



Employment of Bionanomaterials for Injured and Burned Skin Treatment in Rabbit



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IN THIS work, silver nanoparticles were prepared using easy chemical techniques and cheap local materials from industrial sources (silver nitrate) and natural (green apple) for comparison in terms of toxicity. Using X-ray diffraction machine (XRD) and electron microscopy (SEM) and sample element chemical analysis (EDXS), the characteristics of silver nanoparticles in terms of structural characteristics were explored. The sample bonds were tested using FTIR to obtain the highest circumstances for using silver in the therapy of burning rabbit skin. X-ray diffraction results showed the purity of the chemically prepared material (silver nanoparticles) based on the American ASTM card with Miller coefficients determined at (111, 200, 220 and 311). The silver nanoparticle diameter was measured and found between (5-21 nm), the electronic scanner result showed sample surface homogeneity and silver nanoparticles "spherical shape". It has also been studied the biological properties of silver nanoparticles. For the following bacteria (*Micrococcus*, *Bacillus*, *Pseudomonas*, *Staphylococcus aureus* and *E. coli aeruginosa*), silver was identified as an antibacterial agent. Silver demonstrated strong antimicrobial activity and each bacterium's inhibition diameter (30, 36, 28, 24 and 25 mm), respectively. Silver nanoparticles have been assessed toxicity to determine the best dosage for particle use as a treatment for rabbit skin burns. Approximately one year old, male, 1.5-2 kg domestic rabbits were prepared for a week prior to the experiment in a safe follow-up environment. Ultimately, the study included a full histological analysis of the treatment stages of each method used to treat rabbit skin burns (silver nanoparticles, silver-animal fat-zinc juicer) at different treatment times to determine the best model used in burn care.

Keywords: Ointment, Burns, Silver Nanoparticles, Silver-Animal Fat-Zinc Juicer.

Introduction

Skin burning is an injury that can be caused by cold, heat, chemicals, friction, radiation, and electricity [1-6]. Many methods can be employed to heal the burring of the skin, such as using antibiotic ointments or creams that can prevent infection. A biomaterial is a science that can use any substance in the human body with biological systems to treat, fix, increase or remove tissue [7-10]. Recently, silver nanoparticles have been used in laboratory and animal studies in human treatments; toxicity, assessment of possible effectiveness and costs are covered [11-15]. At high concentrations (10% of solution), silver nitrate is toxic, but at low concentrations (0.5% of solution), it is non-toxic, doesn't harm the wound's regenerating epithelium, and ionic silver is a powerful antimicrobial agent (and is bacteriostatic against *S. aureus*, *E. coli*, and *P. aeruginosa*). Once the element has penetrated the bacterial cell, it builds

up as large-surface area silver nanoparticles and causes cell death. This encourages its usage as an efficient antibiotic that may be added to wound and burn dressings to combat the issue of wound infection and as a potent disinfectant for contaminated water. Silver is a common component of widely available healthcare products on the market. A variety of silver-containing dressings are now widely used in the field of wound care, and silver nitrate has been mixed with other components to treat burn wounds by effectively limiting the formation of fungi [16-18].

Material and Methods

Manufacture of ointment from nanomaterials

The nanoparticles were prepared by slicing green apples into small pieces and placing them in a blender with silver nitrate and lemon juice. 500 gm of fresh peeled apples are mixed with 0.5 gm of

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silver nitrate (AgNO_3) and 1000 ml of lemon juice, then placed in a blender and stirring 3.5 min as shown in figure (1). SEM and XRD studied the resulting silver nanoparticles. (20)% of silver nanoparticles are combined with (10)% of ointment zinc and (70)% of animal fat. White rabbits (30) of adult New Zealand, weighing 1.75-2 Kg, were used and weighing a special balance. They've been trapped in the same place for 10 days. The required anesthesia dose was determined by measuring the rabbit in a special balance for the animals. The animals were anaesthetized with a combination of ketamine (25 mg/kg) and xylazine (17.5 mg/kg) intramuscularly.

In three teams, each group consisting of 10 rabbits, the incineration was carried out under sterile conditions. The legs are shaved, washed and decontaminated by 70% with a combination of iodine and ethanol. After that, we cut a small part ($1\text{ cm} \times 1\text{ cm}$) of the skin rabbits for all the groups. Then had been burned the layer under the cutted skin by flame while the rabbits were under anesthesia. After that had been treated all the burned groups with the substance consisting of (Ag nanoparticles, animal fats and zinc juicer) as shown in figure (2).

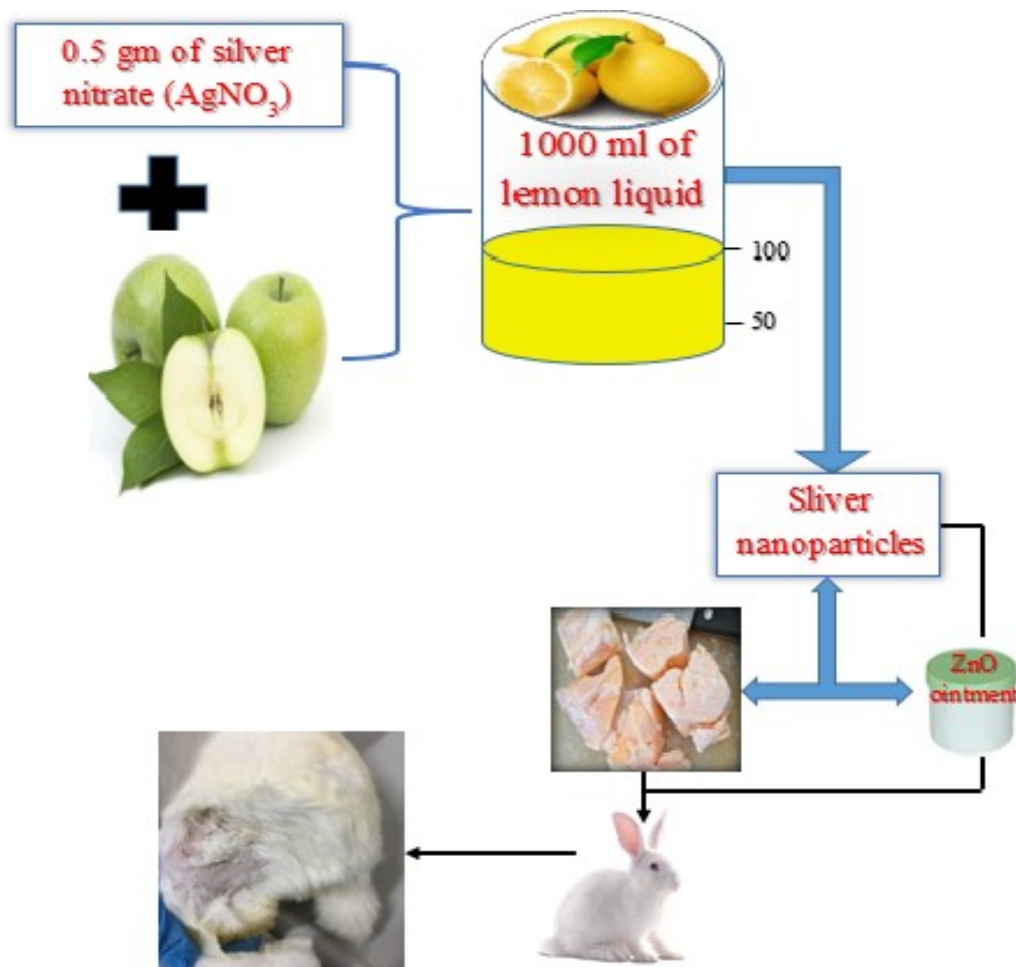


Fig. 1. Manufacture of ointment from nanomaterials.

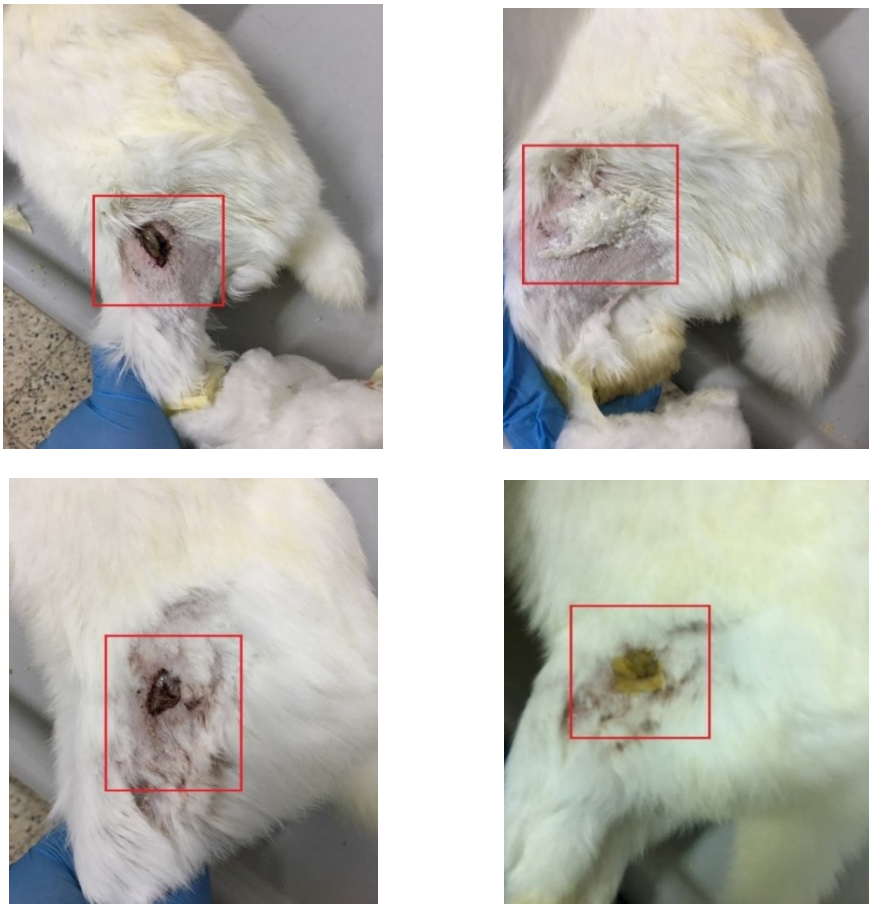


Fig. 2. Burn and treatment skin in rabbits

Results and Discussions

(XRD) is a significant procedure in which crystalline materials are investigated. It affords data on constructions, segments, favored alignments of crystals (texture) and other physical factors such as average crystallite size, structure defects. Figure (3)

shows the structure of nanoparticles and their miller indices (111), (200), (220) and (311) of the recorded material exactly in line with the standard international standard work and transactions based on the American mineralogist crystal structure database [2].

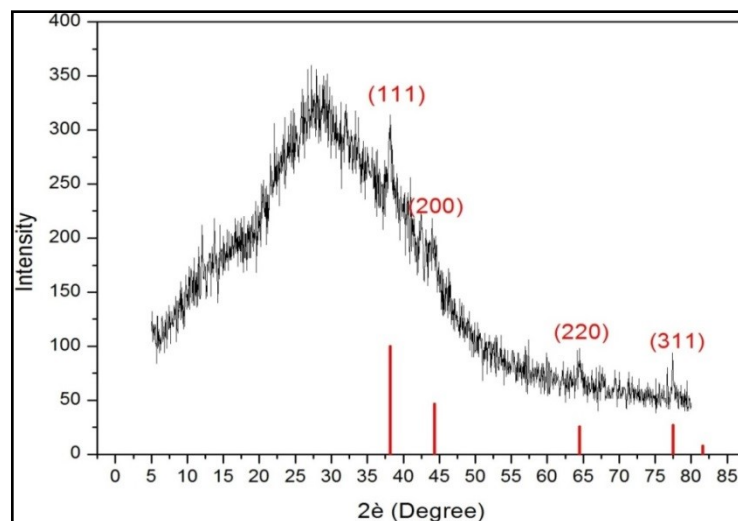


Fig. 3. XRD for AgNps synthesis at optimum condition.

The interaction of current of electron sourced from electron beam, it is possible to collect more information about the samples compositions, this can be achieved by (SEM) . This electron beam would interact with the surface of the sample layers with few millimetres penetration depth which enable to

have more information about the material composition and the grain size. Through the SEM technique, multiple images were taken and an average size of 5 ± 21 nm was calculated by the program iamgej as shown in figure (4).

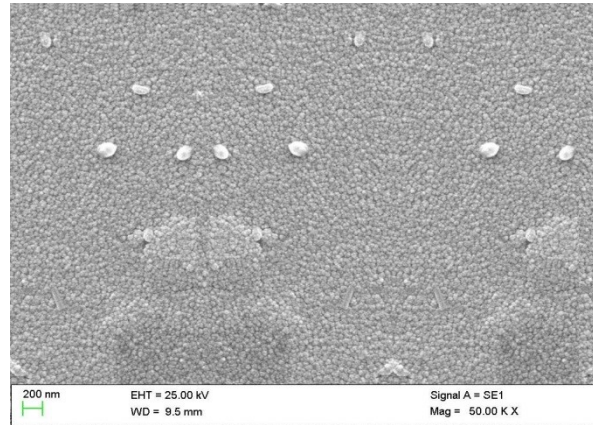


Fig. 4. SEM micrograph for AgNps.

As already stated, analyzing sample's data by EDXS by measuring the elemental composition or chemical characterization. It relies on some X-ray excitation origin and a sample interaction. The characterization capabilities are largely due to the

fundamental principle that each component has a unique atomic structure that allows the electromagnetic emission spectrum to have a unique set of peaks. Figure (5) illustrates the existence of the crystalline nature of silver nanoparticles [3].

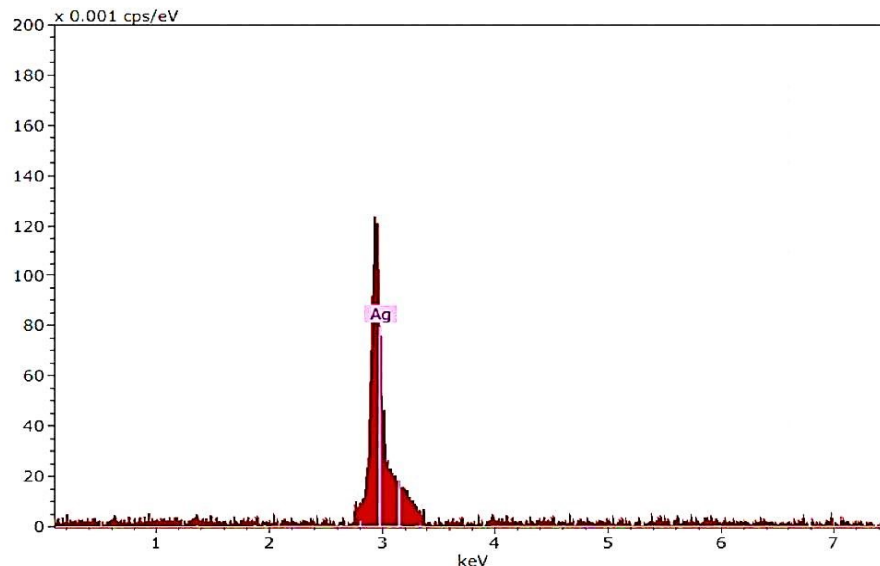


Fig. 5. EDX micrograph of AgNps.

Silver nitrate has anti-inflammatory effects (silver nitrate had anti-inflammatory effects and improved wound healing through the decreased activity of some inflammatory markers, such as TGF- β or the complement system [19,20]. The active biological conductivity of the AgNps nanoparticle was conducted with various types of bacteria

(Micrococcus, Bacillus crossover, Pseudomonas, Staph, E. coli) The inhibitory diameter was 30 mm, 36 mm, 28 mm, 24 mm and 25 mm respectively for each type of bacteria. This indicates that the inhibitory substance had an effective aggregation that led to inhibition of the bacteria as in the figures (6-10).



Fig. 6. Results of inhibition zones of Ag NPs against Micro coccuse



Fig. 7. Results of inhibition zones of Ag NPs against Bacillus cerus



Fig.8. Results of inhibition zones of Ag NPs against Pseudomonas



Fig.9. Results of inhibition zones of Ag NPs against staph



Fig.10. Results of inhibition zones of Ag NPs against *E. coli*

The difference in AgNps inhibition diameter on the different bacterial species is due to each bacterium's ability to resist the inhibitory material.

The lower the diameter of the inhibition, the more the bacteria can resist the inhibitory substance through the antibody that each bacteria possesses.

TABLE 1. Results of inhibition zones of Ag NPs against, Pseudomonas, E. coli, Micro coccus, Staph and Bacillus ceros

Inhibition Zones				
Pseudomonas	<i>E. coli</i>	<i>Micro coccus</i>	<i>Staph</i>	<i>Bacillus ceros</i>
24	25	36	28	30

Two types of ointments were fabricated to be used in the treatment of burned skin (third categories) for rabbits. After a period of treatment, both types of treatment were cured for a period of not

more than two months and there is no epidermal necrosis, losses neither granulation tissue formation, the skin and hair were returned to its original case as shown in the figures (11-14).



Fig.11. Third degree of burn skin in rabbits.



Fig.12. Shows a cure for burns of the fourth degree using an ointment made from (silver, animal fat and zinc Juicer).



Fig.13. Shows full healing and hair blemishes on the skin naturally for burning of the first grade using silver nanoparticles.



Fig.14. Shows full healing and hair blemishes on the skin naturally for burning of the first grade using silver, animal fat and zinc Juicer.

Conclusions

Preparation of silver nano materials from natural resources by chemical methods. The antibacterial test

has been made with significant results for different types of bacteria's. Fabrication of ointment for burned skin in Rabbits. Results showed significant healing for burned skin with short period.

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Conflict of interest

No conflict of interest.

Funding statement

Self-payment (No fund from any institution).

Author's contributions

Author 2 suggested and devised the project. Both 1 and 2 thought in the details the main conceptual ideas, dose and outline. Author 1 worked out almost all of the technical details, and follow up the treating stage till healing.

Ethical approve

https://med.uowasit.edu.iq/?page_id=5678

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استخدام المواد الحيوية لعلاج الجلد المصاب والمحترق في الأرانب

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في هذا العمل تم تحضير جزيئات الفضة النانوية باستخدام تقنيات كيميائية سهلة ومواد محلية رخيصة الثمن من مصادر صناعية (نترات الفضة) وطبيعية (التفاح الأخضر) للمقارنة من حيث السمية. باستخدام جهاز حيود الأشعة السينية (XRD) والمجهر الإلكتروني (SEM) والتحليل الكيميائي لعناصر العينة (EDXS)، تم استكشاف خصائص جسيمات الفضة النانوية من حيث الخصائص الهيكلية. تم اختبار روابط العينة باستخدام FTIR للحصول على أعلى الظروف لاستخدام الفضة في علاج حرق جلد الأرانب. أظهرت نتائج حيود الأشعة السينية نقاء المادة المحضرة كيميائياً (جسيمات الفضة النانوية) اعتماداً على بطاقة ASTM الأمريكية وبمعاملات ميلر المحددة بـ (111، 200، 220، 311). تم قياس قطر جسيمات الفضة النانوية ووجد ما بين (5-21 نانومتر)، وأظهرت نتيجة الماسح الإلكتروني تجانس سطح العينة وجسيمات الفضة النانوية "شكل كروي". كما تمت دراسة الخصائص البيولوجية لجسيمات الفضة النانوية. بالنسبة للبكتيريا التالية (Micrococcus، Bacillus، Pseudomonas، Staphylococcus aureus و E. coli aeruginosa)، تم تحديد الفضة كعامل مضاد للجراثيم. أظهرت الفضة نشاطاً قوياً مضاداً للميكروبات وقطر تثبيط كل بكتيريا (30، 36، 28، 24 و 25 ملم)، على التوالي. تم تقييم سمية الجسيمات النانوية الفضية لتحديد أفضل جرعة لاستخدام الجسيمات كعلاج لحروق جلد الأرانب. تم إعداد أرقامها ما يقرب من عام واحد، ذكور، أوزانهم 1.5-2 كجم من الأرانب المنزلية لمدة أسبوع قبل التجربة في بيئة متابعة آمنة. وفي النهاية تضمنت الدراسة تحليل نسجي كامل لمراحل العلاج لكل طريقة تستخدم لعلاج حروق جلد الأرانب (جزيئات الفضة النانوية، عصارة الفضة-الدهون الحيوانية-الزنك) في أوقات العلاج المختلفة لتحديد أفضل نموذج يستخدم في العناية بالحروق.

الكلمات المفتاحية: مرهم، الحروق، جزيئات الفضة النانوية، عصارة الفضة، الدهون الحيوانية، الزنك.