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THE EFFECT OF IRON NANOPARTICLE PREPARED FROM *PUNICA GRANATUM* PEEL ON MICRORGANISMS

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ABSTRACT
In the present study the Iron nanoparticles synthesizes rapidly by using the *Punica granatum* medicinal plants. The formation of iron nanoparticle was confirmed by observing the color changes from yellow to brown color and using spectrophotometer to detect the peak which observed in the UV- at 360 nm, Iron nanoparticle was characterized by FTIR analysis. The synthesized nanoparticles are evaluated for its antimicrobial activity against human bacterial pathogens as well as fungal phyto pathogens; the microbial property of iron nanoparticles was analyzed by measuring the inhibition zone. The SNPs synthesized toxic towards *Pseudomonas, Escherichia coli* and *Candida* species respectively, the results indicate that the iron nanoparticles may have a good activity against pathogenic microbes.

KEY WORDS: Nanoparticles, Iron nanoparticle, SEM, FTIR.

INTRODUCTION

Pomegranate (*Punica granatum*) is a wide fruit that cultivated throughout the Mediterranean regions. Numerous studies were reported on the antioxidant properties of pomegranate constituents [1]. It was reported that pomegranate contains some species of flavonoids and anthocyanin's, and shows its potent antioxidant activity[2]. In particularly, the most essential constituents of pomegranate peel are phenolic compounds; gallic acid and other fatty acids; flavones and anthocyanin's[3]. Recently, biosynthesis of nanoparticles using plant extract has emerged an easy and viable alternative to traditional chemical and physical methods. Synthesis of nanoparticles using plants can provide more biocompatible nanoparticles than chemical synthesis. Whereas presence of a toxic chemical may lead to the species on the surface of the synthesis nanoparticles that may have undesirable effects in medical applications [4]. This is the first time preparing ferric nanoparticles from *Punica granatum* peel.

MATERIALS & METHODS

Preparation of Extract

For twenty five grams of dried pomegranate peel powder was add 400 ml of deionized water, then heating the flask on an magnetic shaker at 100 °C till boiling. After the extraction, the water solution was filtrated through Whatman filter paper number one. The reddish brown extract was kept in the refrigerator until use.

Synthesis of Nanoparticles

The synthesis reactions were carried (in volume of 10 ml) in sterile tubes containing deionized water. Different volumes from the previously prepared *pomegranate* peel extract (500µL) were added to the reaction tubes. The extract was heated at 80ºC. The color being change after heating at 80C° within 10-15 minutes. Indicate the formation of Iron nanoparticles by measuring the UV-Vis spectrum (Weave length between (300-560 nm) by using UV-Vis Spectrophotometer, The morphology and size of nanoparticle had done by using atomic force microscopy (AFM) analysis by using the instrument SHIMADZU.

Antibacterial activity

The antibacterial activities of SNPs were carried out against Culture of, *Escherichia coli, Pseudomonas aeruginosa, Klebsiella pneumoneae Bacillus subtitles,* and species of fungi *Aspergillus niger, Aspergillus flavus* and *Candida spp.* by disc diffusion method[7]. After solidification nutrient agar plate's bacterial cultures were swabbed on these plates. The sterile discs were immersed in iron nanoparticles solution (5 mg/ml) and placed in the cultured nutrient agar plate and incubation at measured. The experiments were repeated thrice and mean values of zone [8]. The inhibition zone of fungi had done on *Potato* dextrose agar plates prepared and after solidification were swabbed fungal cultures on these plates with 45 cell/ ml. The sterile discs were immersed in iron nanoparticles solution (5mg/ml) and incubate for 7 days.

RESULTS & DISCUSSION

The colored of *pomegranate* extract change by adding ferric sulphate from pale brown to dark reddish brown, because the reduction of Iron ions, due to formation Iron hydrosol (9) Fig(1).

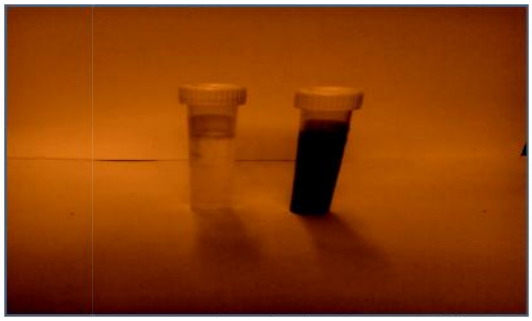

FIGURE 1: Biosynthesis of nanoparticle

The UV-Vis spectrum of colloidal solutions of SNPs synthesized from *Punica granatum* have a peak at 389nm observed by UV-spectrophotometer (Fig 2). The reduction of pure Fe^{2} ions were monitored by measuring the UV-Vis spectrum of the reduction media at 2 hours after diluting a small amount of the sample in deionized water by using UV-Vis Spectrophotometer.

FTIR Fig (3) showed the FTIR spectra of the iron nanoparticles prepare using *Punica granatum* extract. The peaks at The FTIR spectrum of iron oxide nanoparticles shows bands at 3950–3263 cm^{-1} corresponding to O–H stretching and bending bands, 2946, 2834, 1654 cm^{-1} corresponding $–CH_2–$, and –C= O groups can be seen in the FTIR spectra of *Punica granatum* extracts, indicating the presence of carbonyl groups., which may be assigned to –OH, hydroxyl groups present in *Punica granatum* extracts. The strong band of iron oxide nanoparticles shifted at low frequency is due to the involvement of –OH, –C=O in binding and confirming the involvement of hydroxyl and carbonyl groups of *Punica granatum* for the synthesis of nanoparticles. The adsorption frequencies at low wave number (<680 cm^{-1}) come from Fe–O bonds vibrations of nanoparticle. The presence of organic groups on the nanoparticles surface increase the hydrophobicity and preventing aggregation nanoparticles.

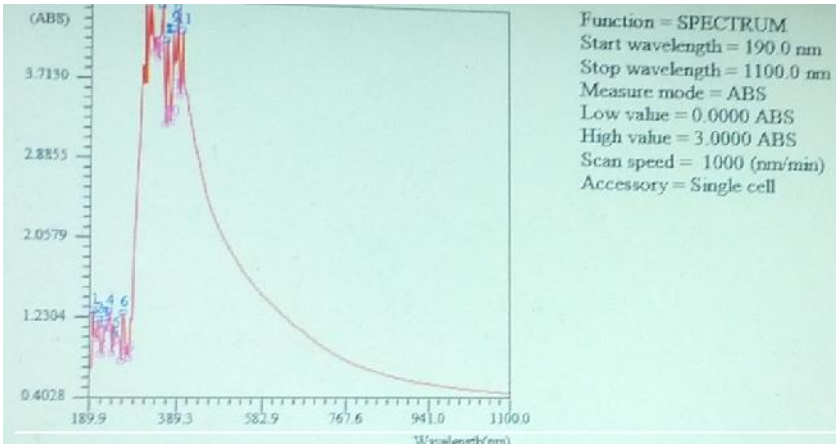

FIGURE 2: UV a bsorbance for nanoparticle

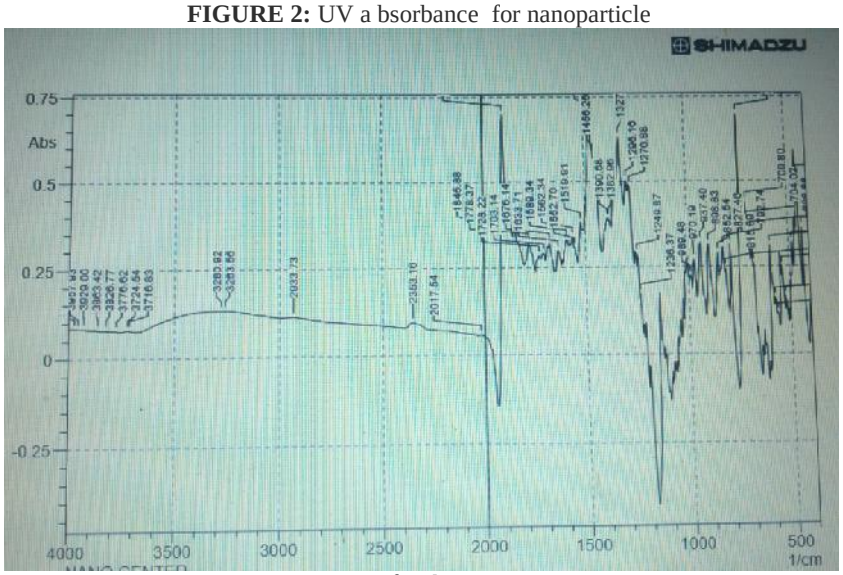

FIGURE 3: A FT-IR spectrum for the *Punica granatum* Fe3O4-NPs

Fig. 4. shows the Iron nanoparticles effect against three types of bacteria and fungi such as *Escherichia coli, Pseudomonas aeruginosa* and *Klebsiella pneumoneae, Candida spp* As it showed a clear inhibition zone, the synthesized nanoparticles were highly effective in their activity against *Pseudomonas aeruginosa> Escherichia coli, > Klebsiella pneumoneae and Candida spp*. The inhibition zone as shown in Fig (4) 22, 17, 15 and for *Candida* (28). The Iron nanoparticles synthesized via green route are highly toxic towards candida also when compared to bacterial species. Thiol group of vital enzymes strongly interacts with ionic iron and inactivate the enzyme activity (12). Our findings of suggested that the inhibition of oxidation based biological process by penetration of metallic Nano sized particles across the microsomal membrane.

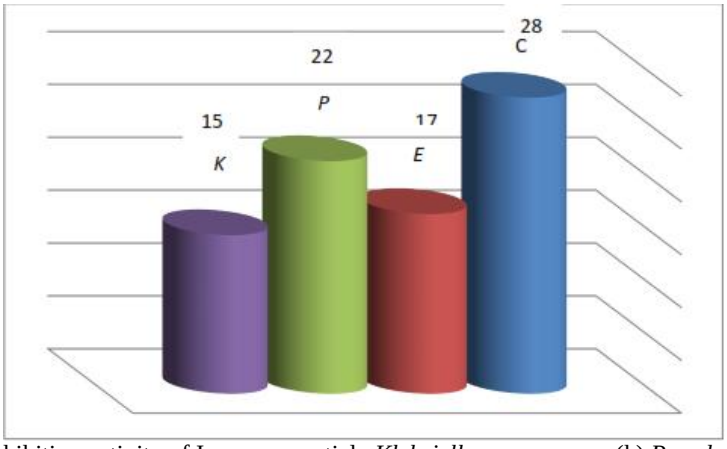

FIGURE 4: showed inhibition activity of Iron nanoparticle *Klebsiella pneumoneae* (k) *Pseudomonas aeruginosa(P), Escherichia coli(E)Candida spp©.*

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