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SILVER NANOPARTICLE OF LBDDS FORMULATION AND EVALUATION WITH ENHANCEMENT OF BIOAVAILABILITY OF LEAF EXTRACT ARTABOTRYS HEXAPETALUS (L.F.) BHANDARI AND ALEURITES MOLUCCANA LINN FOR ANTIMICROBIAL AND ANTIOXIDANT ACTIVITY

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ABSTRACT:-

This study on the formulation and evaluation of silver nanoparticle of LBDDS With bioavailability enhancement of leaf extract Artabotrys hexapetalus (L.f.) Bhandari and Aleurites Moluccana Linn For Antimicrobial and Antioxidant activity. The synthesized nanoparticles would be characterized by UV-Visible spectrophotometry, Scanning Electron Microscopy, X-ray Diffraction, FTIR Spectroscopy, Transmission Electron Microscopy and Particle size analysis. Synthesized nanoparticles would be subjected to biological Application. Most of the oxidative diseases are due to oxidative stress resulting from free radicals Free radicals such as superoxide anion, hydroxyl radicals and non-radical species such as hydrogen peroxide and singlet oxygen are different varieties of activated oxygen constituting reactive oxygen species[16]. An active antioxidative defence system is needed to balance the output of free radicals. Antioxidant therapy by the curing of these diseases has an enourmous importance. These findings suggest that the plant-derived AgNPs could serve as effective natural alternatives to conventional methods and holds potential for application in antimicrobial and antioxidant activity and other biological systems.

Keywords:- Bhandari Aleurites Moluccana Linn, Artabotrys hexapetalus (L.f.), Silver Nanoparticle of LBDDS, antimicrobial and antioxidant activity

INTRODUCTION

The National Science Foundation (NSF), an agency responsible solely to the President of the United States and whose mandate is to fund the best of fundamental science and technology projects funded About 20 Research Centres. NSF was the lead U.S. agency which proceeded with the NNI. The nanotechnology has the potential to remarkable impact on many aspects of current life whether as a result of the production of superior lightweight materials, advanced computing, medicine (diagnostics and treatments), or energy production [8,9]. The impact of scale is most clearly embellished with changes in the physical properties of metallic nanoparticles. For example, gold nanoparticles neither only display a ruby colour 9–10 nm rather than the yellow of bulk gold, but also the optical absorbance spectra of these gold nanoparticle is also size dependent; spherical nanoparticles of diameter 22, 48 and 99 nm have λ max's of 520, 540 and 580 nm respectively [10]. Increasing the surface area and enhancing the drug-solvent interaction are the main ways that nanoparticle compositions increase drug solubility. For instance, the solubility of hydrophobic medications has been greatly enhanced by the use of nanocrystals, which are pure drug particles shrunk to nano scale size.

Nanotechnology has become one of the most promising technologies applied in all areas of science. large surface-to-volume ratio and increased reactivity. Nanoparticles of gracious metals like platinum, gold and silver and other metals like Zn, Fe, Ti, Pd have received global attention due to their extensive applications in the biomedical and physiochemical fields. Nanoparticles have become one of the most active areas of research in the field of drug delivery due to their capacity to deliver various drugs to the target, at appropriate times and in the right dosage. Nanoparticles (NPs) cause attraction of researchers because of their unique properties, owing to their small size (1–100 nm),. The nanotechnology field is one of the upcoming areas of research in the field of material science. Nanoparticle show improved properties of material, such as its size, distribution and morphology of the particles etc. The applications of nanoparticles and nanomaterials are growing rapidly in various fields [2]. In 2000 The United States introduced the National Nanotechnology Initiative (NNI), which was soon followed (2001) by a plethora of projects in nanotechnology in nearly most of the U.S. Departments and Agencies,

MATERIAL AND METHODS

Materials used

All the materials used were of either AR/LR grade or the best possible grade available as supplied by the manufacturer without any further purification

COLLECTION OF PLANT MATERIALS

Artabotrys Hexapetalus (L. F.) Bhandari healthy fresh young leaves of the plants were collected from Sanjevni Nursury Bhopal in the month of August, 2025. And The Aleurites moluccanus (L.) Willd leaves were collected from Sanjevni nursery, Bhopal (M.P.) in the month of July, 2025. The both plant material that is used in the sample was carefully washed in flowing tap water and then washed in purified water then dried at room temperature. The both plant material was then dried in shade up to 3 to 4 weeks without being in fested. Then the treated dried plant was grinded via automated grinder. Odor, Color, flavor, and texture of powdered plant material were estimated. For research, phytochemical and biological tests, dried plant material was sealed in hermetically sealed container and stored.

AUTHANTICATION OF PLANT

Artabotrys Hexapetalus (L. F.) Bhandari & Aleurites moluccanus (L.) Willd leaves plant material was identified and authenticated by Dr. ZiaUl Hasan, Head of Department, Department of Botany, Safia Science College, Bhopal, and a specimen voucher (500/Bot/Safia/18), deposited in the Department of Pharmacology, School of Pharmacy, Peoples University ,Bhopal, for future reference.

PLANT PROFILE

Artabotrys hexapetalus (L.f.) Bhandari

Artabotrys is a genus of woody trees, shrubs, and vines comprising about 130 genera and 2,300 species, which is distributed mainly in tropical and subtropical regions of the world, especially tropical Africa and Eastern Asia and the Indomalayan region [1, 2]. Plants of Artabotrys genus are climbing herbs bearing recurved hooks borne on lateral branches and scandent shrubs are one of the largest genera of the custard-apple family [3]. Artabotrys hexapetalus (L. f.) (A. hexapetalus) Bhandari generally described as a folk drug that has a wide range of medicinal uses belonging to family Annonaceae

USES

As a Chinese traditional folk medicine, its roots and fruits are used for treating malaria and scrofula, respectively [7]. The flower is acrid, bitter; useful in vomiting, diseases of the blood and the heart, leucoderma, headache. A decoction of leaves is given for cholera. Artabotrys hexapetalus flowers are used to treat bad breath, vomiting, itching and leucoderma [8]. Artabotrys hexapetalus leaves decoction was used to treat cholera and malaria.

Aleurites Moluccana Lin

Candlenut or *Aleurites moluccana* is a flowering tree that belongs to the Euphorbiaceae family. In Malaysia, it was commonly known as *buah keras* nut tree. Apart from candlenut, *Aleurites moluccana* is also known as Candleberry, Indian Walnut, Varnish tree, Kukui and Kamiri nut tree, depending on the region [43]. Candlenut trees are native to the Molucca Islands and widely found in South East Asia

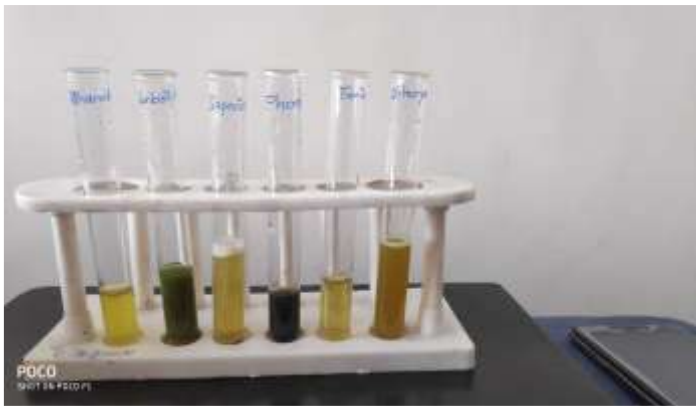
USES

This species has been widely used in Indonesia as one of the traditional remedies passed down through generations and kept as a cultural treasure. Usada, a traditional plant-based medicinal book written in palm leaves by one of the ethnic groups in Indonesia called Sasak, described this herb's usage for diarrhea and pregnant chants [49]. Additionally, indigenous healers of this ethnic group prescribe this herb for asthma, stomach problems, skin ulcers, poisoning recovery, and swollen wombs.

Extraction of plant material

3.5 Phytochemical screening

Chemical tests were carried out different extracts (Aqueous and ethanol) using standard procedures to identify the preliminary phytochemicals following the methodology of Sfowara (1993), Trease and Evans (1989) and Harborne (1973).



Artabotrys hexapetalus (L.f.) Bhandari extract Phytochemical screening

Method: Synthesis of silver nanoparticles

The fresh plant material of Artabotrys hexapetalus leaf broth solution was prepared by taking 5g of thoroughly washed and finely cut leaves in a 300 mL Erlenmeyer flask along with 100 mL of sterilized ddH2O and after that boiling the mixture for 5 min at lastly transferring it. The extract was filtered by using Whatman filter paper no 1 and it was stored at temperature of -15 °C and might be used within a week. The filtrate was treated with aqueous 0.5 to 1.5mM AgNO3 solution in an flask and incubated at room temperature (Refer table 2). As an outcome, a brown solution was created, showing the development of silver nanoparticles.

Figure: (a) Artabotrys hexapetalus Plant extract, (b) Synthesized Silver nanoparticles

It disclosed that aqueous silver ions might be reduced by aqueous extract created from plant parts to produce remarkably stable silver nanoparticles in water [197].

Table: Formulations of silver nanoparticles

Sr. No.	Formulation Code	Extract (gm)	AgNO3 solution (mM)
1.	F 1	10	1
2.	F 2	10	1.5
3.	F 3	10	2

Then Synthesized Silver nanoparticle centrifuged and dried

Figure : Dried Silver nanoparticles

Formulation development of silver nanoparticles gel

Method of preparation

Measured amounts of methyl paraben, glycerin, polyethylene glycol and silver nanoparticles of Brassica oleracea were dissolved in about 100 ml of water in a beaker and stirred at high speed using mechanical stirrer (or sonicator). Then Carbopol 940 was gradually further added to the beaker which already contained this liquid while we were stirring. Neutralized the solution by adding a slow, constantly stirring triethanolamine solution until the gel formed **[200].**

Table 3: Formulation of silver nanoparticles gel of optimized formulation

Ingredients (mg)	**SNGE1**	**SNGE2**	**SNGE3**
Silver nanoparticles	100	100	100
Carbopol 940	300	600	900
Polyethylene Glycol 600	0.4	0.4	0.4
Methyl Paraben	1	1	1
Triethanolamine	2.0	2.0	2.0
Distilled Water	100ml	100ml	100ml

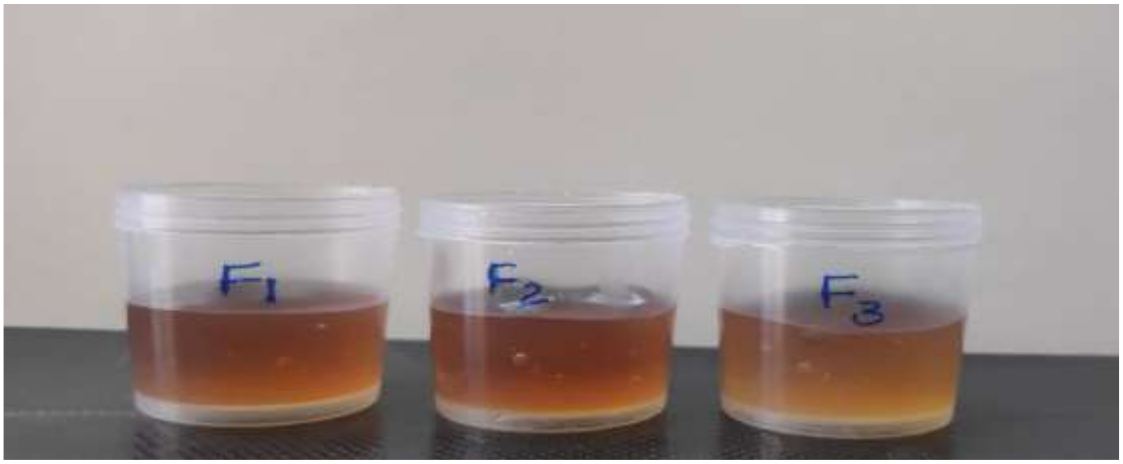


Figure : Formulation Development of Synthesized Silver nanoparticles (SNGE1, SNGE2, SNGE3, prepared from F1, F2, F3)

RESULTS: -

Preliminary phytochemical analysis in *Artabotrys hexapetalus* leaves

Phytochemicals	**Ethanol extract**	**Aqueous extract**
Tannin	-	+
Phlobatannins -	-	-
Steroids	++	+
Alkaloids	++	+
Anthroquinone	++	+

Saponins	+	+
Flavinoids	++	+
Terpinoids	++	++
Tri terpinoids	++	-

Carbohydrates	++	++
Coumarins	+	+
Protiens	-	-
Antharaquinones	++	++
Polyphenols	++	-
Cardiac glycosides	++	++
Coumarins	+	+
Emodins	+	-
Anthocyanins	++	+

"+" indicates presence of the compounds; "-" indicates absence of the compounds, "++" indicates the high concentration

Table 4.2: Preliminary phytochemical analysis in *Aleurites Moluccana* leaves

Phytochemicals	**Ethanol extract**	**Aqueous extract**
Tannin	-	+
Phlobatannins -	-	-
Steroids	++	++
Alkaloids	++	-
Anthroquinone	++	++
Saponins	+	+
Flavinoids	-	-

Terpinoids	++	+
Tri terpinoids	++	-
Carbohydrates	++	++
Coumarins	+	+
Protiens	-	-
Antharaquinones	++	++
Polyphenols	++	-
Cardiac glycosides	++	+
Coumarins	+	++
Emodins	+	+
Anthocyanins	+	-

"+" indicates presence of the compounds; "-" indicates absence of the compounds, "++" indicates the high concentration

Quantitative Analysis of extract of *Artabotrys hexapetalus*l eaves

S. No	**Phytochemicals**	**Results (mg/gm)**
1	Total phenol	7.63 ± 0.85
2	Total Flavonoids	28.3 ± 0.91
3	Total alkaloids	38.83 ±2.66

Values are expressed as Mean ± SD for triplicates

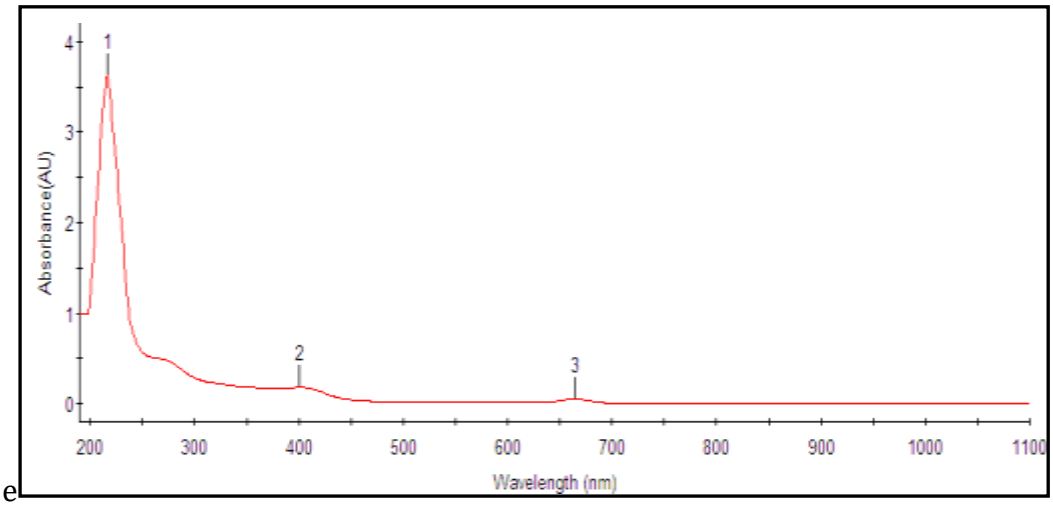
Quantitative Analysis of extract of *Aleurites Moluccana* leaves

S. No	**Phytochemicals**	**Results (mg/gm)**
1	Total phenol	216.08 ±15.12
2	Flavonoids	170.14 ±11.9
3	Total alkaloids	10.30 ± 0.59

Values are expressed as Mean ± SD for triplicates

UV-VIS Spectrum Peak values of ethanolic extract of *Artabotrys hexapetalus*

S.No.	Wave length nm.	Abs.
1	217	3.652
2	401	0.180
3	664	0.052



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UV-VIS Spectrum of ethanolic extract of ***Artabotrys hexapetalus***

UV-VIS Spectrum Peak values of ethanolic extract of *Aleurites Moluccana Lin*

S.No.	Wavelengthnm.	Abs.
1.	472.00	0.550
2.	446.00	0.654
3.	334.00	0.115
4.	267.00	0.162
5.	214.00	0.598
6.	463.00	0.538
7.	359.00	0.088
8.	380.00	0.067

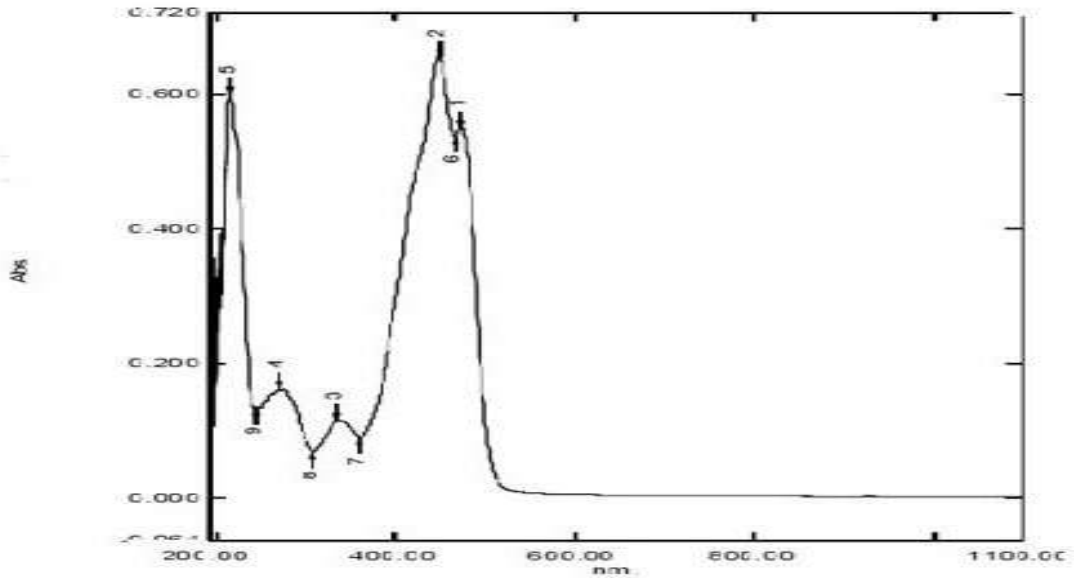

Fig. 4.2 UV-VIS Spectrum of ethanolic extract of *Aleurites Moluccana Lin*

HPLC analysis of *Artabotrys hexapetalus* leaf extract

Peak#	Ret. Time	Area	Area%	Height	Height %	Compounds identified by literature
1	3.450	2416874	58805	21.946	38.979	Gallic Acid
2	3.999	5986954	81791	54.363	54.215	Quercetin
3	8.156	2597547	10039	23.586	6.654	Gallic Acid
4	18.206	11580	229	0.105	0.151	Quercetin

HPLC profiles of Artabotrys hexapetalus leaves were analysed and four compounds namely Gallic Acid, and Queretin having elution times could be obtained when each compound was analyzed individually using the mobile gradient phase consisting of ethanol and 1% acetic acid in water during 30 minutes run time.

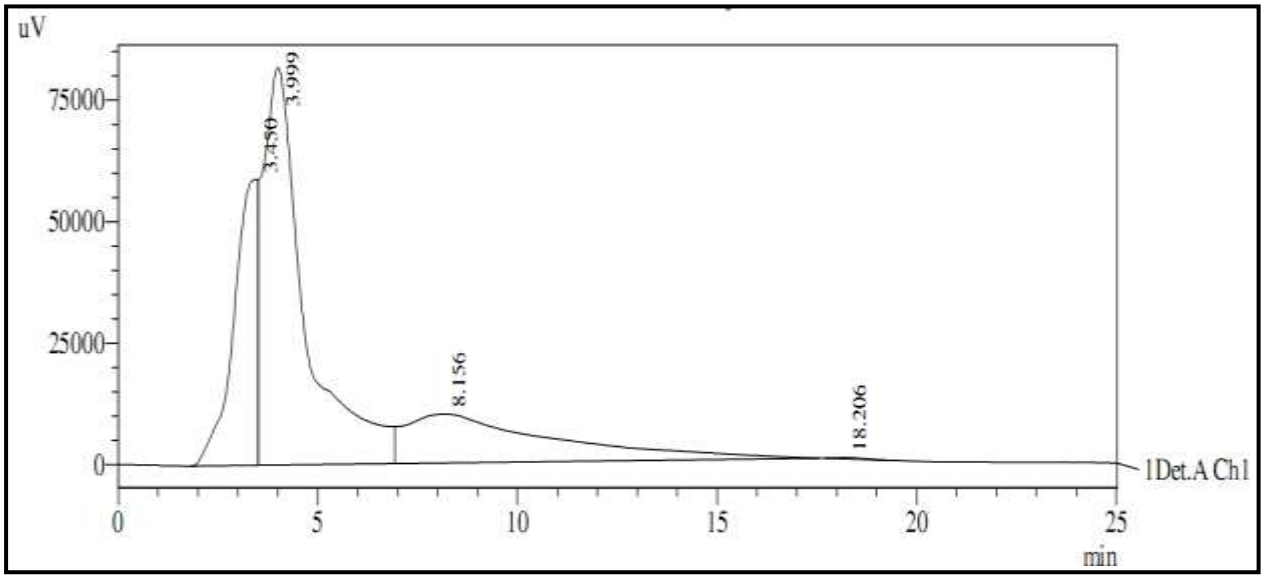

Figure 4.6: Chromatogram of HPLC analysis of *Aleurites moluceanus) leaf* extract

In vitro antioxidant Activity

Determination of total antioxidant capacity Artabotrys hexapetalus & Aleurites moluccanus

Table 4.9. **Antioxidants activity test results of candlenut (Aleurites moluccanus) leaves extract**

Concentration	DPPH free radical	% Inhibition Hydrogen Peroxide scavenging	Ascorbic acid
20	31.4 ± 0.62	44.25 ± 0.47	31.5 ± 0.15
40	42.8 ± 0.37	52.30 ± 0.27	52.9 ± 0.92
60	60.7 ± 0.45	58.35 ± 1.09	61.8 ± 0.38
80	66.79 ± 0.36	64.81 ± 0.47	72.2 ± 0.72
100	72.7 ± 0.79	70.09 ± 0.97	83.3 ± 0.69
IC50	48.9	44.82	29.3

Table 4.10.: *In vitro* antioxidant activity of Artabotrys hexapetalus

Concentration	DPPH free radical	% Inhibition Hydrogen Peroxide scavenging	Ascorbic acid
20	31.4 ± 0.62	44.25 ± 0.47	31.5 ± 0.15
40	42.8 ± 0.37	52.30 ± 0.27	52.9 ± 0.92
60	60.7 ± 0.45	58.35 ± 1.09	61.8 ± 0.38
80	66.79 ± 0.36	64.81 ± 0.47	72.2 ± 0.72
100	72.7 ± 0.79	70.09 ± 0.97	83.3 ± 0.69
IC50	48.9	44.82	29.3

Table 4.11.**Antimicrobial efficacy of Artabotrys hexapetalus leaf extract**

No.	Test Microorganism	Ethanol extract(3mg/ml)	
		Volume (µl)	Zone of inhibition in Diameter(mm)
1	*E.coli*	50	20
		100	23
		150	25
2	*Bacillus cereus*	50	22
		100	24
		150	25
3	*Staphylococcus aureus*	50	18
		100	19
		150	19
4	*Salmonella typhi*	50	20
		100	22
		150	25

Table4.12.**Antimicrobial efficacy of Aleurites moluccanus leaf extract**

No.	Test Microorganism	Ethanol extract(3mg/ml)	
		Volume (µl)	Zone of inhibition in Diameter(mm)
1	*E.coli*	50	21
		100	24
		150	26
	Bacillus cereus	50	21
		100	23
		150	24
3	*Staphylococcus aureus*	50	19
		100	20
		150	18
4	*Salmonellatyphi*	50	21
		100	23
		150	24

Table 4.13 **Synergistic Antimicrobial Efficacy of Silver nanoparticles synthesized using *extracts* with Tetracycline antibiotic.**

Sl 0 No	Category of Bacteria	Test Microorganisms	Volume (µl)	Zone of inhibition in Diameter (mm)			
	Gram Positive bacteria			AgNO3 extraxt	AgNPs extrax t	Tetracycline 30mcg/disc	AgNPs with Tetracycline (30mcg)
1		*Bacillus cereus*	100	12 ±0.10	14±0.23	18±0.23	22±0.25
2		*Staphylococcus aureus*	100	14±0.12	15±0.24	19±0.05	22±0.21
3	Gram Negative bacteria	*Escherichia coli*	100	16±0.21	17±0.41	23±0.27	24±0.18
4		*Salmonella typhi*	100	09±0.14	12±0.28	18±0.29	23±0.17

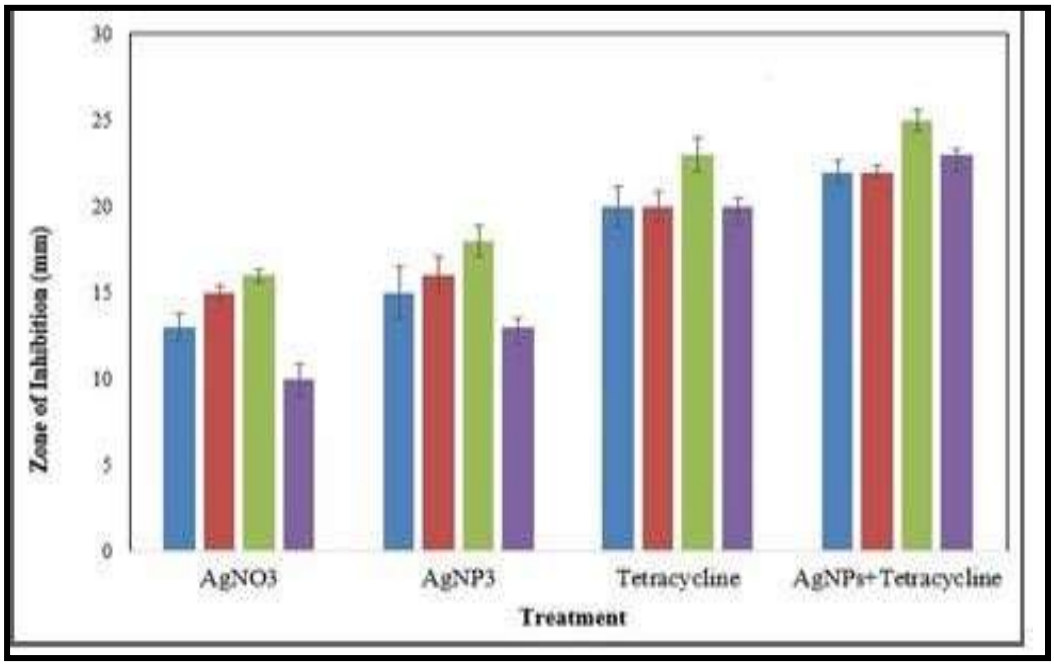

Figure 4.7 Antimicrobial action of Silver Nanoparticles with tetracycline

Summary and Conclusion

The current work also illustrated a green and environmentally acceptable nano synthetic mechanism for the phyto production of durable and spherical silver nano particles. during the phyto-manufacturing of silver nano particles (AgNPs) from silver nitrate, extract of the medicinal plant On osama bracteatum was used as a capping and reducing agents. In the current study, physiochemical analysis of the medicinal plant selected plant On osma Bracteatum revealed that it contains several phytochemical with significant antioxidant and antimicrobial potential. The finding of physical- chemical characterization showed that the produced AgNPs had a spherical form and the optical size range. Furthermore, the results of antibacterial analysis suggests that the methanolic extract and silver nano particles could be used as natural alternatives to synthetic antibiotics for the treatment of bacterial infections, particularly against E. coli, P. aeruginosa, B. subtilis and S. capitis. Overall, this environmentally friendly technology may be a competitive and alternative to existing physical or chemical processes for production of nano particles and may be employed as inhibitors in a range of biological applications.

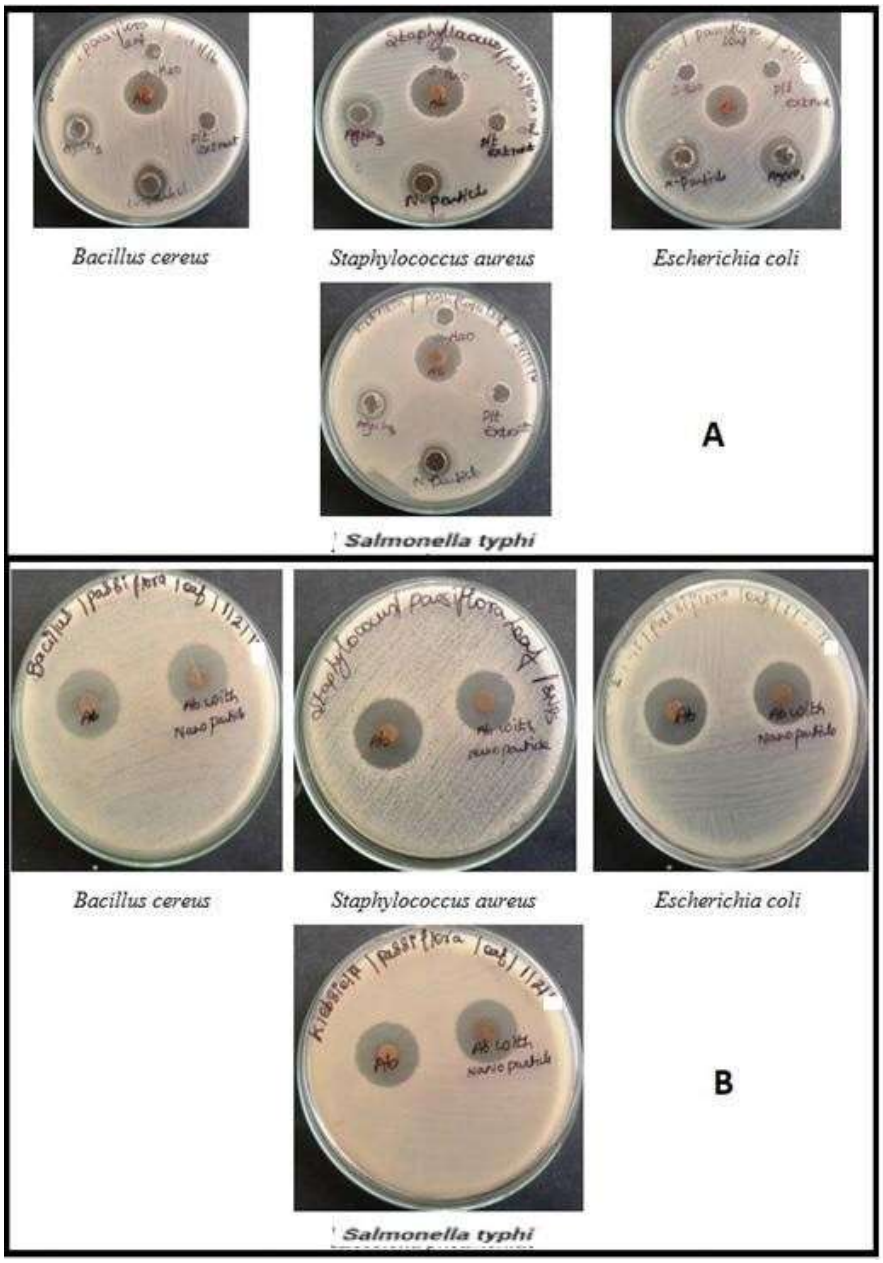

Figure 4.8 A. Antimicrobial efficacy of silver nanoparticles of Artabotrys hexapetalus (L.f.) Bhandari extract (A) Aleurites Moluccana Lin extract (B) antimicrobial efficacy of silver nanoparticles with tetracycline.

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