L3** | **L4** |
|---|---|---|---|---|
| (PS) | 0.2 | 0.3 | 0.4 | 0.5 |
| Valsartan (ml) | 6 | 6 | 6 | 6 |
| CTAB (ml) | 4 | 4 | 4 | 4 |

**Making pumpkin extract into Zinc oxide nanoparticles (ZnO NPs):**

**Combining different weights of sodium dodecyl benzene sulfonate (SDBS) solution (Valsartan) with pumpkin seed extract (Ps)**

Four solutions of different weights of pumpkin seed extract (0.2, 0.3, 0.4, and 0.5mg) were mixed with the highest viscosity mixture (4/6) of SDBS and Valsartan, respectively, to produce a mixture of 10 ml for each weight. The volumes retrieved from the prepared solutions for both medications are shown in Table 2.

**Table 2: Volumes extracted for both materials with varying cardamom weights**

| | **L1** | **L2** | **L3** | **L4** |
|---|---|---|---|---|
| (PS) | 0.2 | 0.3 | 0.4 | 0.5 |
| Valsartan (ml) | 6 | 6 | 6 | 6 |
| SDBS (ml) | 4 | 4 | 4 | 4 |

**ZnO NPs are prepared from parsley extract [31]**

1. Dissolve 5 grams of zinc acetate ($CH_3COO$) in water.50 mL of deionized water with $2.2H_2O$.
2. Make the pumpkin seed extract by putting 50g of pumpkin seeds in a beaker with 100 ml of nonionic distilled water after thoroughly washing them three to five times. After 30 minutes of heating, remove the 50ml filtrate and transfer it to a very dry and clean beaker.
3. Fill a round-bottom flask with three holes with fifty milliliters of ethylene glycol, and stir moderately. With constant swirling, add the prepared pumpkin seed extract and zinc acetate in droplets from the beaker's mouth.
4. A gelatinous substance is created once the addition is complete. Give it two hours to stir. Filter the material.
5. Dry at 110°C for 12 hours after filtering. Figure 1. illustrates the phases of ZnO NP production.

**2-5 Effect of adding zinc nanoparticles (ZnO NPs) [32]**

1. A 250 ml beaker is filled with non-ionic distilled water and heated using an ultrasonic device for three hours. The mixture is then transferred to a 250 ml volumetric bottle and the volume is filled to the mark with non-ionic distilled water. This creates a 0.002M solution of ZnO NPs, which is already used as a solution to prepare other concentrations.

2. Using distilled water and the rule of dilution, the concentrations (M0.001 and 0.0001,0.0001,0.00050.00005) are made from the original solution. For instance, to make a solution of zinc nanoparticles, for instance, with a concentration of 0. (001M), it is put in (50ml) of theIn a 100ml volumetric bottle, the original solution mentioned in paragraph (1) is used to make the (CTAB) and (mb) solutions, which are then used to make the mixture with the highest viscosity. Additionally, as shown in Table 2., pumpkin extract is added and dissolved with distilled water.

**Study of chemicals**

**Laboratory animal preparation**

The investigation was carried out at Tikrit University's Faculty of Veterinary Medicine's Animal House Laboratory. Fifteen male laboratory mice, ages two to three months, weighing an average of 260 to 300 g at the start of the experiment, were employed in this investigation. The lab rats were kept in plastic cages with wooden tops, taking into consideration elements like temperature, ventilation, and cleanliness. A premade feed was given to them.

**Test of concentration**

Oxidative stress was induced by valsartan. Five animals were used for each of the three drug concentrations - 5, 10, and 20 mg/kg - in order to determine the optimal dose. Subsequently, the concentration was determined, and it was discovered that 5 mg/kg of the final feed was the optimal dose of the drug to increase blood pressure.

**Experiment Design**

During the three-week experiment, rats were randomly divided into three groups, each group consisting of five animals. After being dissolved in saline (0.9% normal saline), the resulting extracts were administered to the rats daily at a dose of 1 milliliter per kilogram of body weight.

**The C+ positive control group was provided with normal drinking water.**

**Group 1** received 150 mg/kg body weight of pumpkin plant extract on Valsartan with CTAB surfactant after taking oral saline for a week. Over the course of two weeks, she was also given 14 daily dosages at a concentration of 5 mg/kg. After a week of saline administration,

**Group 2 was administered Group 2:**

Pumpkin Seed Extract of Zinc Nano Extract on Valsartan with Surfactant SDBS orally at a concentration of 150 mg/kg body weight. Additionally, throughout the course of two weeks, 14 daily doses at a dosage of 5 mg/kg were given.

After the 21-day period, the animals were starved for 10 hours, and the heart-stab procedure was used to take 7-8 cm3 of blood. After that, the blood was released into an anticoagulant-free test vials with disposable silica gel in them. The serum was then extracted using a centrifuge set at xg1006 speed for 10 minutes. It was then divided into 400-µL tubes and kept at -20°C until the chemical testing were finished.

**Spectroscopy of Atomic Absorption**

To examine a heavy element for which a cathode-only solution is not available: -. Weigh out 0.5 g of ground dry earth and place it in a glass beaker. Five milliliters of strong nitric acid at 70% HNO3 should be added. The model is placed on a hot plate at 105 ´C for an hour. Ten milliliters of distilled water should be added once the model has cooled. For five minutes, thoroughly mix the model using a Rolex rotary shaker. Allow the solids to exit the model by precipitation. At 2000 rpm, the model needs to be moved to the centrifuge. To filter the model, use filter paper (Whattman 0.45). Fill the container with fifty milliliters of distilled water. Read the sample with an atomic absorption spectrometer.

**Results and Discussions**

**Green nanoparticle synthesis and characterization (ZnO-NPS)**

For the investigation of a heavy element (cathode alone) for which there is no conventional solution:

Green nanoparticles that have been synthesized and crystallized (ZnO-NPS). They were taken to the Tikrit University Multipurpose Laboratory in the Salahuddin Governorate, Iraq, for characterisation. Examination of functional groups: The ZnO-NPS composite nanoparticles and pumpkin seed extracts' functional groups were investigated. Four thousand to six hundred centimeters is the wavelength range of FTIR is from 4000 $cm^{-1}$ to 650 $cm^{-1}$ .

Analysis with FESEM: FESEM pictures were captured in order to observe the nanoparticles' form and surface characteristics. EDX evaluation: EDX spectra were analyzed in order to identify and measure the elements and ascertain their distribution on the nanoparticle surface. Analysis of atomic absorption: To verify the components' presence and amount.

**Measurements of micelle production using viscosity and thermodynamics:**

Since gels or supramolecular aggregates have significant applications, particularly in a variety of sectors, due to their distinctive ability to act as thermally regulated living polymers, the development of filament-like micelles or worm-like micelles results in a noticeable rise in any solution. As a result, this study needs to be conducted at various temperatures in order to compute the thermodynamic functions, and viscosity can be regarded as clear proof that worm-like sol-gels are present in the suggested investigation. The ability to produce worm-like micelles in a mixture of surfactant (CTAB/SDBS) and medication (Valsartan) was investigated by measuring the viscosity of solutions at various mixing ratios and temperatures. The viscosity of a 3% mixture of Valsartan and CTAB/SDBS at various temperatures is displayed in Table 2. and ratios of mixing. Since the hydrophobic hydrocarbon chain of CTAB/SDBS had four more CH2 groups than Valsartan's, the ratio (4/6) had the highest viscosity, according the data. The viscosity and percentages of CTAB/SDBS and Valsartan at various temperatures are depicted in the figure. As Table 2 illustrates, increasing the temperature causes the molecules' kinetic energy to rise, breaking the molecular bonding forces and resulting in a drop in viscosity. Because of this, there are fewer forces interacting between water molecules and, on the other hand, between surfactant molecules.

Molecular bonds, causing the viscosity to drop. This is the cause of the weaker interactions between water molecules and, on the other hand, between molecules of surfactants. Furthermore, the results indicates that CTAB/SDBS alone has a higher viscosity than the

viscosity. These results are in line with earlier research findings and are caused by the longer hydrocarbon chain of CTAB/SDBS as opposed to valsartan alone. Overall, the findings show that worm-like micelles were generated and that greater viscosity values were obtained by increasing the CTAB/SDBS/Valsartan mixing ratios; the greatest viscosity (K283.15) was attained at a mixing ratio of 4/6.

Nanocomposites of zinc oxide are now accessible. The thermodynamic parameters of the micelle production process in the temperature range were calculated using the following formulas. 283.15, 293.15, 310.15, and 323.15 K, in that order: 310.15, 323.15, 293.15, K283.15, and K283.15. The heat content of the micelle formation (ΔH) was calculated using equation (0) (Van't Hoff) from the graph of the relationship between (ln η) and the reciprocal of temperature (1/T), which was computed from the slope values of the linear relationship (R \ HΔ- by substituting the value of R with 8.314 J mol-1). Table 3 shows that when a mixture of ionic surfactants (CTAB/SDBS)/Valsartan is present, $\Delta G^{o}$ values usually rise with temperature, followed by a drop in viscosity, which inhibits the formation of worm-like micelles.

**TABLE 3** Viscosity (η) values and other associated thermodynamic functions for the CTAB/Amphotericin B Mixed system at various temperatures 2

| **CTAB 3%wt** | **Methyldopa 5×10$^{-4}$ M** | **Zn** | ***η (Pa.s) x 10$^{2}$*** **(ΔG$^{o}$ kJ.mol$^{-1}$)** ***{ΔS$^{o}$ J.mol-1.K$^{-1}$}*** | | | | **ΔHº kJ.mol$^{-1}$** |
|---|---|---|---|---|---|---|---|
| | | | **283.15 K** | **293.15K** | **310.15K** | **323.15K** | |
| 6ml | 4ml | 2x10$^{-3}$ | 1.41960 (17.705) {-1396} | 0.000141 (6.838) {-520.9} | 0.000263 (6.823) {-491.3} | 0.000895 (2.160) {-149.2} | -22333.0086 |

**FTIR spectrum of zinc oxide**

This technique is used to detect the effective aggregates of organic and inorganic molecules by passing infrared radiation to the sample and measuring the transmittance of the sample and the energy values emitted by the infrared-absorbing chemical bonds. The characterization, as shown in Figure 2, showed the presence of effective aggregates of the network surrounding ZnONPs with the peak at 3379 cm-1 representing the O-H absorbance, while the absorbance at 2928 cm-1 represented hydroxyl aggregates and the absorbance at 1107 cm-1 was observed. 1 non-polar aggregates such as alkyl aggregates as well as some hydrophilic aggregates that helped to increase the affinity and bonding in the gel sample as in the OH aggregates. Another band appears at 439 cm-1 attributed to the Zn-O adsorption and another band at the peak 617 cm-1 clearly shows the Zn-O reduction adsorption.

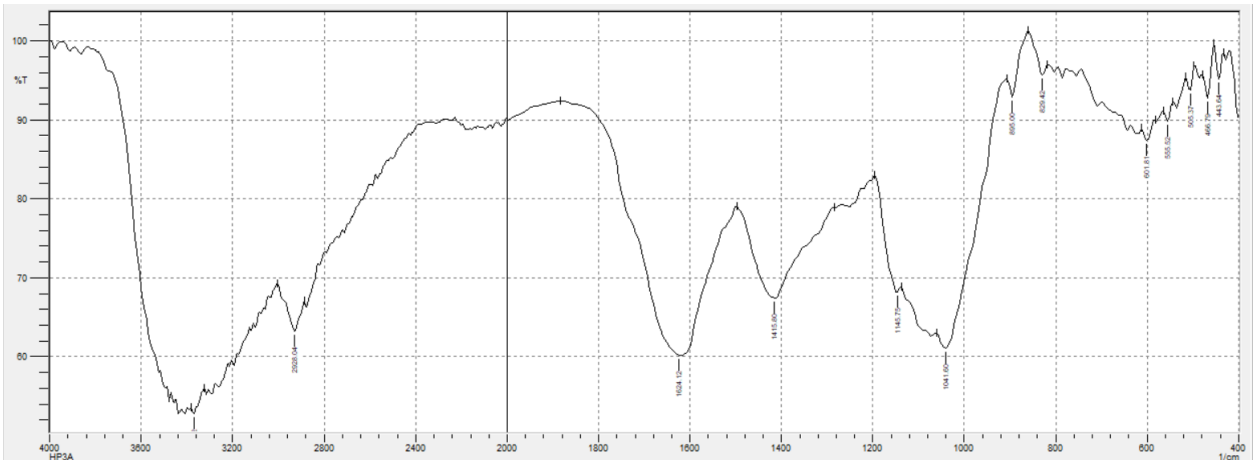



**Fig 2** : FTIR spectrum of zinc oxide

**XRD pattern of ZnO NPs nanoparticles**

to ascertain the elemental composition of the produced nanoparticles. Pure zinc nanoparticles (29%), (40.16%), (50.03%), (58.31%), and (66.30%) were found in Figure 3. A large fraction of ZnO nanoparticle atoms appeared on the surface. This could be caused by the zinc acetate nanoparticles used in the synthesis process, or the vegetable pumpkin seed extract used. The presence of carbon and organic components present in the plant biomaterials on the surface of the synthesized nanoparticles was confirmed by the strong signal of the green synthesized nanoparticles also generated by the EDX results, as shown in Figure 3. The zinc precursors used in this investigation may have contributed to the results (see below). The XRD pattern showed no other peaks, indicating the high purity of the obtained ZnO nanoparticles Figure 3: XRD pattern of ZnO NPs nanoparticles.

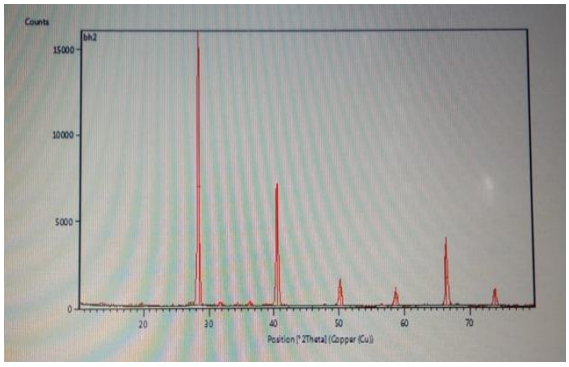


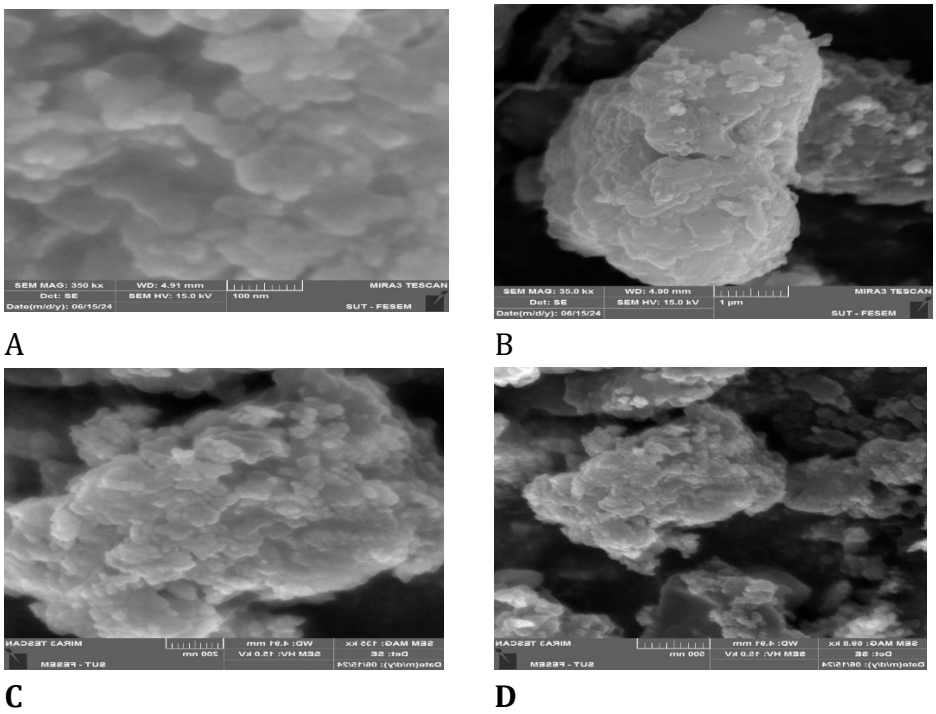

**Fig 3:** *shows the XRD pattern of ZnO nanoparticles*

the extract's good and consistent texture indicates a high percentage of crystallized nanocrystalline magnesium. as verified using XRD readings.

**Scanning electron microscope (SEM) images of compound L1**

**A.** Clear peeling on the edges of the large laminae, the peeling is in spaced circles and is similar to the image of a hurricane on a beach. The presence of floral structures indicates an epithelium with localized translucent peeling with the appearance of holes in the layers. **B**. Good peeling of the sheets despite the low surface area, indicating that the material is not suitable for gas storage. This may also be due to its high susceptibility to sniping and retention of elements, which is observed when sniping surface active substances loaded on ZnO nanorods of the drug. **C.** The presence of cracks on the surface

of large sheets in close proximity and in a pinkish color indicates the presence of sheets that contain many cavities within the material and thus its high density. This indicates high viscosity .**D.** The presence of the phenomenon of nanoflowers, the formation of which is attributed to the retention and explosion of nitrogen gas from between the inner plates, forming the shape of a flower, with nanoscale measurements and floral parchment, and the presence of granular clusters attributed to the increase in the amount of the element As shown in Figure 4.



A B

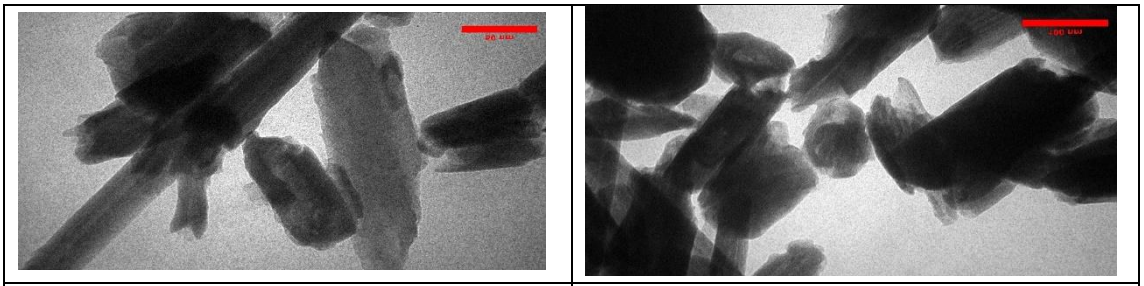
**C** **D**

**Fig 4** *: Scanning electron microscope (SEM) images of compound L1*

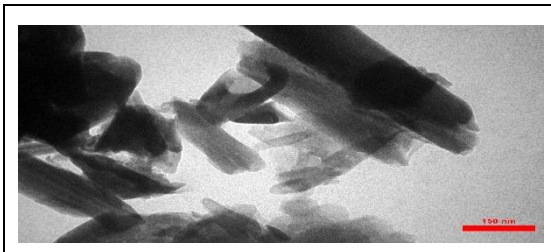
Transmission electron microscopy (TEM) images in Figure (5) of compound (L1):

**Transmission electron microscopy (TEM) images of compound L1**

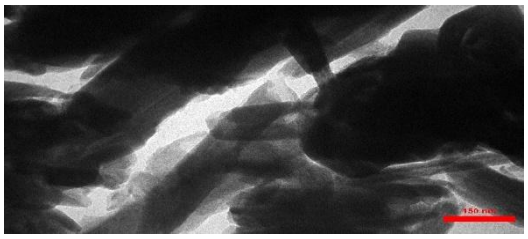
**A**. The presence of longitudinal cavities along the lamina. **B** . The presence of obvious surface pores. **C**.The presence of elevations on the surface of the lamina that reach a polygonal needle shape and give extra space to the lamina. **D**. Homogeneous distribution of aggregates on the surface As shown in Figure 5.



A B



C



D

**Fig5:** *Transmission electron microscopy (TEM) images of compound L1*

**Absorption of elements**

The elements ($Zn^{+2}$) were studied using the plant extracts. The concentration of additional elements in the reference solution was ascertained using the atomic absorption technique.The zinc content was found to be 20.31 ppm using a 1000 ppm concentration of the generated product.

In order to study $Zn^{+2}$ using an atomic absorption technique, the mice were given nanobotanical plant extracts for 15 days. Following this, their blood was drawn, and serum was extracted from the blood of sick mice. This involved using the 1000 ppm concentration of the synthesized compound to calculate the ratio of elemental ions in their standard saline solutions using the serum, and estimating the concentration of the remaining elements in the standard solution:

The mechanism of adsorption was according to the surface structure of the compounds that were generated and the generation of protonated salts from the compounds that were surface-active. The compound's serum served as the basis for the mechanism underlying the existence of $Zn^{+2}$. It is crucial to remember that the compound derivatives' nitrogen or oxygen atoms function as donor ligands, creating one or more bonds to create a stable complex. In this instance, the ions and the prepared active surface had a high affinity due to electrostatic attraction. In this instance, the ions and the produced surface-active chemicals had a high affinity due to electrostatic attraction. Since zinc levels fall when blood pressure rises, it was shown that if rats' blood pressure dropped after receiving a medication containing plant extracts, indicating a high zinc content As in Table 4 and 5. The elements ($Zn^{+2}$) were studied using plant extracts. The concentration of other elements in the standard solution was ascertained using the atomic absorption technique, and using a concentration of 1000 ppm of the generated compound, it was found that the concentration of zinc was 22.3736 ppm.

**Table 4** : Zinc element percentage for group 1

| Removal Percentage(%) | Serum concentration administered (ppm) | Serum concentration to control (ppm) | metal ions |
|---|---|---|---|
| 141 | 17.6129 | 12.01613 | (Zn+2) |
| 90 | 16.87903 | 18.70967 | (Zn+2) |
| 158 | 18.03226 | 11.37097 | (Zn+2) |
| 91 | 15.62097 | 17.064516 | (Zn+2) |
| 124 | 16.56452 | 13.33871 | (Zn+2) |

**Table 5** : Zinc element percentage for group 3

| Removal Percentage(%) | Serum concentration administered (ppm) | Serum concentration to control (ppm) | metal ions |
|---|---|---|---|
| 157 | 18.90806 | 12.01613 | (Zn+2) |
| 169 | 20.39516 | 18.70967 | (Zn+2) |
| 174 | 19.83065 | 11.37097 | (Zn+2) |
| 143 | 24.40323 | 17.064516 | (Zn+2) |
| 130 | 17.88716 | 13.33871 | (Zn+2) |

## Conclusions

1.The highest viscosity that can be obtained is at a mixing ratio of 4:6 of CTAB and Folstaran, respectively.

2.The viscosity of the binary mixture (worm or nematode formation) of surfactant and drug increases with decreasing temperature. The viscosity of the binary mixture of CTAB and Folstaran increases more rapidly when pumpkin seed extract alone is added due to the effect of hydrogen bonding and other molecular interactions, 3. The viscosity increases as the weight of the added extract increases and the temperature decreases. The viscosity of the mixture (CTAB, volstaran, and extracts) increases with the addition of nanomaterials, because nanomaterials act as a network at the micelle junction and continue to bind to each other due to their small size and high surface area.

4. The viscosity also increases as the concentration of added nanomaterials increases and the temperature decreases. The formation of worm-like or filamentous micelles for most of the studied systems is spontaneous ((ΔG°)) is negative, thermally negative ((ΔH°)) and entropically negative ((ΔS°)), as evidenced by the values of the thermodynamic function calculations. The surfactants keep the nanomaterials in solution without agglomeration, which increases the effectiveness of the prepared blend.

5. The ability of CTAB, SDBS and prepared and loaded nanomaterial extracts to treat blood pressure in rats using plant nanomaterial extracts in an environmentally friendly and economically inexpensive way.

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# تأثير استخدام جسيمات أكسيد الزنك النانوية المعزولة من (بذور اليقطين) لتعديل خصائص عقار فالسارتان

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**معلومات المؤلف**
الايميل:
الموبايل: :

**الخلاصة:**
تُستخدم الجسيمات النانوية على نطاق واسع كناقلات للإطلاق المتحكم فيه للدواء، بما في ذلك فالسارتان، بسبب زيادة تركيز الدواء في موقع العمل، وأوقات استبقاء أطول، وتحسين التوافر البيولوجي والتوزيع الحيوي، وتقليل الآثار الجانبية، وتقليل تراكم الدواء. تُعد الجسيمات النانوية خيارًا جيدًا لإدارة الدواء نظرًا لمساحة سطحها الكبيرة وصغر حجمها وقدرتها على تحسين نفاذية الدواء في الحواجز البيولوجية مع الحفاظ على خصائصها الدوائية. يمكن تصنيف الجسيمات النانوية على أنها عضوية أو غير عضوية أو هجينة. اختبرت الدراسة الحالية تأثيرات جسيمات أكسيد الزنك النانوية المستخرجة من بذور اليقطين على بروميد السيتيل تريميثيل الأمونيوم (CTAB) المحمل بالفالسارتان مرة واحدة ودوديسيل سلفونات بنزين الصوديوم (SDBS)، حيث يعد ضغط الدم بلا شك أحد أكثر الحالات الطبية انتشارًا لدى البالغين وكبار السن. أظهرت النتائج انخفاضًا في نسبة عنصر (الزنك). عندما تم قياس نسبة عنصر الزنك في الفئران المصابة بارتفاع ضغط الدم بعد تناول جرعات من المستخلصات، وجد أنها زادت. وهذا يشير إلى أن الدواء الذي يحتوي على المادة الخافضة للتوتر السطحي والمستخلص النانوي فعال للغاية في خفض ضغط الدم باستخدام مواد أقل تكلفة وصديقة للبيئة.