A REVIEW ON INDIAN TRIBAL PLANTS AND THEIR BIOGENIC PROPERTIES

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ABSTRACT

Green synthesis of silver nanoparticles (AgNPs) is considered to be nature-friendly and risk-free to the ecosystem. India is copious in biodiversity; the traditional medicine consists of the plant as a major component. The tribal people who live in the rural region are entirely dependent on the tribal plants for their medical emergencies. These tribal plants have attracted the modern drug industry to develop drugs which are economical with minimal side-effects. The present study focuses on the tribal plants such as Aegle marmelos, Andrographis paniculata, Acacia arabica, Ficus religiosa, Cassia auriculata, Punica granatum, and Tinospora cordifolia used by the Bhilla, Irular, Dimasa, Paliyan Sholaga, and Dantewada tribes of India for their antimicrobial activity. Since these tribal plants are well known for its medicinal properties, the AgNPs synthesized from these plants were found to have enhanced antimicrobial activity than the pure plant extract.

Keywords: Green synthesis, Silver nanoparticles, Tribal plants, Antimicrobial.

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INTRODUCTION

Ancient Greeks, Romans, and Egyptians considered silver has one of the potent agents and used it to preserve food and water due to its excellent antimicrobial properties. Hence, it was the third metal used by them next to gold and copper [1]. In addition, silver has been used in the traditional Ayurvedic medicine around 2000 years ago as silver ash, its colloidal and suspended form to restore the body. Even silver nitrate was used in medicine as wound healing, counterirritant, purgative, and also to treat brain infections [1, 2]. Rajata, another name for silver during ancient Acharyas was used from the time of Charaka and is included in Charakra Samhita, a scheduled book of Ayurveda. Due to its clear, lustrous properties and due to its genuine properties such as bright whitening of metal during heating or cutting without any formation of furrows and ridges makes it valuable in therapeutics [3]. Rajata Bhasma was found to be effective in the enhancement of immune system due to its high solubility, absorbance, and catalyzing effect on the body [3, 4].

Nanotechnology is important in modern research due to its nano-sized particle ranging from 1 to 100 nm and its wide range of applications in medicine [5, 6] as thaneranotic agents [7], in delivering ocular drugs to the target site in ophthalmology [8], as nanoparticle-assisted drug delivery to the skin as it can act as route for delivery of local and systematic drug as anti-inflammatory drugs, anti-phoagocytosing drugs, antioxidants, antimicrobial agents, and nanodots are used [11]. In food industry, nanoparticles are employed to detect contaminants or microbes present in packed foods and also to prevent obesity in the form of nanofoods [12]. Nano-enabled water and wastewater systems can increase the treatment efficiency of alternative water resources [13]. It is also used in the textile industry especially due to its high durability for fabrics, excellent protection from ultraviolet rays, anti-static property and has good resistance to wrinkles of cotton and silk [14]. In the agricultural field, nanomaterials can be used to improve the efficiency of seed germination, to protect the plants by detecting the pathogens and pesticide residue [15]. Also used in electronic storage systems [16].

Metallic nanoparticles, in the form of colloids or sols, are used for ornamental decorations by the middle ages [17] are of noble metal nanoparticles (NMNs) and non-NMNs. Noble metals include ruthenium (Ru), rhodium (Rh), palladium (Pd), silver (Ag), osmium (Os), iridium (Ir), platinum (Pt), and gold (Au) where these metals are inert and hence resistant to corrosion unlike non-noble metal [18]. Among these metals gold (Au), silver (Ag), and platinum (Pt) has unique and adjustable electrical, optical, structural parameters (size, shape, composition, surface) and chemical properties, high surface area, good stability, and good biocompatibility. Since NMNs consists of better selectivity and activity than transition metals, it can be used in many environmental applications [19, 20]. Non-noble metals can be used along with noble metal to synthesize bimetallic nanoparticle which has high catalytic activity [21] and has the potential for adapting the electron distribution of alloy nanoparticles. Non-noble metals also have some less expensive metals such as Fe, Co, Ni, and Cu has been developed for the dehydrogenation of ammonia borane [22].

Silver as a noble metal has its origin from ancient time has rich esthetic and medicinal values, where it is known by different names such as Dutch (zilver), German (Silber), and Anglo-Saxon (seolfor), Greek (Argyros), Latin (argentum), Italian (Argento), French (argent) and Spanish (Plata). In addition, silver is used in bone prostheses, ophthalmic surgery, veterinary medicine, desalination of seawater, and as active adsorbent [16]. It is believed that colloidal form of silver has the high germicidal activity such as antibacterial, antifungal, antiseptics, and no toxicity against humans [23]. Due to its antifungal property, silver nanoparticles (AgNPs) are extensively used to prevent biofouling on the surface of the cathode [24]. AgNPs has gained boundless interest due to their unique properties such as chemical stability [25, 26], good conductivity [27, 28], catalytic [29] and most important antibacterial [30, 16] antifungal [31], antiviral, [32-34] and anti-inflammatory activities [35-37]. In addition, silver has occupied a major place in consumer products where some of the products are toothpaste, as an engineered nanomaterial get exposed to environment and makes available for humans through drinking water, humidifiers, and through soil [38,39]. It is used in clothing to protect from body odor, medicines such as acne creams and sulfadiazine creams, cosmetics, baby pacifiers, washing machine, and electronic gadgets [40]. The AgNPs used in industry for developing commercial products found to contain AgNP in their wastewater and it was found that its presence does not affect the chemical oxygen demand removal [41].
| S. No | Tribal plant name | Part used | Characterization | Inference |
|-------|-------------------|-----------|------------------|-----------|
| 1     | A. marmelos      | Leaf      | UV- 420 nm; XRD-fcc; FTIR | Antimicrobial action against *B. subtilis* and *P. aeruginosa* |
|       |                   | Fruit     | UV- 421 nm; XRD-24 nm (fcc); TEM- 18–30 nm; HRTEM- 24 nm; CV analyses- peaks at –0.31 and 0.10V | Antibacterial activity against *E. coli*, *B. cereus*, *S. aureus*, *P. aeruginosa* was carried on and the maximum antibacterial activity was observed against *B. cereus* |
| 2     | A. paniculata    | Leaf      | UV- 410 nm; XRD-K; SEM- 35–55 nm, spherical; EDX | Antiplasmodium activity against *P. falciparum* revealed lowest inhibition rate at IC50, 25 µg/ml (20%) and highest inhibition at 100 µg/ml (83%) |
|       |                   | Whole plant | UV-430 nm; SEM- 40–80 nm, spherical; TEM-14–26 nm; FTIR | Antibacterial activity against *S. aureus*, *P. aeruginosa* and *E. coli* |
|       |                   |           |                 | Antifungal activity against A. niger and not on A. flavus |
| 3     | A. arabica       | Gum       | UV-462 nm; SEM- spherical, 35 nm; XRD- crystalline; SAED= 94%; ICP-AES | AgNPs synthesized were effective against both *B. subtilis* and *P. aeruginosa*. Where, AgNPs is more potent against Gram-positive than Gram-negative bacteria |
|       |                   | Bark      | UV-430 nm; TEM-40–55 nm; XRD- Fcc, 45 nm; SEM- spherical, 40–50 nm; FTIR; EDX | Antimicrobial activity against *S. aureus* and *P. aeruginosa*, which showed potential antibacterial activity against *S. aureus* |
| 4     | F. religiosa     | Leaf      | UV-430 nm; SEM- spherical, 5–50 nm; XRD- fcc, 4 nm; AFM-W=280 nm, T=4 nm; EDX; FTIR | FESEM and AFM confirms the particles are polydispersed. The reduction of silver ions and stabilization of the AgNPs was due to the participation of quinones and flavonoids |
|       |                   | Latex     | UV-422 nm | AgNP were collected from latex of 6 different plant where among them *F. religiosa* ranks 3rd depending on the size of AgNP |
| 5     | C. auriculata    | Leaf      | UV-450nm; XRD-Rcc, 20.84 nm; SEM-spherical, 20–40 nm; FTIR | The synthesized AgNPs are stable where the control of shape and size of AgNP is easy due to selection of plant leaf extract |
|       |                   | Flower    | UV-436nm; TEM-circular distribution, spherical; XRD: 50–70 nm, Fcc; FTIR | The synthesized AgNP exhibited antibacterial activity against *S. typhi*, *K. pneumonia*, *E. faecalis* and *E. coli*, except *S. aureus* |
| 6     | P. granatum      | Seed      | UV-472 nm; XRD- Fcc, 10–30 nm; SEM-nano flower and spherical, 10–30 nm; EDX; FTIR | AgNPs produced showed effective antibacterial activity against *B. cereus* with 14 mm zone of inhibition than *Pseudomonas*, *S. albus*, Proteus |
|       |                   | Fruit peel | UV-448 nm; XRD- Fcc, 15–35 nm; SEM-nanoflower and spherical, 10–30 nm; EDX; FTIR | AgNP produced is effective against *B. cereus* with 17 mm inhibition zone than *Pseudomonas*, *S. albus*, Proteus |
|       |                   | Leaf      | UV-400 nm | Antimicrobial activity against *B. cereus*, *Pseudomonas*, *S. aureus* were studied |
|       |                   | Flower    | UV-450 nm | Antibacterial activity against *B. cereus*, *Pseudomonas*, and *S. aureus* were studied. Where Staphylococcus showed maximum inhibition zone |
|       |                   | Fruit     | UV-490 nm | Antibacterial activity against *B. cereus*, *Pseudomonas*, and *S. aureus* were studied |

(contd...)
Table 1: (continued)

| S. No | Tribal plant name | Part used | Characterization | Inference |
|-------|-------------------|-----------|------------------|-----------|
| 7.    | T. cordifolia     | Leaf      | UV- 430 nm; XRD- 24 nm, fcc; SEM- spherical; EDX; FTIR | The AgNPs produced from the plant showed high antibacterial activity against both Gram-positive and Gram-negative bacteria than the pure plant extract. The AgNPs produced showed high activity against Staphylococcus sp. and Klebsiella sp. than Bacillus sp. T. cordifolia acts as very good multi drug resistant agent against P. aeruginosa. |

UV-Vis: Ultraviolet-visible, FTIR: Fourier transforms infrared, EDX: Energy dispersive X-ray, SEM: Scanning electron microscopy, TEM: Transmission electron microscopy, XRD: X-ray diffractometer, FCC: Face-centered cubic, CV: Cyclic voltammetry, HRTEM: High-resolution transmission electron microscopy, SAED: Selective area electron diffraction, ICP-AES: Inductively coupled plasma atomic emission spectroscopy, AFM: Atomic force microscopy, W: Width, T: Thickness, PCA: Principal component analysis, AgNPs: Silver nanoparticles, A. marmelos: Aegle marmelos, A. paniculata: Andrographis paniculata, A. Arabica: Acacia Arabica, F. religiosa: Ficus religiosa, C. auriculata: Cassia auriculata, P. granatum: Punica granatum, T. cordifolia: Tinospora cordifolia, B. subtilis: Bacillus subtilis, P. aeruginosa: Pseudomonas aeruginosa, E. coli: Escherichia coli, B. cereus: Bacillus cereus, S. aureus: Staphylococcus aureus, P. falciiparum: Plasmodium falciiparum, A. flavus: Aspergillus flavus, A. niger: Aspergillus niger, S. typhi: Salmonella typhi, K. pneumonia: Klebsiella pneumonia, E. faecalis: Enterococcus faecalis, S. albicus: Staphylococcus albicus, C. albicans: Candida albicans, P. vulgaris: Pseudomonas vulgaris

SYNTHESIS OF AGNPS

AgNPs can be synthesized by several methods. Among the huge number of methods available in physical method evaporation-condensation and laser ablation approaches are commonly used to produce large quantities of AgNPs. However, this method is not widely used due to its time-consuming procedure, expensive equipment, and high operating conditions [5]. In the case of chemical synthesis of AgNPs, many methods are available such as chemical reduction method, polyol method, radiolytic method and much more. In comparison with the physical method, by chemical method AgNPs can be produced at low cost, simple equipment and in high yield. The three major components involved in the chemical synthesis process are the metal precursor, reducing agents (organic and inorganic), stabilizing, or capping agents [42,43]. These components used are of toxic and hazardous chemicals and they contain potential environmental risks [42].

Whereas the green synthesis method is a quick process, economic, safe to environment, and humans [44]. Some of the green synthesis methods involve polysaccharide method, irradiation method, biological method, polyoxometalates method, and tollens method. The biological method is mostly used one where its sources consist of plants, algae, diatoms, bacteria, yeast, fungi, and human cells [44,45]. Plant-mediated synthesis is an attractive method for nanoparticle synthesis and considered as the best option among other biological methods due to its effective inhibitory action against extensive drug resistance microbes [46]. In addition, nanoparticles can be synthesized at ambient temperature, low cost, short production time, and in large volume [44]. Here, due to the presence of phytochemicals, the silver nitrate will be reduced to AgNPs where the biomolecules present in it act as both reducing and capping agent, making the process easy and reliable [47,48].

TRIBAL PLANTS

There are various tribal communities worldwide who lives as scattered and small groups in the plains, forest, hills, and distant areas from the mainstream population. Their social, cultural, and economic patterns differ from one region to another. The largest tribal population was found in India which comprises 8.6% of the total population of the country. India consists of 29 states and 7 union territories where the tribal population of India belongs to three races, namely, the proto-australoids, the mongoloids, and the negritos. In addition, the Indian tribes have been denoted by different names such as Vanajati (caste of the forest), Vanavasi (inhabitants of forest), Pahari (hill dwellers), Adimjati (primitive people), Girijan (hill dwellers), Amavichit Jan Jati (scheduled tribe) [49-51].

These indigenous people maintain a close relationship between the man and the surroundings and hence found to have great knowledge on the use of plants to cure various diseases, where nearly 6500 plants were used by the traditional healers in Southeast Asia. The documentation of the tribal plants and its traditional uses as medicine has conquered the modern drug industry, where the inborn antimicrobial activity of the tribal plant can be enhanced by its respective synthesis of AgNPs [52-54]. These tribal plants can also act as a potent source to develop anticancerous and antibiological drugs with low or no side effects for the user [55].

Aegle marmelos

1. Kingdom: Plantae
2. Family: Rutaceae
3. Genus: Aegle
4. Species: A. marmelos.

A. marmelos is a subtropical species which can adopt a wide range of habitat and hence can be cultivated worldwide. It is native to India and the tree grows wild in dry forest of central and southern India, Burma, Pakistan and Bangladesh, it is also grown in Nepal, Myanmar, Tibet, Ceylon, Vietnam, Laos, Cambodia, Sri Lanka, Thailand, Indonesia, Malaysia, Surinam, Trinidad and Northern Luzon of Philippine Islands. A. marmelos is a slow-growing, medium-sized tree which can grow up to 12–15 m tall. It has a short trunk, and its bark is thick, soft, flaking, and spreading. The wood of this tree is used as carts and for construction purposes. From the wounded branches, the gum is discharged slowly which tastes sweet first and irritating to the throat later. This gum is used as adhesives. The leaves are deciduous, arranged in an alternate fashion where 4–10 cm long and 2–5 cm wide oval, pointed, shallow-toothed leaflets are present. These leaves cause sterility in women and its extract consists of insecticidal activity against brown planthopper.

The tree produces fragrant flowers in the month of April and May with green outside and yellow inside along the young branches. The fruits produced were found to be edible and have different shapes such as oval, flat, spherical, oblong, and pear grows up to 5–20 cm in diameter. The fruit has thin hardy shell gray-green outside where it takes 10–11 months to ripen and appearsellowish in color [56,57].
The Bael tree is considered as one of the most sacred trees of India [58]. *A. marmelos* is used by the Bhilla tribe of Maharashtriatotreat snake bite. The snake-bitten part is treated by applying the leaf juice and in case of nausea, squeezed leaves are swallowed [59]. The chemical constituents present in the different parts of this tree are alkaloids, coumarins and steroid [58]. Due to the presence of various phytochemical constituents, it is used in Ayurveda and in ethnomedicine since it has potent antibacterial, antifungal, antiviral, antioxidant, antitumours, antiallergic, antispermatogenic, anti-diabetic, anti-inflammatory, and antihypertensive properties [58,60,61].

**Andrographis paniculata**

1. Kingdom: Plantae
2. Family: Acanthaceae
3. Genus: *Andrographis*
4. Species: *A. paniculata*.

*A. paniculata* also known as the king of Bitters is an annual herb cultivated in tropical and sub-tropical Asia, Southeast Asia, India, China, America, West Indies, Bangladesh, Hong Kong, Pakistan, Philippines, Malaysia, Indonesia, and Thailand. *A. paniculata* is an herbaceous plant which grows in moist shady places to a height of 30–110 cm. The stem of this plant is tetragonal in shape with glandular hairs outside. The leaves are green or copper shade arranged in a simple, opposite decussate fashion of 6–10 cm long and width of 3.5–5 cm. The flowers are the complete one, bisexual in nature, hypogynous, pentameric, and in a cymose inflorescence. The three layers in the root are packed together with visible secondary growth. The root and leaf are the major parts used in the traditional medicine [62,63]. The Irular tribe who resides in the Kadambur hills in sathyamangalam forest of Erode district in Tamil Nadu uses the leaf extract of *A. paniculata* for Snakebite, Chicken pox, and Cancer [64]. In addition, this plant is used in the traditional medicine to treat skin infections, respiratory diseases, herps, dysentery, fever, sore throat, lower urinary tract infections, and diabetes and to reduce inflammation. The bitter and cold property of this herb is considered in the traditional Chinese medicine, and hence, it serves as a remedy for acute infections such as tonsillitis, gastroenteritis, pyelonephritis, and pneumonia [65]. The phytochemicals found in the *A. paniculata* are a lot of terpenoids such as diterpenoid lactones and various other compounds like flavonoids such as flavones; xanthones; norrirodoids; and polyphenols. This plant is known for its antimicrobial, anti-inflammatory, anti-allergic, immunostimulant, antidiabetic, antitumours, anti-oxidant, and anti-protozoan activities. It also possesses the ovicidal and larvicidal activity against *Culex quinquefasciatus* and *Aedes aegypti*; anti-inflammatory activity, anti-angiogenic activity, and hepatoprotective and anti-inflammatory activity [65,66].

**Acacia arabica**

1. Kingdom: Plantae
2. Family: Mimosaceae
3. Genus: *Acacia*
4. Species: *A. arabica*.

*A. arabica* is a multipurpose tree, found widely distributed in tropical and sub-tropical regions of India, Sri Lanka, Australia, Africa, and Egypt. *A. arabica* is a perennial tree which usually grows up to 2.5–10 m tall. Thin, dark reddish-brown bark is present with purple-brown branches where the leaves grow up to 30–40 mm long. Golden yellow flowers are present with straight pod, and the seeds are found to be round in shape. The yellow color gum is secreted from the cuts of the bark where its root extract is used in the treatment of jaundice [75]. Phenols, tannins, steroids, alkaloids and flavonoids, Vitamin K, n-cocasanol, methyl oleanolate, lanosterol, stigmastanol, lupen-3-one, β-sitosterol-D-glucoside, phytosterol, albuminoids, caoutchoue, kaempeferol, quercetin, and myricitin, phytosterols, bergapten bapogol, and linoelic acid are the phytochemical constituents of this plant [76]. The presence of various chemical constituents makes the plant to be involved in anti-diabetic, antimicrobial, antiviral, anti-inflammatory, anti-asthmatic, anticonvulsant, parasympathetic modulatory, estrogenic, antitumor, antiallergic, and antihelmintic activities [76-78].

**Cassia auriculata**

1. Kingdom: Plantae
2. Family: Caesalpiniaceae
3. Genus: *Cassia*
4. Species: *C. auriculata*.

*C. auriculata* also known as Tanner's casia is inherent to India and Sri Lanka, and it is prominently found in South India throughout the year. These are ornamental shrubs with yellow colour flowers. Almost all parts of the plant are known for their medicinal values such as astringent properties of the bark, anthelmintic properties of the fruits and leaves, ethnomedicine issues relieving property of seeds, skin diseases relieving property of root, and anti-diabetic property of the flowers [79,80]. The Puliyan tribes of the Sirumalai hills in Southern India used the juice of *C. auriculata* flowers to cure digestion problems in children [81]. Avarai panchangai chooram, an ayurvedic medicine consists of all five parts of the plants such as roots, leaves, flowers, barks and unripe fruits can be used to control diabetes [82]. The phyto-constituents present in *C. auriculata* are alkaloids, tannins, phenoile flavonoids, flavonoids, carbohydrates, proteins, sterol, terpenoids, and cardiac glycosides [83]. The plant is also known for its antimicrobial activity where the whole plant powder along with *Tinospora cordifolia* stem and leaves are mixed with cow's milk, used to treat diarrhea when taken internally. In addition, the flower juice of this plant is taken along with goat milk internally for veneral diseases. Among the other parts of this plant, the leaf and flowers act as a potent antimicrobial agent [84]. Other activities such as antioxidant [85], antipyretic, hepatoprotective, antiprotozoan, anti-oxidative, antibacterial and antihyperglycemic are possessed by this plant [86].

**Punica granatum**

1. Kingdom: Plantae
2. Family: Lythraceae
3. Genus: Punica
4. Species: P. granatum.

P. granatum is found in Iran, Afghanistan, India, Northern Africa, Caucasian, Tunisia, and Southern United States. In India, it is found widely in the Western Himalaya regions. The P. granatum known as the pomegranate is a small tree which can grow from 20 to 30 ft high and found to be deciduous. It consists of red-brown bark with stiff, spiny branches; the leaves are narrow and lance-shaped with glossy in appearance; the flowers are brilliant red in colour and exist on the fruit; the fruits are round in shape around 2-5 in. wide with a prominent calyx at the base, the fruits are edible and takes 5-7 months to mature [87-90].

The sholaga tribes who live in the villages of Bagur in the Kathiri hills of Erode district, Tamil Nadu, India used its buds and fruits as a relief from dysentry [91]. The root and stem barks of this plant have astringent and anthelmintic activities; flowers can stop bleeding; fruits are sweet, sour and act as astringent laxative and diuretic; the seeds have astringent, cardiotonic, and stomachic properties. In the case of tapeworm infection root and stem bark is used; for vomiting, pitta, ophthalmodonya, ulcers, and hydrocele flowers are used. To treat anemia, bronchitis, splenopathy and pectoral diseases fruits are used [92].

The substances such as alkaloids, triterpenoids, steroids, glycosides, saponins, flavonoids, tannins, carbohydrates, resins volatile oils, gums, and Vitamin C make the plant to have great medicinal importance [93,94]. And hence, the plant is considered to have antibacterial activity [95], antifungal activity [96], antioxidant activity [97], anticancer activity and anti-inflammatory activity. In addition, the plant is known as a remedy for osteoarthritis, cardiovascular disease, obesity, neonatal brain injury, Alzheimer’s disease, and male infertility [98,99].

**T. cordifolia**
1. Kingdom: Plantae
2. Family: Menispermaceae
3. Genus: Tinospora
4. Species: T. cordifolia.

*T. cordifolia* is dispersed throughout India, Sri Lanka, Burma, China, tropics of Australia, and Africa [100]. *T. cordifolia* is a large deciduous shrub with large branches and attractive greenish yellow unisexual flowers. This plant is well known as Guduchi has vast applications in ayurvedic medicine [101,102].

The whole plant decoction of this plant is used by the Dantewada tribe of Ghatrattagah to treat rheumatism, urinary problems, heart problems, and fever [103]. The stem is one of the main ingredient in many ayurvedic medicine, where the plant is known for its anti diabetic, anti-allergy, anti parasodic, antileptic, and antidiabetic properties [104]. From the phytochemical analysis, it was found that the leaves of this plant contain 40.8 mg/g total phenolic content which is higher than the stem with 12.8 mg/g. In addition, the presence of other chemical constituents such as alkaloids, terpenoids, steroids, glycosides, saponins, flavonoids, carbohydrates, resins volatile oils, gums, and Vitamin C make the plant to have great medicinal importance [93,94].

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The present documentation reveals that the folk medicine practices of the native tribes. In this present study, different tribal plants used by different tribal communities and the ability of these tribal plants to produce its respective AgNPs with a higher efficacy has been studied. In addition, the biogenic properties of these tribal plants were evaluated. All the tribal plants were found to have innumerable phytochemical constituents especially flavonoids, saponins, tannins, glycosides, steroids, phenols, and terpenoids which contributes for the synthesis of AgNPs from the metal salt, silver nitrate. Hence, this tribal plant-mediated synthesis of AgNPs as nanomedicine is suspected to resolve various difficulties in the pharmacological industries.

**CONCLUSION**

Given synthesis of AgNPs is aboon in the field of nanotechnology which is eco-friendly, cost-effective, and is a rapid process. The present documentation reveals that the folk medicine practices of the native tribes. In this present study, different tribal plants used by different tribal communities and the ability of these tribal plants to produce its respective AgNPs with a higher efficacy has been studied. In addition, the biogenic properties of these tribal plants were evaluated. All the tribal plants were found to have innumerable phytochemical constituents especially flavonoids, saponins, tannins, glycosides, steroids, phenols, and terpenoids which contributes for the synthesis of AgNPs from the metal salt, silver nitrate. Hence, this tribal plant-mediated synthesis of AgNPs as nanomedicine is suspected to resolve various difficulties in the pharmacological industries.

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**AUTHORS CONTRIBUTION**

1. Anju K: The main author of the work is currently doing project on tribal plants and their inborn microbial activities and came up with the structure and model of the manuscript.

2. Anitha Jagadeeshwar I: Researches about the novel tribal plants in and around the area for antimicrobial activities. It promotes a better understanding of the native plants and their inborn therapeutic values. The author has contributed in language correction and in formulating reference session.

3. Vidhya Lakshmi D is a Research scholar at Department of Chemical Engineering, AC Tech, Anna University, Chennai. Her field of interest includes Chemical engineering application in wastewater treatment, solid waste management, Leachate treatment and Management. Formatting of table, font reference has been done by this scholar.

4. Nagendra Gandhi N: Corresponding Author is the project mentor. He is the Professor and Head of Chemical engineering department, ACT Cam pus, Anna University, Chennai. His areas of interest include Extraction, Green Technology, Hydrotherapy, Environmental studies, Mass transfer, separation technologies. He has more than 70 journals published and has presented at many national and international conferences. He has conducted many workshops.

**CONFLICT OF INTEREST**

None declared.

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