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Synthesis of Nano-Pomegranate Peel via Sol-Gel Method and Screen Characterization

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Abstract

Nano peel solution was prepared using Sol-gel technology at a temperature of (80) Celsius. A number of tests were performed to describe the properties and structure of Nano material, including scanning probe microscopy (SPM), which showed the symmetric cumulative distribution of the solution Nanoparticles and the average grain size equal to 64.5 nm and the identical distribution of the Nanoparticles with a diameter of 37.75 nanometers, with a measurement area ranging between (1531.23-1558.19) nanometers. Nano-solution analyzed with a scanning electron microscope (SEM), Inspect type (S50), with a magnification power up to X2000, where dense flakes of nano particles with a diameter of (50 ± 10) nanometers were observed. The antibacterial activity of nano-solution by using gram- positive bacteria St. aurous and gram-negative E. coli show the inhibition diameter of (St. aurous) was 27 mm and 25 mm in (E. coli).

1. Introduction

Study of Nanomaterial is recently widespread due to their large space of Sol–gel used [1]. Nanoparticles made in Sol-gel application considered safe theoretically and when conjugated with herbal extract may potentially activate the activity of herb besides producing nano herbal extract nontoxic and valuable in the natural system [2]. Nano herbal extract is distinguished from others by its their small size, high surface-to-volume ratio, electronic properties, functional groups and aggregation behavior, high efficiency, and ability to penetrate the tissues of different organs as a good source of drug for the treatment of many diseases [3, 4]. Pomegranate peel considers as a rich source of polyphenols with potent antioxidant properties [5] and antibacterial properties. Peels are widely used to treat infections found in human sexual organs, in addition, to treat mastitis, acne, folliculitis, pile, allergic dermatitis, scalds, diarrhea, and dysentery [6, 7]. So the presences study concerns with the preparation of Nanomaterial by Sol-gel methods and characterization.

2. Experimental Procedure

Preparation of Nano-Pomegranate Peel Solution

100 g of pomegranate peel collected washed with tap water then exposed the peels to sunlight for two days after derided grinding by a coffee grinder to a fine powder. 1 gram of crusts powder is taken and dissolved with 100 ml quantity of (ethanol alcohol, water, and acetic acid) placed in a glass beaker of 1 liter capacity and stirred using Ultrasonic Probe sonicator type (USA) and add to the Beaker 10 ml of concentrated acetic acid with the addition of 100 ml of distilled water and by continuous stirring at a temperature of 80 ° C for 4 hours for 10 days.

Characterization of Nano Pomegranate Peel Solution

Scanning Probe Microscope (SPM) and Scanning Electron Microscope (SEM)

Scanning Probe Microscopy technique used to measure mechanical, magnetic, electrical, and electrochemical surface topography on a nanometer scale. It can measure features from as small as interatomic spaces to a tenth of a millimeter. The ability to measure surfaces in three dimensions provides more precise topographical data of air and liquids beside the analysis the size of particles in nano-solution [8].

Antibacterial Activity of Nano Solution

The diffusion method was used to evaluate antimicrobial activity by using of Mueller-Hilton agar medium inoculated with bacterial suspension then incubated at 35 ℃ for 24 h., finally inhibition zones were measured considered as antibacterial activity [9].

3. Results and Discussion

Figure (1) shows the homogenous distribution of nanoparticles in peel solution and Table (1) shows the average diameter of nanoparticles is 64.5 nm.

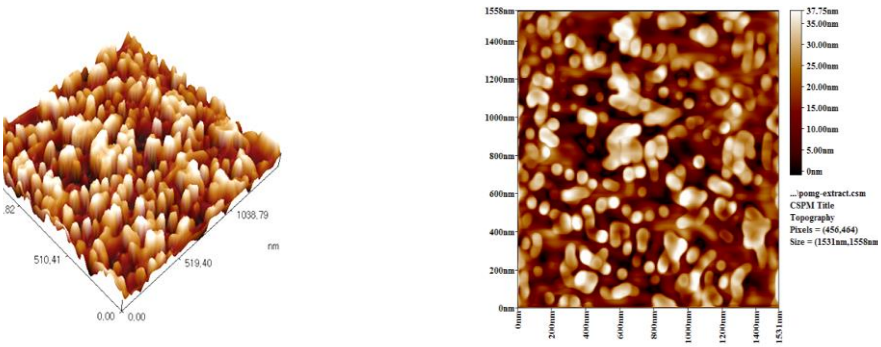

Figure (1). Homogenous distribution of particle by SPM.

Table (1). Diameter of Nano pomegranate peel solution by SPM.

10% of Nano-particles at 40 nm
50% of Nano-particles at 60 nm
90% of Nano-particles at 85 nm
Avg. Diameter of Nanoparticles 64.5 nm

The Nanoparticles of peel solution were observed as fine sheets with diameter rate (**64.5**) nm scanning by electron microscope (SEM) as seen in Figure (2).

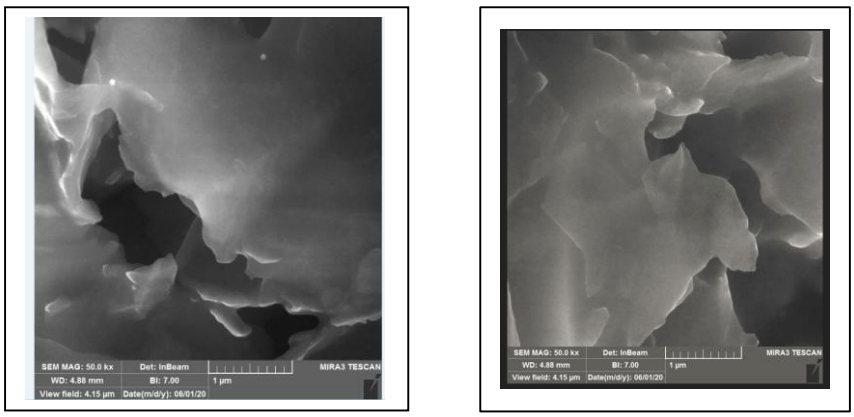

Figure (2). Nano peel analyzed by SEM show fine sheets.

EDS pattern of Nanoparticles was shown in Figure (3) which observe two peaks of carbon and oxygen which acted as a capping agent to nanoparticles and in Table (2) shows the element present in solution.

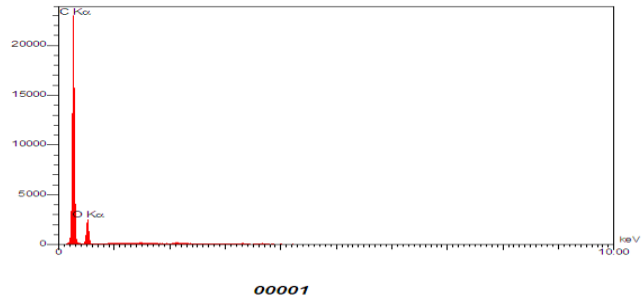

Figure (3). EDX pattern of pomegranate peel Nanoparticles by FE-SEM.

Table (2). Pomegranate peel Nanoparticles elements components.

Elt	Line	Error	K	Kr	W%	A%	ZAF	Ox %	Pk/Bg	Class	LConf	HConf
C	Ka	148.3643	0.8830	0.4861	67.21	73.19	0.7231	0.00	6030.22	A	66.66	67.76
O	Ka	40.8585	0.1170 1.0000	0.0644 0.5505	32.79 100.00	26.81 100.00	0.1965	0.00 0.00	760.55	A	32.05	33.53

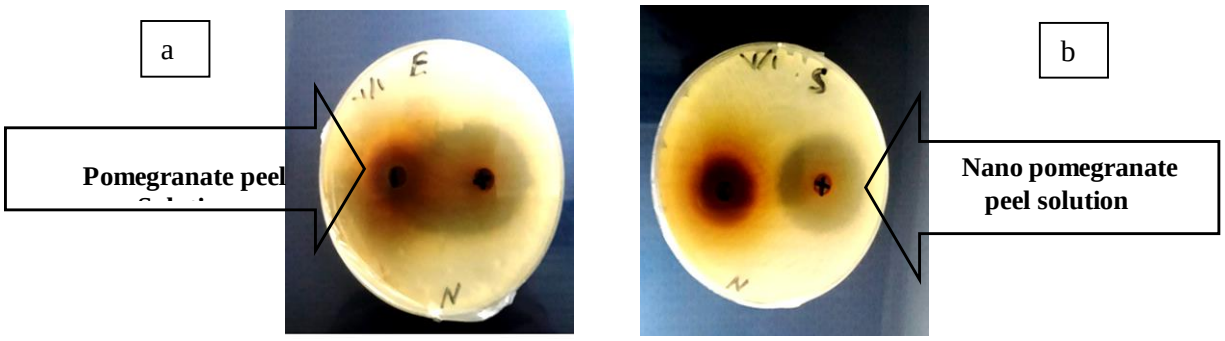

Figure (4). Antibacterial activity of pomegranate peels solution in gram-positive and negative bacteria.

The antibacterial effect of Nano pomegranate peel solution shows good antimicrobial activity against ***Escherichia coli*** and ***Staphylococcus aureus*** according to the solution. The inhibition diameter of Nano peel solution in *St. aurous* was 25 mm and in *E.coli* was 27 mm while crude solution shows (20 , 15)mm **.**

4. Conclusion

In the study, Nano pomegranate peels solution prepared by Sol-gel method which is considered one of the simplest methods of preparation by using temperature 80℃. The Nano solution analyzed by AFM shows (64.5) nm diameter range and EDX image show two peaks, the high peak representing carbon at 67.2% at w% and low peak representing oxygen at 32.7% at w%. The antibacterial activity of Nano solution shows diameter between (25-27) mm in *St. aurous* and *E.coli* compared to crude solution due to elements presence made it more efficient and can be used in different fields of pharmaceutical industry in the future.

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