International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

Biosynthesis of Silver Nanoparticles from Abutilon Indicum (L.) Seed Extract and Evaluation of Antibacterial and Anti-Inflammatory Activity.

Ponnivalavan M*, Senthil Kumar M, Mohammed Salman AK, Sameeha Sherin, Sharmila M, Shinas Muhammed Kutty PM, Sibiya S.
Sree Abirami college of Pharmacy, Coimbatore-21.

Submitted: 15-15-2023 Accepted: 25-12-2023

ABSTRACT:
In the present study, the synthesis of silver nanoparticle from aqueous extraction of Abutilonindicum (L.) and its anti-inflammatory & antibacterial properties were studied.The bioactive compounds from Abutilon indicum were identified by Thin Layer chromatography.TheAgNPs synthesis was done using the aqueous seed extract of A. indicum (L.)and silvernitrate.The AgNPs were characterized by using ultraviolet visible spectrophotometric analysis, Fourier transform infrared spectroscopy (FTIR) and Scanning electron Microscopy (SEM). The anti-inflammatory and Antibacterial assays were followed by the standard methods.The diclofenac sodium method and Trypsin method carried out for anti-inflammatory activity.The agar well diffusion method carried out for antibacterial activity.So, our study indicates the AgNPs synthesis from A. Indicumpossess anti-inflammatory and Antibacterial potential which may be used for therapeutic purposes mainly in the prevention of oxidative damage that occur during inflammation and bacterial infection.

Key words: Abutilon indicum linn,Anti-inflammatory, Antibacterial, AgNps, SEM, FTIR, UV-Vis spectrophotometric analysis.

I. INTRODUCTION:

Medicinal plants are thought to be a plentiful source of chemicals that can be utilized to create synthetic, pharmacopeial, or non-pharmacopeial medications. Apart from that, these plants are essential to the evolution of human cultures worldwide. Moreover, some plants are considered as important sources of nutrition and as a result of that they are recommended for their therapeutic values. Some of the plants include ginger, green tea, walnuts, aloe, pepper, and turmeric etc. Some plants and their derivative are considered as important sources for active ingredients which are used in aspirin and toothpaste etc.

Since ancient times, therapeutic plants, often known as medicinal herbs, or just herbs, have been recognized and utilized. Plants produce a wide range of chemical substances for use in their biology, such as protection against herbivorous animals, fungus, and insects. In science, around 12,000 active chemicals are known. Herbal medicines can be helpful and have negative side effects just like conventional drugs since these chemicals act on the human body in the same way as pharmaceutical drugs. However, the effects of using a plant as medicine might be complicated because a single plant can contain a variety of chemicals.

In non-industrialized communities, medicinal plants are frequently utilized to cure illness, in part because they are significantly less expensive than contemporary medications. Medicinal plants are the potential resources of raw materials which are used in the manufacturing of many drugs. They play a significant role in maintaining our human health.Worldwide, conventional medical procedures employ plant medicines to treat a wide range of illnesses. The medicinal plants are useful for healing as well as for curing human disease due to presence of phytoconstituent. Medicinal plants are possessed to have various properties like antioxidant, anti-inflammatory, anti-cancer, anti-diabetic, anti-helminthic etc.

Herbs are utilized not just for therapeutic purposes but also for food preparation, natural coloring, insect control, tea, and other products. Various types of medical plants and herbs are used in various countries to deter ants, flies, and mice from entering houses and offices. Medicinal herbs are now a major source for the production of pharmaceuticals. One such traditionally used plant is Abutilon indicum.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

ABUTILON INDICUM:

Abutilon indicum is a native plant of south Asia, often known as "Thuthi" or "Kanghi" in Hindi. Our discipline of pharmacy has nature as its best friend. Natural medications work well and don't have any negative side effects. Known by most as "Country Mallow," Abutilon indicum(Linn.) sweet (Malvaceae) is a perennial plant that can grow up to 3 meters tall. Medicinal plants are a gift from nature that help people live healthy, disease-free lives. It is essential to maintaining our health. One of the medically and culturally most diverse nations on earth is India, where the use of medicinal plants is still revered today as part of a long-standing custom. The three primary traditional medical systems practiced here are Ayurveda, Unani, and Siddha. Since ancient times, diverse portions of medicinal plants have been employed in India to treat a variety of illnesses. Abutilon indicum is one such plant in this sense. About 150 annual or perennial herbs, shrubs, or even small trees belong to the Abutilon L. genus of the Malvaceae family, which is extensively spread throughout the tropical and subtropical regions of America, Africa, Asia, and Australia. The species includes some highly prized Ayurvedic herbs, and there has recently been a resonance of scientific interest in learning more about the species.

The leaves are 1.9–2.5 centimeters long, oblong, acuminate, toothed, and infrequently sub trilobate. The peduncles of the yellow flowers are joined above the center. The calyx is 12.8 mm long, divided in the center, with elliptical, apiculate lobes, and a yellow, 2.5 cm diameter corolla that opens in the evening. The petioles are 3.8–7.5 cm long, the stipules are 9 mm long, and the pedicels are frequently 2.5–5 mm long, axillary solitary, jointed very near the top. The fruits are capsule-shaped, very pubescent, and prominently display beaks that spread horizontally. The pubescent, sturdy, branching stems reach heights of 1-2 meters. The seeds are black or dark brown, 3-5 mm in size, reniform, tubercule, or very finely stellate-hairy.

Abutilon indicum (L.) Sweet, sometimes referred to as "Country mallow" in English, "Kanghi" in Hindi, and "Atibala" in Sanskrit, is a plant that grows throughout northern and central India and the outer Himalayan tracts from Jammu to Bhutan up to an elevation of 1500 m. It is widely distributed in wastelands and grows as a weed. It is an herbaceous or shrubby plant that is tomentose; the stem is rounded and frequently has a purple hue. The smooth-surfaced, cylindrical root has a diameter of 1.2 to 1.5 cm, a yellow hue, and a salty flavor and aroma. The yellow stem has a diameter of 0.3 to 0.9 cm. Evergreen, stipulate, and cordate leaves are present. The bark is smooth on the inside and has a hairy, yellow outside that has been flattened. Fibrous fractures are seen. The blooms are bisexual, pedicellate, and yellow in color. The petiole is cylindrical with stellate hair, 1.5–7.0 cm length, and yellowish brown in hue. The lamina is dull green in color, hairy above and glaucous below, crenate, reticulate, acute to acuminate, minutely stellate, and dentate. There are glandular hairs and a coriaceous texture. Fruit is a highly pubescent schizocarp that resembles a capsule, with prominent beaks that extend horizontally. The seeds are 3-5 mm in size, hairy, reniform, tubercule or minutely stellate, minute, glabrous, and black or dark brown in color. The stem has blunted unicellular and multicellular hairs with an undulating shape under the microscope. The secondary wood in the root is arranged in distinct rings, and its form is likewise undulating. A few enormous unicellular hairs can also be seen. Dorsi-ventral leaves are covered in pitcher glandular hairs that resemble flasks and are stellate. While stomata are amniocytic, epidermal cells have straight anticlinal walls.

AYURVEDIC PROPERTIES:

- GUNA (Properties) - Laghu, Snigdh, Pichel
- RASA (Taste) - Madhur
- VIPAK (Metabolism) - Madhur
- VIRYA (Potency) – Sheet
- PRABHAV (Impact) – Balya

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

SCIENTIFIC CLASSIFICATION:

Kingdom	**Plantae- Plants**
Subkingdom	**Tracheobionta- Vascular plants**
Super kingdom	**Spermatophyta- Seed plants**
Division	**Magnoliophyte- Flowering plants**
Class	**Magnoliopsida- Dicotyledons**
Subclass	**Dilleniidae**
Order	**Malave's**
Family	**Malvaceae- Mallow family**
Genus	**Abutilon mill- Indian mallow**
Species	**Abutilon indicum (L.) sweet- Monkey bush**

TRADITIONAL USES:

Many tribal societies and forest inhabitants use the leaves, roots, flowers, seeds, and seed oil of the shrub Abutilon indicum (L.) Sweet to treat a wide range of illnesses. In the Siddha medical traditions, the plant has long been considered a reputable treatment for ulcers, leprosy, jaundice, and piles. The roots of four plants known as Bala (Sida cordifolia Linn.), Atibala (A. indicumLinn.), Mahabala (Sida rhombifolia Linn.), and Bhumi Bala (Sida veronica folia Lam.) were used in Vedic times to treat uterine abnormalities, cardiac issues, vata-pitta ailments, heart troubles, and bily blood.Both the seeds and the roots were used in fever decoction form. In light of several folk remedies for various illnesses, scientists have attempted to confirm the plant's effectiveness through scientific biological testing. The primary classes of chemicals found in the plant are amino acids, hexoses, alkaloids, flavonoids, n-alkane mixes (C22–34), and saponins.

BIOLOGICAL ACTIVITY:

Abutilon indicum is a plant with a variety of biological activities. Some of these include wound healing, hepatoprotective, antihypertensive, antitumor, anti-inflammatory, anti-fertility, anticonvulsive, anti-helminthic, anti-diarrheal, antimicrobial, and free radical scavenging.

CHEMICAL CONSTITUENTS:

Understanding a medicinal plant's unique chemical components is crucial for maximizing extraction techniques, assessing possible toxicity, and comprehending the plant's pharmacological activity. Numerous components from A. indica species have been identified; these include alkaloids, flavonoids glycosides, proteins, lactones, sesquiterpenes, flavonoid aglycones, steroids, carbohydrates, phenols, and tannins.

NANOPARTICLES:

Pharmaceutical research pertaining to nano-sized items is expanding quickly in the present day. The methods for identifying, treating, and curing diseases have evolved thanks to advances in nanoscience and technology, which has had a profound impact on human life. A rapidly expanding scientific discipline, nanobiotechnology deals with the creation and construction of technologies. The creation of nanoparticles with varying chemical compositions, sizes, morphologies, and controlled disparities is a significant field of research in nanobiotechnology. Particulate dispersions or solid particles with a size range of 10–1000 nm is referred to as nanoparticles.

It has a wide range of application in areas such as health care, cosmetics, food and feed, environmental health, mechanics, optics, biomedical sciences, chemical industries, electronics, space industries, electronics, space industries, drug-gene delivery, energy sciences, optoelectronics, catalysis, single electron transistors, light emitters, nonlinear optical devices, and photo-electrochemical applications.

Production of nanomaterials may be carried out by three types of methods:
1. biological (production of nanoparticles by microorganisms),
2. chemical (e.g., chemical vapor deposition CVD, chemical reduction),
3. physical (e.g., physical vapor deposition, PVD, production of thin films).

The present study is designed to investigate anti-bacterial and anti- inflammatory activity in the silver nano- particles of aqueous seed extract of Abutilon indicum by using UV-Visible, FTIR, FESEM, Diclofenac sodium and trypsin methods respectively [36].

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

ANTIBACTERIAL ACTIVITY:

In the previous three decades, the pharmaceutical industry has created a lot of new antibiotics, yet microbes have become more resistant to these medications. Generally speaking, medications used as therapeutic agents can genetically transfer and develop resistance in bacteria. This fact raises concerns due to the amount of hospital patients with reduced immunity and the emergence of multi-resistant bacterial strains. Approximately 80% of people in developed nations use traditional medicine, which contains substances derived from therapeutic plants. Thus, more research on these plants is necessary to fully comprehend their characteristics, safety, and effectiveness.With their established antibacterial qualities, the application of phytochemicals and plant extracts can be very important to medical interventions. Numerous research demonstrating this efficiency have been carried out in various nations in the past few years. Many plants have been employed for their antibacterial properties, which are a result of chemicals produced during the plant's secondary metabolism. These goods are recognized by their active ingredients, such as tannin and phenolic compounds, which are included in essential oils.

Many scientists have studied the antibacterial qualities of plants all around the world, but particularly in Latin America. A study conducted in Argentina examined 122 recognized plant species that are utilized as medicinal remedies. Twelve of the compounds recovered from these plants were found to inhibit the growth of Staphylococcus aureus, ten to inhibit Escherichia coli, and four to inhibit Aspergillus Niger. An extract from Tabebuia impetiginous was found to be the most powerful chemical. Compounds derived from Parthenium argenteum were found to have antibacterial activities against Pseudomonas aeruginosa, Torulosis, Hansamala, Klebsiella pneumoniae, and Candida albicans. Research revealed that extracts from nine identified plants in Uruguay suppressed the growth of Bacillus subtilis, E. coli, and P. aeruginosa but had no effect on C. albicans or Saccharomyces cerevisiae.

ANTI-INFLAMMATORY ACTIVITY:

Alocalized physical condition known as inflammation occurs when an infection or injury causes a portion of the body to become swollen, red, painful, etc. It forms the foundation of pathology. The restoration of tissue structure and function, as well as cellular homeostasis, is ultimately the result of the advantageous host response. Wounds, infections, and tissue damage require an inflammatory response in order to heal.

There are two types of inflammation: acute inflammation, which is localized and less severe, and chronic inflammation, which develops when the pathogen causing the acute inflammation is not eradicated or destroyed. After that, it develops into an auto-immune condition that targets healthy, normal host cells, leading to an illness. Chronic inflammation can also eventually lead to rheumatoid arthritis and in some cases, cancers as well, The biological complexity of chronic inflammation, with multiple cell types. such as macrophages and T cells, and cytokines, such as tumor necrosis factor (TNF), No anti-inflammatory therapy cures a majority of patients with a disease in which inflammation plays a major role, such as arthritis.

II. MATERIALS AND METHODS

A. SELECTION OF PLANT

Abutilon indicum Linn was collected from nearby places of Coimbatore, Tamil Nadu for this investigation on the basis of literature review.

Abutilon indicum Linn is a species of flowering plant known by the common name “Thuthi”.

Abutilon indicum is also known as “country mallow”.

It belongs to the family Malvaceae and comes under genius of Abutilon Mill.

B. COLLECTION OF SEEDS

The seeds of Abutilon indicum was collected from the surrounding area of Coimbatore, Tamil Nadu.

The plant was identified and authenticated.

C. PREPARTIONS OF SEED EXTRACT

- The seeds of Abutilon indicum is freshly collected, washed and dried for 7 days.
- Then the seeds are dried in hot air over for 2 hours.
- The seeds are powdered for 10 grams.
- Take 1gm of powder and add 25 ml of sterile distilled water in Erlenmeyer conical flask and kept in rotary shaker for 24 hours.
- The mixture was filtered using filter paper.
- The filtered seed extract was enclosed with aluminum foil to protect from the sunlight, dust and stored at room temperature for further analysis.
- The phytochemical test is performed for seed of Abutilon indicum plant.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

D. PHYTOCHEMICAL ANALYSIS

TEST FOR STERIODS

LIBERMANN BURCHARD TEST:

The extract (0.5ml) was added with 1ml of acetic anhydride and 1ml of concentrated sulphuric acid. Formation of violet to green color indicates the presence of steroids.

TEST FOR FLAVANOIDS

ALKALINE REAGENT TEST:

The extract (0.5ml) was added with few drops of ammonium solution and few drops of concentrated HCL. A yellow coloration indicates the presence of flavonoids.

TEST FOR SAPONINS

FROTH TEST:

The extract (0.5ml) was added with 2.5 ml of distilled water and shaken vigorously. Formation of froth indicates the presence of saponins.

TEST FOR PHENOLS

LEAD ACETATE TEST:

The extract (0.5ml) was added with 0.5ml of lead acetate solution. Formation of precipitate indicates the presence of phenols.

TEST FOR TANNINS

FERRIC CHLORIDE TEST:

The extract (0.5ml) was added with 0.5ml of ferric chloride solution. Formation of brown color indicates the presence of tannins.

TEST FOR AMINO ACIDS

NINHYDRIN TEST:

The extract (0.5ml) was added with 2 to 3 drops of ninhydrin solution and boiled in water bath for 10 minutes. Formations of blue color indicates the presence of amino acids.

TEST FOR PROTEINS

BIURET TEST:

The extract (0.5ml) was added with 0.5ml of 40% sodium hydroxide solution and 1 drop of 1% copper sulphate solution. Formations of violet color indicates the presence of proteins.

TEST FOR CARBOHYTRATES

BARFOED TEST:

The extract (1 ml) was added with 0.5ml of Barfoed's reagent and boiled in water bath for few minutes. Formations of reddish-brown precipitate indicates the presence of carbohydrates.

TEST FOR REDUCING SUGARS

FEHLING'S TEST:

The extract (0.5ml) was added with equal quantities of Fehling solution of A & B and heated. Formation of brick red precipitate indicated the presence of reducing sugars.

E. THIN LAYER CHROMATOGRAPHY

REQUIREMENTS

- TLC plate
- Idoine chamber
- Seed extract

PROCEDURE

- Theextract of 0.1ml were spotted on TLC plate coated on TLC silica gel.
- After spotting the sample TLC sheet was dried and kept in standard chamber containing ethyl acetate: toluene: acetic acid in the ratio of 3:7:0.5 (v/v) as a mobile phase.
- The plate was removed and dried.
- The development of sample spots was finally confirmed by spraying iodine chamber.
- The Rf value was measured by using the formula

$$\text{Rf VALUE} = \frac{\text{DISTANCE TRAVELLED BY SOLUTE}}{\text{DISTANCE TRAVELLED BY SOLVENT}}$$

E. PREPARATION OF SILVER NANOPARTICLES

REQUIREMENTS

- Seed extract
- Distilled water
- $AgNo_3$
- Beaker
- Mechanical stirrer

PROCEDURE

- Add 1.698gm of $AgNo_3$ with 10 ml of distilled water and continuously stirred by mechanical stirrer.
- The seed extract was divided into control (4ml) and sample(10ml).
- Then 10 ml of sample was added slowly to the $AgNo_3$ and kept in dark place for 48 hours.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

- A colorless solution was turned into reddish brown color which indicates the presence of nanoparticles.
- Then subjected for UV- Visible spectrophotometric analysis.
- The prepared silver nanoparticles were then analyzed by FTIR and SEM methods.

CHARATERIZATION OF NANOPARTICLES

UV –VIS Spectrophotometric Analysis

The synthesized sample was examined under UV Visible spectrophotometer – Labtronics LT291.

The sample were scanned in the wavelength ranging from 300-600 nm and the characteristic peaks were detected by keeping distilled water as blank.

FTIR

FTIR study was done for the identification of the functional group which is present in the synthesized nanoparticle.

Using Shimadzu instrument from 4000^{cm-1} to 400^{cm-1} scanning was done and finalized the compound.

SEM

A scanning electron microscope (ZEISS) was used to study the morphology and size of synthesized nanoparticle.

ANTIBACTERIAL ACTIVITY

- The agar well diffusion method was used to study the antibacterial activity of the sample.
- 24 hours old culture of (70µl cultures) E. coli, S. aureus, and S. typhi were taken and spread on the Mueller Hinton agar plates to cultivate a uniform microbial growth on plates.
- The Mueller Hinton Agar was taken in the conical flask.
- That it was wrapped with covering papers for the prevention of enter of water into the flask.
- The non- absorbent cotton is used for cleaning the conical flask.
- MUELLER HINTON AGAR PLATES- 39g of Mueller Hinton agar was dissolved in 1000 ml of distilled water and sterilized under autoclave at $121^{o}C$ for 15 minutes.
- Followed by wells were made with crock borer and the samples were added to the respective wells along with negative (DMSO) and positive control (ampicillin-AMP-10mcg).
- Finally, the petri dishes were incubated for 24 h at 37 °C.
- In order to evaluate the antibacterial activity of the samples, the diameter of the inhibition zone was measured and noted.

ESTIMATION OF TOTAL FLAVONOIDS CONTENT:

- Take 1ml of extract and add 0.1 ml of 10% $AlCl_3$.
- Add 0.1 ml of 1M potassium sodium tartrate.
- Add 2.8 ml of distilled water and incubate at room temperature for 30 minutes determined against 415nm.

ANTI INFLAMMATORY ACTIVITY

Diclofenac method:

- The in-vitro protease inhibition assay was carried out for the aqueous extract, with diclofenac sodium as a standard.
- For the reaction mixture of 2.0 ml consisting of 250 µl of trypsin & 1.0 ml 25 mm Tris-HCl buffer (pH 7.4) and 1.0 mL of an aqueous solution were added accordingly.
- The mixture was incubated at 37°C for 5 minutes. 1.0 ml of 0.8% (w/v) casein was added and the mixture was incubated for 20 minutes.
- 2.0 ml of 70% (v/v) perchloric acid was added and the cloudy suspension was centrifuged at 6000 rpm for 5 minutes, and the absorbance of the supernatant (protein hydrolyzed) was determined at 280 nm against the buffer as a blank.
- The percentage inhibition of proteinase inhibitory activity was calculated according to the formula:

Percentage proteinase inhibitory action = (AB −AS) ×100/AB

Where;

AB- Absorbance blank

AS- Absorbance sample

Trypsin Method:

- Take 1ml of sample and add 0.06 mg of trypsin and 1 ml of 20mm Tris HCl.
- Mixed well and incubated at $37^{o}c$ for 5 minutes.
- Add 1 ml of 0.8% casein solution.
- Incubate for20 minutes and add 2 ml of 70% perchloric acid.
- Centrifuge 5000 rpm for5 minutes and collect the super Nant was determined at 280nm.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

- The percentage inhibition of proteinase inhibitory activity was calculated according to the formula:

Percentage proteinase inhibitory action = (AB −AS) ×100/AB

Where;

AB- Absorbance blank

AS- Absorbance sample

III. RESULTS AND DISCUSSION

1. PHYTOCHEMICAL ANALYSIS:

The Phytochemical analysis of aqueous seed extract of Abutilon indicum clearly shows the presence of several important phytochemicals.

S. NO.	TEST	OBSERVATION	RESULT
1.	**Steroids:** Liberman Burchard test	Violet to green color is obtained	Presence of steroids
2.	**Flavonoids:** Alkaline reagent test	A yellow color is obtained	Presence of flavonoids
3.	**Saponins:** Froth test	Froth is observed	Presence of saponins
4.	**Phenols:** Lead acetate test	Precipitate is observed	Presence of phenols
5.	**Tannins:** Ferric chloride test	Brown color is obtained	Presence of tannins
6.	**Amino acids:** Ninhydrin test	Blue color is obtained	Presence of amino acids
7.	**Proteins:** Biuret test	Violet color is obtained	Presence of proteins
8.	**Carbohydrates:** Barfoed test	Reddish brown precipitate is obtained	Presence of carbohydrates
9.	**Reducing sugars:** Fehling's test	Brick red precipitate is obtained	Presence of reducing sugars

TLC STUDY OF ABUTILON INDICUM

TLC study of the aqueous seed extract of Abutilon indicum (L.) is given below and theSolvent system in the ratio of ethyl acetate: toluene: acetic acid (3:7:0.5v/v)

Distance travelled by solute = 3 cm

Distance travelled by solvent = 7 cm

$$\text{Rf value} = \frac{\text{Distance travelled by solute}}{\text{Distance travelled by solvent}} = 0.42$$

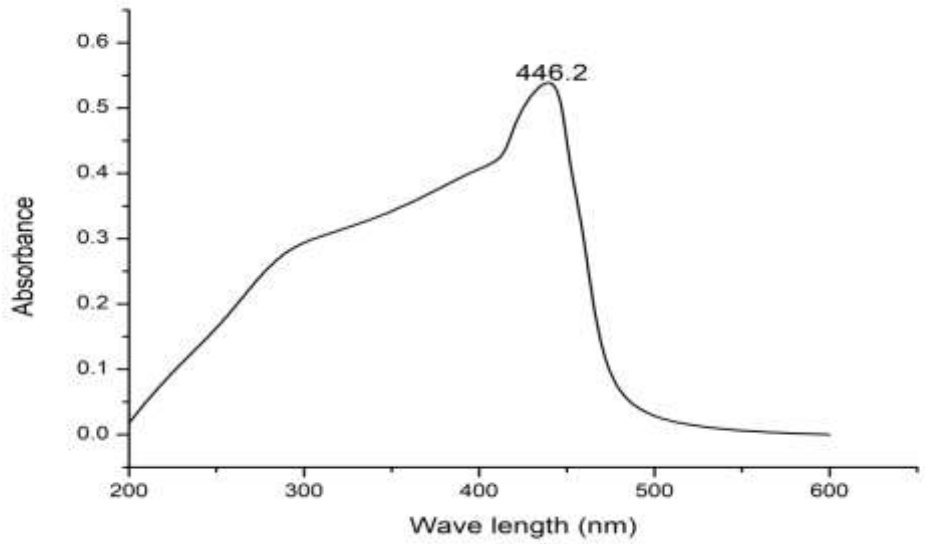
Rf value = 0.42

Aqueous seed extract of Abutilon indicum matches with the flavonoid standard. Hence, confirms the presence of flavonoid.

CHARACTERIZATION OF SILVER NANOPARTICLES OF ABUTILON INDICUM.

A. **UV Visible spectrophotometric analysis:**

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

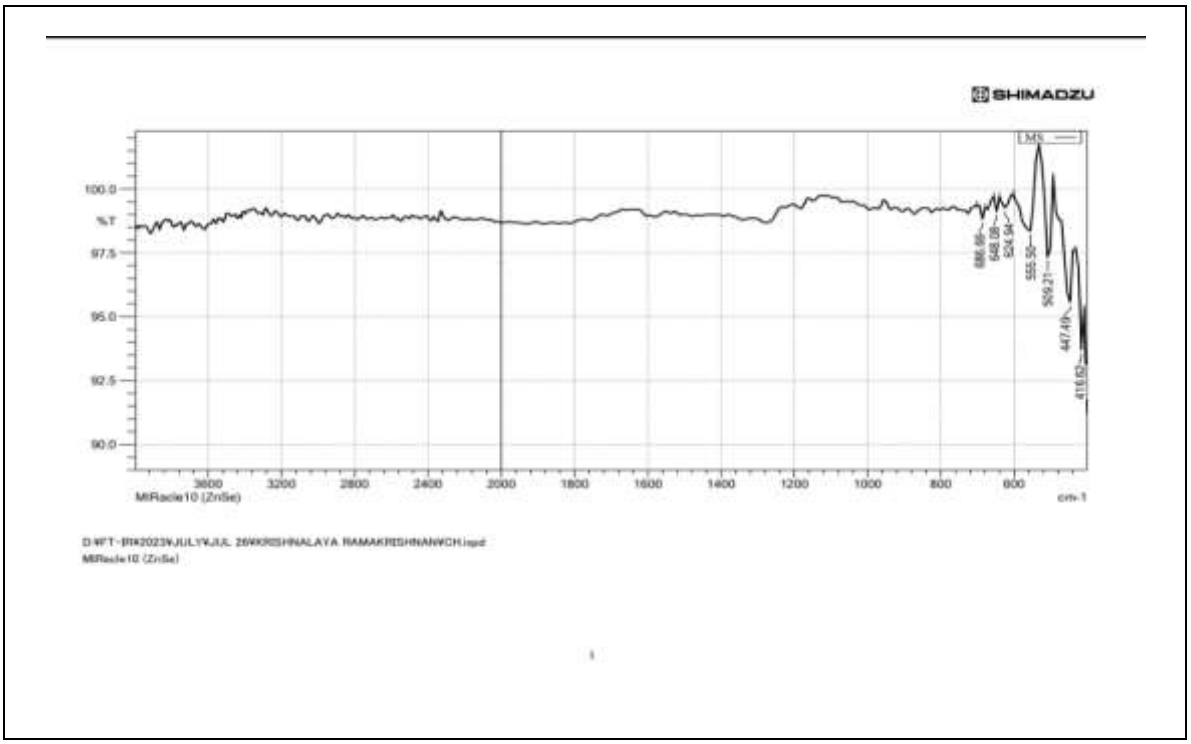


UV-VISIBLE SPECTROPHOTOMETRIC ANALYSIS

λ max of Abutilon indicum seed scanned at range 200 to 600nm and absorbance at **446.2nm.**

B. FTIR:

FOR SEED EXTRACT:



FTIR FOR SEED EXTRACT

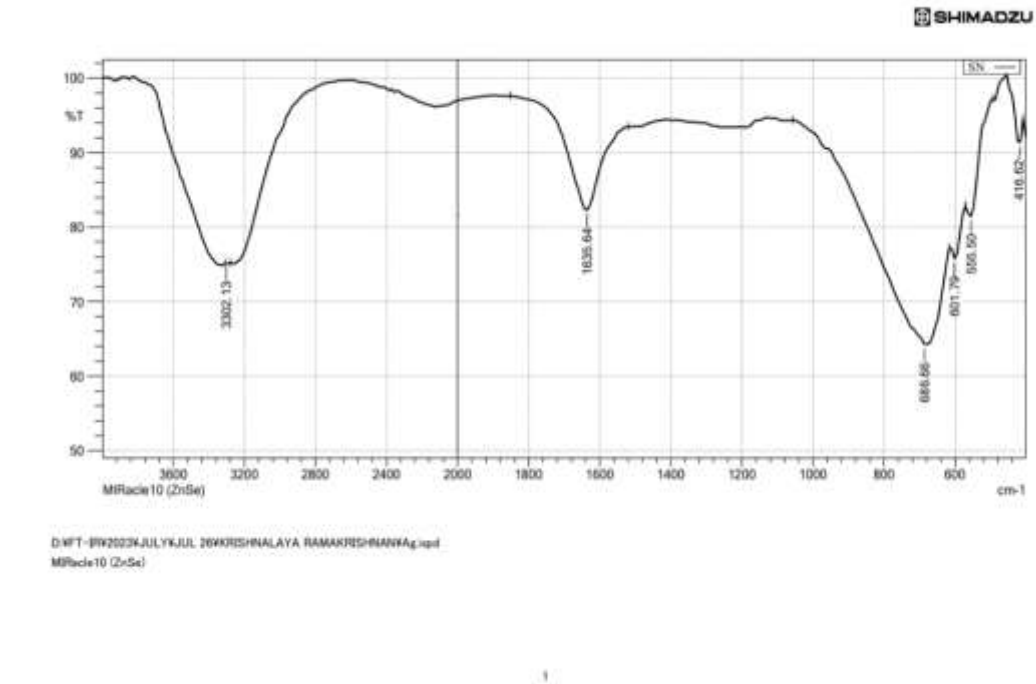
International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

FREQUENCY (cm^{-1})	FUNCTIONAL GROUP	INTENSITY
686.66	C- Cl	Strong
648.08	C-Cl	Strong
624. 94	C-Cl	Strong
555. 50	C-Br	Strong
509.21	C-Br	Strong
447.49	C- I	Strong
416.62	C-I	Strong

FTIR FOR SEED EXTRACT

The functional groups present in the seed extract of Abutilon indicumare carbon chloride, carbon bromide, carbon iodide with strong intensity.

FOR SEED SILVER NANOPARTICLES:



FTIR FOR SEED SILVER NANOPARTICLES

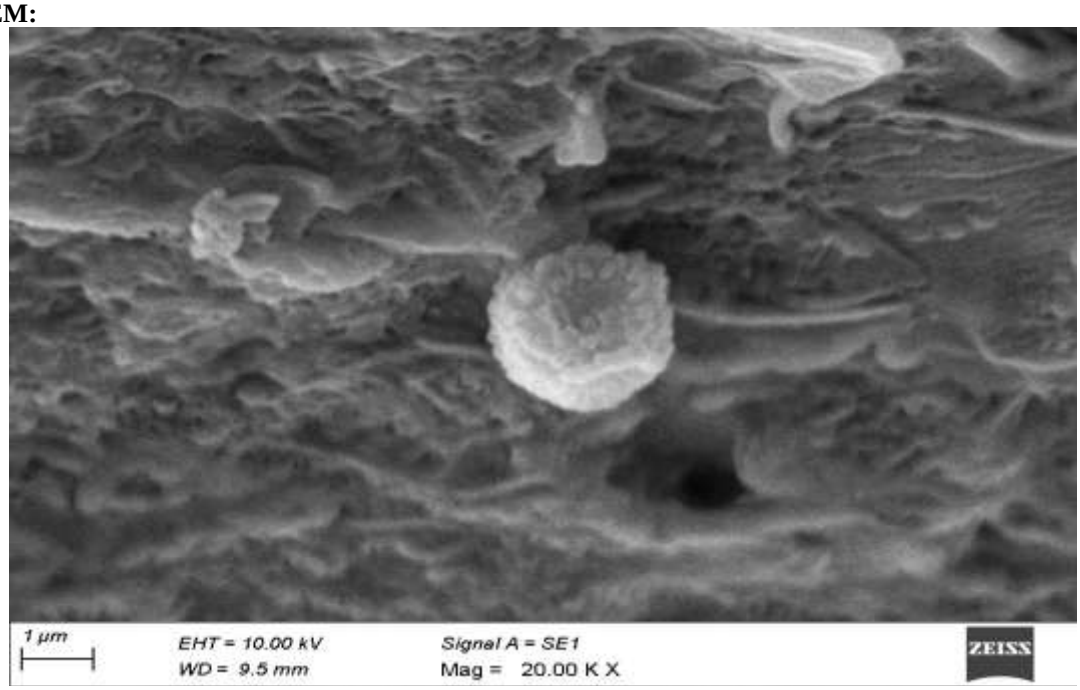
International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

FREQUENCY (cm^{-1})	FUNCTIONAL GROUP	INTENSITY
3302.13	Alcohol OH stretch	Strong
1635.64	C= C alkene	Weak
686.66	C- Cl	Strong
601.79	C-Cl	Strong
555.50	C- Br	Strong
416.62	C- I	Strong

FTIR FOR SEED SILVER NANOPARTICLES

The functional groups present in seed silver nanoparticles of Abutilon indicum are alcohol, alkenes, carbon chloride, carbon bromide, carbon iodide with strong and weak intensity.

C. SEM:



SEM FOR SEED EXTRACT

The green synthesis of silver nanoparticles was demonstrated by using SEM. This SEM image confirmed that the metal particles are present in nano size. The SEM micrograph of synthesized silver nanoparticles was magnified in 1µm and 9.5 nm wide at an accelerated voltage of 10kV and the particles were round and linear shaped with an average diameter of 90nm-186nm. The SEM image show small scattered structure. The silver nanoparticles shape and size were photographed by using SEM.

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

4.ANTIBACTERIAL ACTIVITY:

ESCHERCHIA COLI

SALMONELLA TYPHI

STAPHYLOCOCCUS AUREUS

ANTIBACTERIAL ACTIVITY

Antibacterial activity of the seeds of Abutilon indicum against bacterial pathogens by agar diffusion method

NAME OF ORGANISM	SAMPLE	ZONE OF INHIBITION (in mm)		
		SNP	DMSO	DISC/ nm
E. Coli	14	15	NIL	NIL
S. Aureus	21	26	NIL	18
S. Typhi	14	26	NIL	19

International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781

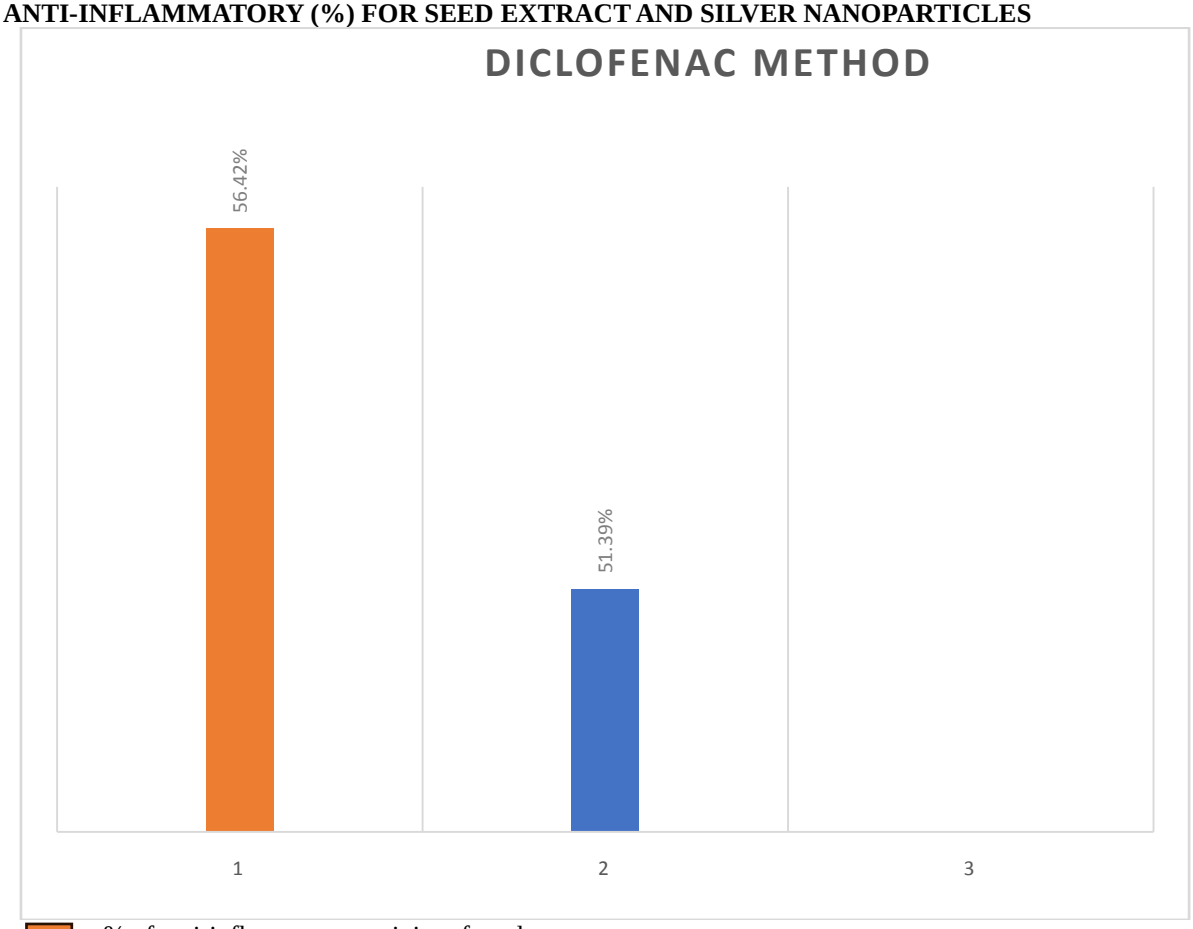
ANTIBACTERIAL ACTIVITY

1. ANTI- INFLAMMATORY ACTIVITY

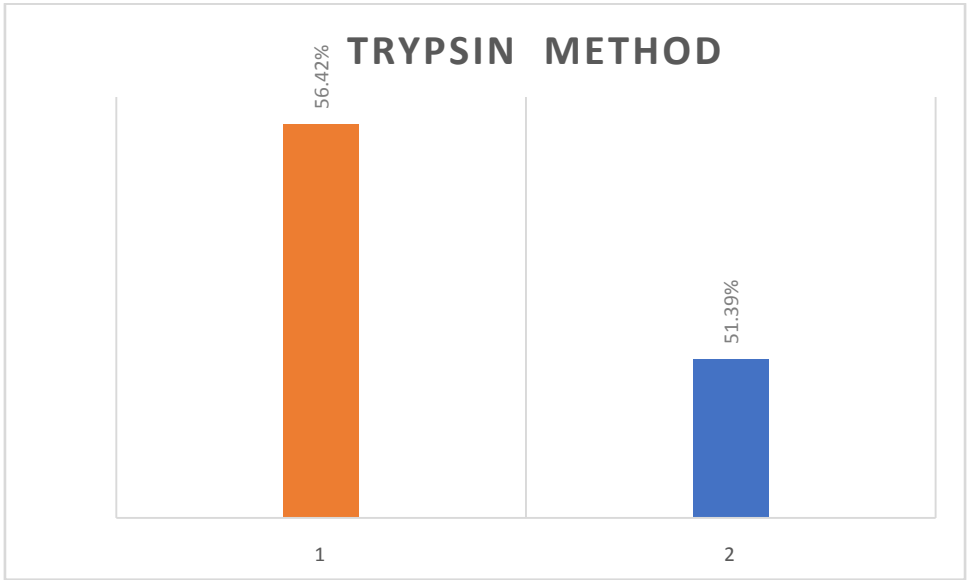
ANTI-INFLAMMATORY ACTIVITY (%) OF SEED EXTRACT AND SEED SILVER NANOPARTICLES

OPTICAL DENSITY (OD)	BLANK	STANDARD	SEED EXTRACT	SEED $AgNo_3$	ANTI- INFLAMMATORY ACTIVITY (%)	
					SEED EXTRACT	SEED $AgNo_3$
DICLOFENAC	0	0.382	0.173	0.106	54.71%	72.25%
TRYPSIN	0	0.179	0.078	0.087	56.42%	51.39%

ANTI-INFLAMMATORY (%) FOR SEED EXTRACT AND SILVER NANOPARTICLES



International Journal of Pharmaceutical Research and Applications
Volume 8, Issue 6 Nov-Dec 2023, pp: 2448-2461 www.ijprajournal.com ISSN: 2249-7781



% of anti-inflammatory activity of seed extract

% of anti-inflammatory activity of seed nanoparticles

ANTI-INFLAMMATORY ACTIVITY

IV. SUMMARY AND CONCLUSION

The aim of the present study was to find out the antibacterial and anti-inflammatory activities of prepared silver nanoparticles of aqueous seed extract of Abutilon indicum. Extracts derived from Abutilon indicumpossess carbohydrates, steroids, glycosides, flavonoids, tannins and phenolic compounds and these phytoconstituents were reported to have various biological activities such as antibacterial and anti-inflammatory etc.,

In the present study, the prepared aqueous extract and the silver nanoparticles of the Abutilon indicum showed significant antibacterial and anti-inflammatory activities the selected methods. However, the silver nanoparticles have showed a better activity than the extract and lesser than the standard.

In conclusion, the present study has been completed as per the aim and plan proposed. The antibacterial and anti-inflammatory activities have been done by using standard methods too.

BIBLIOGRAPHY

[1]. Alexis Nzilla et al., 2022. Biogenic synthesis and characterization of chitosan-CuO nanocomposite and evaluation of antibacterial activity against gram positive and gram-negative bacteria. Polymers14: 1-20.

[2]. Yogesh et al.,2020. Antibacterial activity of Abutilon indicum against Datura innoxia on disease causing bacteria. International Journal of Research and Analytical Review (6): 140-146.

[3]. Thanish Ahamed et al., 2019. Anti-inflammatory activity of Abutilon indicum. Drug invention today 11: 1637-1639.

[4]. Uthaya Chandirika et al.,2018. Biosynthesis and characterization of silver nanoparticles using leaf extract of Abutilon indicum. Global Journal of Biotechnology and Biochemistry 13 (1): 7-11.

[5]. Rajeshwari et al., 2018. Medicinal properties of Abutilon indicum. International Journal of Research in Phytochemical and Pharmacological Sciences 1: 1-4.

[6]. Nithya Tharani et al.,2018. Phytochemical analysis of seed extract of Abutilon indicum. International Journal of Creative Research Thoughts 6:447-450.

[7]. Sevarkodiyone et al.,2018.Medicinal properties of Abutilon indicum. International Journal of Research in Phytochemical and Pharmacological Sciences 1: 1-4.

[8]. Jannathulferdioz et al., 2017.antibacterial activity of Abutilon indicum. Asian

Journal of Pharmaceutical and Clinical Research 10:80-81.

[9]. Alexandrina nuta et al.,2016. green synthesis of silver nanoparticles using plat extracts. Chemical science 10: 188- 193.

[10]. Achika et al., 2016. Phytochemical screening and antimicrobial studies. Ind chem 2: 113.

[11]. Thiruvengadam et al., 2016. Plant mediated of silver nanoparticles. Nanoscale research letters.no, 11: 40-54.

[12]. Abbas et al., 2016. Antioxidant, cytotoxic and antimicrobial activities of crude extract of Bergenia ciliata. Future Journal of Pharmaceutical Sciences 6: 320- 344.

[13]. Nagati et al., 2015. Green synthesis of silver nanoparticles using leaf extract of medicinally potent plant Saraca indica: a novel study, appl. nanoscience 6: 368-355.

[14]. Roy et al., 2015. Plant mediated green synthesis of silver nanoparticles- a review. International Journal of plant Biology & Research 3: 1044-1055.

[15]. KoumaraVeloukailasam et al., 2015. Abutilon indicum L (Malvaceae)-medicinal potential review. Pharmacognosy Journal,7 (6);330- 332.

[16]. Chauhan et al., 2015. Ethnomedicinal uses and phytochemical of Abutilon indicumL: an overview. Journal of Pharmacognosy and Phytochemistry 3 (5):66- 72.

[17]. Logeshwari et al., 2015. Synthesis of silver nanoparticles using plant extracts and analysis of their antimicrobial property. Journal of Saudi Chemical Society 19: 311-317.

[18]. Linga Rao et al., 2015. Evaluation of antimicrobial efficacy and silver nanoparticles. Appl. Nanoscience 5: 827-835.

[19]. Sekar et al., 2015. Phytochemical analyses and antibacterial activity of Abutilon indicum (L.) sweet. Journal of Chemical and Pharmaceutical Research 7(12): 524-530.

[20]. Chandrasekaran et al., 2015. Antibacterial activity of Abutilon indicum. J. Med. Herbs. Ethnomed.1(1): 50-58.