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Antibacterial Activity by Lithiumnanoparticles has been Synthesis with *Muse* Spp. Peels

SadiyhaYasir Offi Al-jubory*[1],Ghasoun Mohammedaliwadai[2], Wafaaabdalwahed jheel[3]

[1,2,3]College of Biotechnology, University of Al-Qadisiyah, Diwaniyah, Iraq.

*Corresponding Author: SadiyahYasirOffiAljubory

E-mail: Sadiyh.algubory@qu.edu.iq

ORCID: https://orcid.org/0000-0003-3374-9993

ABSTRACT

In latest years, green synthesis of nanoparticles became greater than before interesting as a consistent, workable and environmentally friendly method for synthesizing a large range of materialslithium oxide nanoparticles (LiO-NPs) have been synthesized by using banana (*Muse*spp) peels aqueous extract and characterized by UV,XRD, SEM, FTIR.Results of XRD show a good degree of crystallinityof created LiNPs.The average crystallite size of LiNPs was 18.148 nm. SEM images reveal spherical particles aggregated as elongated - leafy shape.Li-NPs exhibited antibacterial activity in form of zone inhibition, this zone increased withincreasing aconcentration of LiO-NPs.

Keywords: Antibacterial; Lithium nanoparticles; *Muse* spp. Peels

1-INTRODUCTION

Nanotechnology involves the creation, management and use of materials in size less than a micron. (Goddard et al.;2007;Vert .,et al 2012).There is a growing commercial request for nanoparticles because of their varied applicability in many areas as agriculture, food safety,medicine, chemistry,cosmetics ,energy, biology,physicsand, environmental science (Mobasser and Firoozi ,2016).
Nanoparticles have been synthesized in many types of shapes, such as Nanobelts (Zhao et al .; 2020),nanospheres (AgamandGuo, 2007),,Nanocrystals (Zhang et al .; 2019), nanorods, nanochains, (Krali and ; Makovec , 2015) ,nanostars, nanoflowers, nanoreefs, (Choy et al .; 2004) ,nanowhiskers (Björk et al .; 2002), nanofibers, and nanoboxes (Sun ,2002*)* nanolubricantpowders (Bastide et al .; 2011;Wang et al .; 2020), and nanopowders, nanofillers (Bhattacharya ,2016).

Nanoparticles are creating by physicals ,chemical ,and biological techniques. Traditionalprocedures (physical and chemical methods) may be synthesized big quantity of nanoparticles, but they need poisonous chemicals as protecting agents to preserve stability, which causes toxicity in the environment (Goddard et al.;2007; Salam. et al .;2014).The biological ways include the use of fungi, yeast, bacteria, algae, and plants.Using microorganisms is dangerous because of their pathogenicity. So, green synthesis of nanoparticles is preferred methods (Pal et al .; 2019).

Many nanoparticles were synthesized with biological materialthatsafety, unharmful, eco-friendly such as plant.Banana peel, which is one of the most rich and available bio-wastes.Banana peels have been used in the preparation of various nanoparticles such as gold nanoparticles (Bankar et al.;2010a ;Vijayakumar et al.;2017), silver nanoparticles (Bankar et al,;2010b). Lithium (Lotfabadet al .;2014)

Lithium is found in trace quantitiesin plants,soils and in approximately all the organs of the human body .(Ammari*et al*.;2011). Lithium, which is broadly used in the administration of patients with endocrine and renal disorder.(Gitlin ,2016).LiCl appeared replacement therapeutic agent for *K. pneumoniae* cause liver infections (Tsao et al.;2015).Li2CO3 nanoparticles exhibited smart properties for bone repair applications (Covarrubias et al.;2018).Li-doped MgOnanoplates were showed bactericidal activity on *Escherichia coli* (Rao et al .; 2014) . Lithium nanoparticles were created by chemical methods (Jang et al .; 2004),by physical ways by induction thermal plasma (Ibrahim, 2015), By green synthesis by using the extract of *Opuntiaficus-indica* (Álvarez et al .;2015).In this study, we will prepare lithium nanoparticles by extracting banana peels.

2. MATERIALS AND METHODS

Preparation of the banana peels extract (BPE) and lithium oxide nanoparticles (LiO-NPs)

Banana(*Muse* spp.) peels extract (BPE) and lithium oxide nanoparticles (LiO-NPs)were prepared according to Al-Jubory (2020).Banana peels using as capping and reducing agents. 25 gm from dry banana peels powder were added to 100 ml of deionized water heated at 60ºC for 10mins,filtered and use immediately. Lithium oxide nanoparticles were prepared by adding (0.04 g) of LiO to 200 ml of deionized water (DW), then heated at 60 ° C for ten minutes and adding a few drops of BPE until it turned to brown color and dried at 60 ° C and kept it.

Nanoparticle characterization

The nanoparticles were analyzed using :Powder X-ray diffraction was carried out by a X-ray diffractometer (Bestic Germany Aluminium) by using CuKα radiation(λ = 1.54 Å) at 40 kV and 40 mA, Fourier transform infrared spectroscopic measurements (FTIR) were done using Shimadzu FTIR–8400S .The particle size and morphology of the nanoparticles were analyzed by scanning electron microscopy (SEM) with a SEM HV:30.00KV VEGA\\TESCAN/Czechy.

Antibacterial activity

The antibacterial activity of the LiO-NPs (25-100)% concentration) was determined by the standard well diffusion method against Gram-negativebacteria (*Klebsiellapneumoniae*) andagainst Gram-positive (*Streptococcus pneumoniae*).The bacteria at three days age with at a concentration of 1X 10^8 CFU / ml were planted onto the Muller Hinton agar plate . 0.1 ml from each concentration of LiO-NPs were added into the wells of 6 mm in diameterseparately, the plates hadbeen incubated at 37 C° for 48 hours and measured the inhibition zones. (Abdel Raouf*et al*.,2017).

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RESULTS AND DISCUSSION

Ultraviolet-visible spectroscopy (UV-Vis) analysis

In the current study, the absorption spectrum of LiO-NPs created by green method using banana peels aqueous extract (Fig.1) shown the conversion of lithium ion to lithium nanoparticles. The whole reaction mixture is changed to brawn color, and revealed an absorbance peak about290.5 nm feature of LiO-NPs, due to its surface Plasmon resonance absorption band (Álvarez et al.;2015).

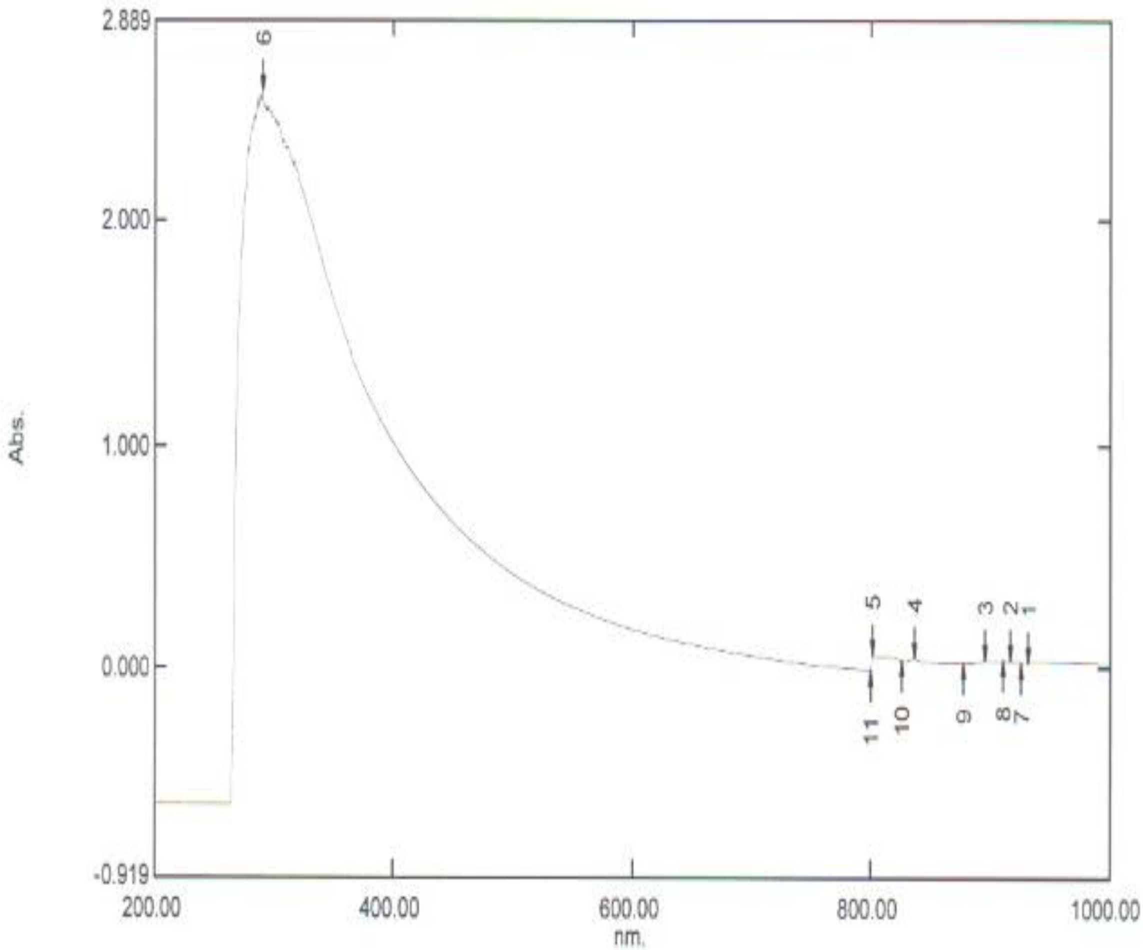

Figure 1: Ultraviolet–visible spectrum of theLiO-NPs prepared with banana peels extract

X-ray diffraction (XRD)

The X-ray diffraction (XRD)shape of the LiO-NPsis illustrated in Fig. 2. It is observed that, sharp crystalline peaks are observed at 2Ɵ :28.4570,43.8214.52.1423,53.0269, 59.8144, 63.6631, 66.5356,72.0807 and 74.58,These peaks are very close to what was mentioned in previous references in the preparation of lithium nanoparticles (Perumal et al.;2020). Strong diffraction peaks approve that the createdLiO-NPs samples reveal a well degree of crystallinity. The middling crystallite size of LiO-NPsare calculatedby using Debye-Scherrer equation :$D = 0.94\ \lambda / \beta \cos\theta$: where λ is the X-ray wavelength, θ is the Bragg angle, and β is the full width at half maximum (FWHM)) of the diffraction peak (Klug and Alexander, 1959) was18.148nm.The peaks appeared spherical shape of LiO-NPs which was further confirmed by SEM.

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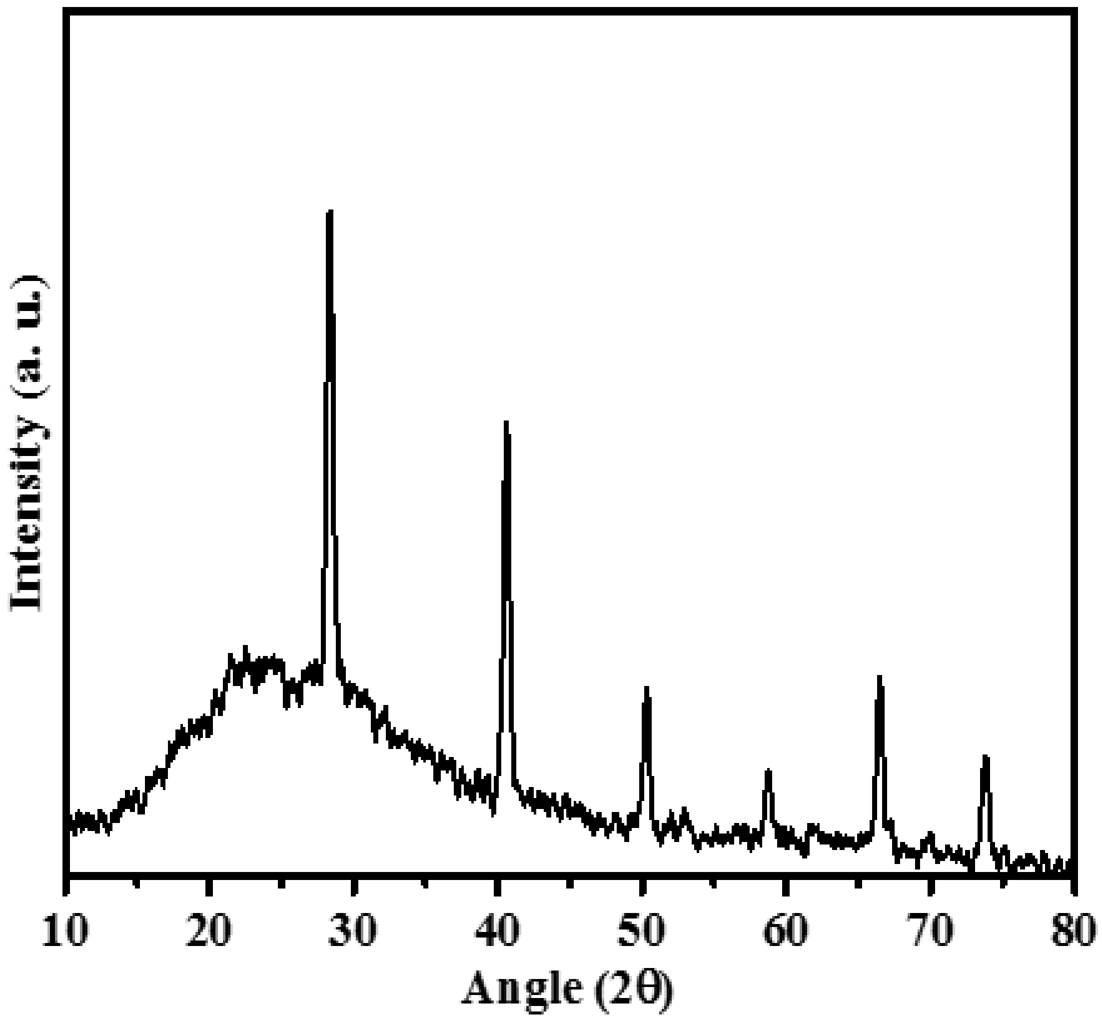

Figure 2: XRD pattern of LiO-NPs prepared with banana peelsextract

Scanning electron microscopic (SEM)

Fig. 3explain the SEM images of LiO-NPs. As can be seen, the LiO-NPs revealspherical particles with size ranging from 81.24 to 125.52 nm.The particles size was determined by analyzing the recorded SEM image. The assessed average size of those particles was 97.22 nm. which shows well developed surfaces, being similar to those in the articles (Aravindan et al .; 2010; Yuan et al.;2006 .; Wolf, et al .;2016),Lee et al .;2013).In addition, the particles become accumulated due to their inherent magnetism (Ni et al.;2009) and the heat treatment at higher temperatures can encourage the aggregation of nanoparticles (Shen et al.;2012). We can be see that the particles that are of well-developed surfaces consist of a lot of small sized particles as elongated - leafy shape of LiO-NPs ,this corresponds to what was mentioned in the previous literature, the particles shape change by increasing the incubation period into rectangular which was further confirmed by SEM images (Alemi, et al.;2013).

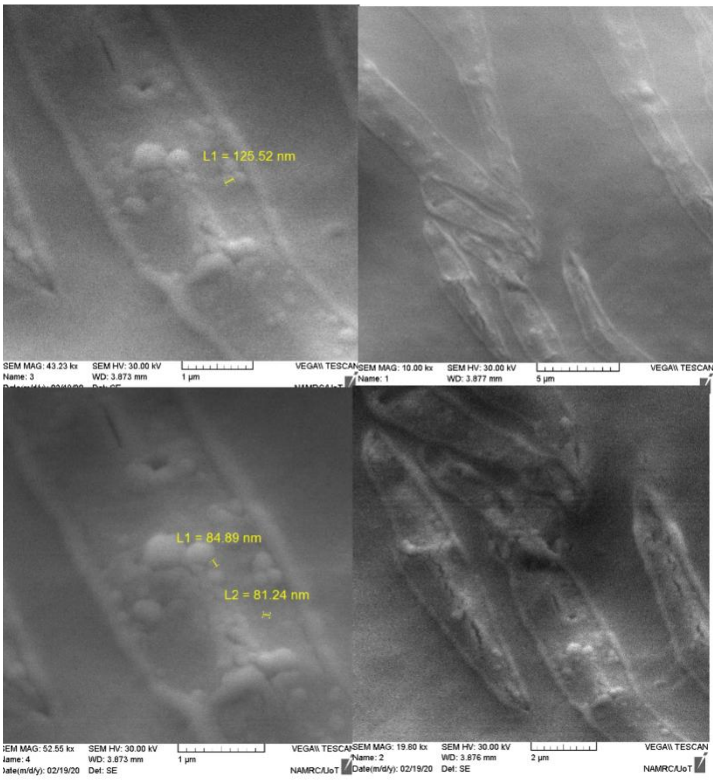

Figure3: SEM pattern of synthesized LiO-NPs prepared with banana peels extract

Fourier transform infrared spectroscopic (FTIR)

In Figure 4 wasexhibit infrared diffuse reflectance spectrum of the LiO-NPs powders, between 4000 and 500 cm−1 .We show eight spectral peaks corresponding toO-H (3394.48 cm−1,2923.88 cm−1,1419.51 cm−1) ,C-H(2854.45 cm−1),C-O(1319.22 cm−1,1272.93 cm−1),C=O (1606.66 cm−1),C-O (1056.92 cm−1) (Delpuech et al.;2014).The characteristic vibrational bands are in conform with the past study,that mention stretching vibrations of LiOH around 3600 cm1 and for H2O in LiOH at 1573 cm1 (Covarrubias et al.;2018)Hydroxyl groups due to water molecules .Other functional groups belong to peels extract as some of the active groups of the extract can be left on the surface of the nanoparticles(Khan et al .;2020). Also each lithium ion coordinated with four oxygen atoms, two from hydroxyls and two from waters (Parker et al .;2011).

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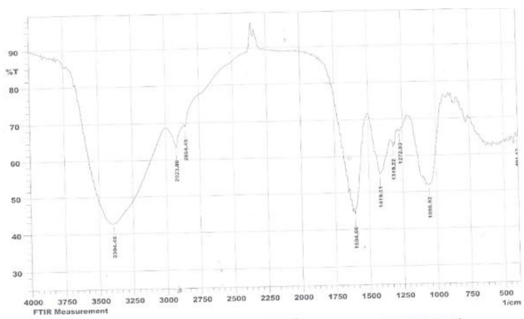

Figure 4 : FT-IR spectra of lithium nanoparticles from banana peelsextract

Antibacterial activity of synthesized Lithium oxide nanoparticles (LiO-NPs).

The green synthesizedLiO-NPs exhibited good antibacterial activity against Gram negative (*K.pneumoniae*) and Gram positive (*S. pneumoniae*) bacteriaof the tested bacteria strains (Table 1) this is in agreement with a previous report (Padmanabhan et al.;2019). The influence of LiO-NPs of the antibacterial was evaluated by the standard well diffusion methodand measure inhibition zones of bacteria.*Klebsiellapneumoniae*was more sensitive than *Streptococcus pneumoniae*with 18.4 and 16.2 mm, respectively.Nasret al.(2020) and Kahan et al (2020)have been mentioned the similar results for the antibacterial activity that Gram negative was more sensitive than Gram positive for nanoparticles .The mechanism of impact of LiO-NPs against bacteria may be by damage the cell membrane of bacteria through direct contact of the bacteria with the LiO-NPs (Li et al.;2015), it can bind with the proteins and deactivate them, or it interacted with the bacterial nucleic acids, thereforestopped microbial replication.The results suggest that a good antibacterial ability of LiO-NPs which synthesis with banana extracts (Khalid et al .;2014;Rao et al .;2014; Qasim M T and Al-Mayali H K (2019).

Table 1.Effect of deferent concentrations of Lithium nanoparticles (LiO-NPs) against *Streptococcus pneumoniae* and *Klebsiellapneumoniae*. (Inhibition zone diameter (mm)

Bacteria	Agents					
	Concentration of LiO-NPs %				E	G
	0.0	25	50	100		
Streptococcus pneumoniae	0.0	6.3	8.5	16.2	0.0	23.5
Klebsiellapneumoniae	0.0	9	11	18.4	0.0	22.5

E: Banana peel extract ,G: Gentamycin

CONCLUSION

In conclusion, excellenceLiO-NPs were createdby a green synthesis technique.LiO-NPs samples reveal a well degree of crystallinity. The average crystallite size of LiNPs are calculated as 18.148 nm .LiNPs which synthesis with banana extracts had a good antibacterial ability against Gram negative and positive bacteria.

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