ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

Synthesis of herb silver nanoparticle and study the effect against some bacterial infection

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Abstract

Antibacterial activity of synthesized silver nanoparticles was done by agar well diffusion method against three pathogenic bacteria ,*Proteus vulgaris* , E.*coli* . *Staphylococcus aureus* . The green synthesized silver nanoparticles can be used in the field of medicine, due to their high antibacterial activity. In this present investigation we report the green synthesis of siver nanoparticle (AgpNs) by using the leaf extract of three herb ex,*Rosemary officinalis* , *Punica granatum, Artemisia vulgaris*

Keywords:Nanoparticle , green herb, pathogenic bacteria , antibacteroial

Introduction

Nanotechnology provides aessential oil have been kown good plant form to modify and develop the important properties of metal in the form of nanoparticles having promsing application in diagnostic , biomarkers, cell labelling(1, 2), contrast agents for biological imaging, antimicrobial agent, drug delivery systems and nanodrug for treatment of various disease(1, 2). Nanotechnology eco-frendly ways (3). Nanoparticle deal with the synthesis of nanoparticles withcontrolled size ,shape nanoparticle one and 1oo and diversity and increase specific surface of materials of the nanometer scale lengh (3, 4). The silver nanoparticle are vigorously involved in the antimicrobial activity against a lot of disease causing food born and water borne pathogenic bacteria and fungus(5). Artemisia is also shrub plant that growth in several countries. The arial parts of this plant activity the silver. Rosemary its herb and oil are coare rich source manly used as spice and flavoring in food processing its desirable for against both in food processing for its desirable flavor, high antioxidant activity and latelgas antimicrobial agents (6,7,8,9) reported that rosemary plantacti are rich source compound with high antimicrobial; activity so against both Gram positive and negative bacteria. High percent of the antimicrobial activity that attributed to carnosic acid and carnasol. Each plant essential oil have been known of centuries, but their strong flower limited their use in food(10).The antibacterial properties of nanoparticle having size between one and 100 nanoparticle are scribed to their small size and increase specific surface area.(11,12). Ecofriendly synthesis of palladium nanoparticle(7dNPS) were achieved using Phyllanthus emblica(p.emblica) seeds as reducing agent . The aim of the present study was to investigate the medically imporrtant plant is used in the synthesis of medically silver nanoparticle and study the effect of herbs ,nanoparticle against S.*aureus*, E.coli, *Proteus*.*vulgaris*.

Materials And Methods

Collection of plant materials

Arial parts of *R.officinalis* and *A.vulgare* were collected from medicinal plants garden of pharmacognosy and medicinal plants department of college of pharmacy of Al Mustansiriya university, while the fruits cover and peel of P. granatum plant was obtained from locally market of Baghdad. The plant samples were identified authentically by national herbilisim of Iraq .

Preparation of Extracts

All plant sample extracts were washed, dried under room temperature and converted to powder using mechanical grinder, 150 g of each plant powder wasindividually packed in thimple of soxhlet apparatus and extracted with 1000 ml of aqueous ethanol(thanol water80-20 v/v) for 12 each extract was filtered and concentrated under vacuum using arotary evaporator to get dry residue.

Synthesis of Silver Nanoparticle

10 ml of extract of the each herb was treated with 90 ml of 1mM silver nitrate solution and kept in room temperature. Subsequently the synthesis of silver nanoparticle was initially identified by brown colour formation and further monitored by measuring UV-vis spectra of the reaction mixture.

Antibacterial Activity of Synthesized slver Nanoparticles

The antibacterial activity of synthesized silver nanoparticle was performed by agar well diffusion method against pathogenic bacteria . S.*aureus* , E,*coli*,P.*vulgaris* freash over night culture of each strain was swabbed uniformly onto the individual plate containing sterile agar and 5 wells were made with the diameter of 6mm. Then 25 microliter of purified silver nanoparticle , extract of three herbs , and silver nitrate solution were poured into each well and antibiotic disc Gentamicin placed as control and incubate for 24 hour at 37 c . After incubation the different levels of zonation formed around the well and its was measured. This experiment was repeated for three times. (13).

Determination of MIC(minimal inhibitory extract)

The Mic value of Ag-NPs and extract were determined by broth microdilution assay. The Ag-NPs were serially diluted two fold with deonised water concentration ranging for 50-7.8 mg/ml . The extract were serially diluted to fold with 10 % (DMS) containing 1-1.56 mg ml after shaking 100 ml of dilute AGNps . 0.1 , and extract was added to each well of 96 well microliter plates. Microbial suspention were adjusted to 00.5 MacFarland and diluted to 1x10 oss 6 CFU/ ml then 100 ml of the suspention was added to each well and incubated at 35 -42 c for 24 hour Mic value were determined as the lowest concentration compound that incubated bacteria after 24 hours(14).

Results

Table(1) have shown zone of inhibition mm of clinical isolation and concentration of *A*.vulgaris and nanoparticle. Table (2) have shown antibacterial activity of silver nanoparticle and *A. vulgaris*. Table (3) have shown zone of inhibition zone mm of clinical isolation of concentration *R. officinalis* extract nanoparticle Table (4) have shown antibacterial activity of silver nanoparticle of *R.officinali of* Ag

Nps to the plant species mg /ml. Table (5) have shown zone of inhibition of clinical isolation concentration of *Punica granatum* peel extract nanoparticle Table (6 have shown antibacterial activity of silver nanoparticle of *Punica granatum* peel Agnps mg / ml.

Table (1): Zone of inhibition in mm of clinical isolation and concentration of *A. vulgaris* and nanoparticle (extract + AgNPs) .

Type of M-O	Herb + nanoparticle			Herb only	Antibiotic(control)
	1%	3%	5%		
1. S-*aureus*	17	18	20	6	10
2. *Proteus.vulgaris*	11	12	13	7	8
3. E.*coli*	12	13	14	6	7

Table (2): Antimicrobial activity of silver nanoparticle and *A. vulgaris* AgNPs mg/ml.

Strain	MIC	MBC	MIC	MBC
1. S.*aureus*	60	120	4.30	6.10
2. *proteus.vulgaris*	10.3	20.6	2.5	2.5
3. E.*coli*	120	460	3.2	3.2

Table (3) : Zone of inhibition zone mm of clinical isolation of concentration *R. officinalis* extract nanoparticle (extract + AgNP).

Type of M.O	1%	3%	5%	Rosmary only	Antibiotic(control)
1- S-*aureus*	8	9	10	7	10
2- *Proteus.vulgaris*	11	12	13	8	10
3- E.*coli*	10	11	12	7	11

Table (4): Antimicrobial activity of silver nanoparticle of *R. officinalis* of AgNPs mg/ml.

Strain	MIC	MBC	MIC	MBC
1- S-*aureus*	60	120	4-30	
2- *Porteus.vulgaris*	10-3	20-6	2-5	5-10
3- E.*coli*	120	459	3-20	3-10

Table (5): Zone of inhibition of clinical mm of clinical isolation of concentration *p.granatum* peel extract nanoparticle (extract + AgNPs).

Type of M.O	1%	3%	5%	Pecls only	Antibiotic(control)
1- S-*aureus*	13	14	15	10	12
2- *Proteus.vulgaris*	14	15	16	9	11
3- E-*coli*	5	6	7	4	6

Table (6): Antimicrobial activity of silver nanoparticles of *p.granatum* peel AgNPs mg/ml.

Strain	MIC	MBC	MIC	MBC
1- S-aureus	30	60	3-29	5-10
2- proteus.vulgaris	10-3	20-5	2-2	2-4
3- E.*coli*	60	120	2-20	2-30

DISCUSSION

The *A.vulgaris*, *Rozemary*, peel extract of *P. granatum* quikly reduce Ag to Ago and enhance synthesis of silver nanoparticle with highly antibacterial activity. (15). Addition of the aqeous herbal extract to the 1mM aqueous Agno3 solution resulted in change of colour with in 5-10 minutes which can be varied according to the plant species chosen. The reason could be the qualitative variation in the formation of SNps or availability of H or to reduce the silver. The Change in colour was obtained which resulted due to the excitation of the surface plasmin Resonance(SPR) variation of the silver nanoparticle formed. The green herb are the site of photosynthesis and accessibility of more the ion to reduce the silver nitrate into silver nanoparticle.

We have been synthesis nanoparticle from the three herbs ,*A.officinalis*, *R. officinalis* and peel of *p. granatum* extract which acts as excellent source for the reducing agent (15). This result is agreement with M.Vanagumet al (16)2014 who reported the green synthesized silver nanoparticle can be used in the field of medicine, due to their high antibacterial activity. The present study included the bioreduction of silver ions through medicinal plants extracts and testing for their antibacterial activity. The aqueous silver ion exposed to the extract, the synthesis of silver nanoparticle were confirmed by the change of colour of plant extract. The mechanisims of inhibitory effect of silver ion on microorganisims is somewhat kown. Somes studies have reported that positive changes in the silver ion issignaton for their antibacterial. The mechanisims of the reaction involve the reduction aqueous metal ion with plant leave extract. Plant extract colour change after complete of the reaction. And it is well kown that the silver nanoparticle exhibit yellowish brown abacteria on dark brown based on their size. This result agreement with Y. hua et al 2017(17) who report all strain especially the resistant strain were significantly inhibited by herb Ag Nps at comparatively low concentration

(MIC) ranging from 0.032 to 0.063 mg/ ml . Therefore, proposed the AgNps will have agreementt potential in anti MRbacteria (18). The result showed the synthesized nanoparticle showing good antibacterial effect against E.*coli*, S.*aureus*, p.*vulgaris* so the presents study accent the use of herb for the synthesis of silver nanoparticle with potent antibacterial effect (19). Both the component of metallic silver antibacterial and metabolic of plant has antibacterial well kow nanoparticle develop mechanisim nanoparticle adhere to the cell wall and increase the pore size of cell membrane which altimately facilities the plant metabolite to enter in the cell or interrupt the bacterial colonization. The green synthesized nanoparticle could be used in the medical field against disease due to their high efficiency as antibacterial agent. The silver nanoparticle exhibit ahigh ayantibacterial effect due to their developed surface which provides the maximum contact with environment. Further more their toxicity is presumed to be size and shape dependent because small size of nanoparticle may pass through cell membrane.Inside abacteria, nanoparticle can interact with DNA,thus losing its ability to replicate which may lead to the cell death. Green synthesized nanoparticles also have the more effective antimicrobial zone inhibition of the pathogen .

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