SIIC036

SYNTHESIS OF SILVER NANOPARTICLES USING PLANT EXTRACTS

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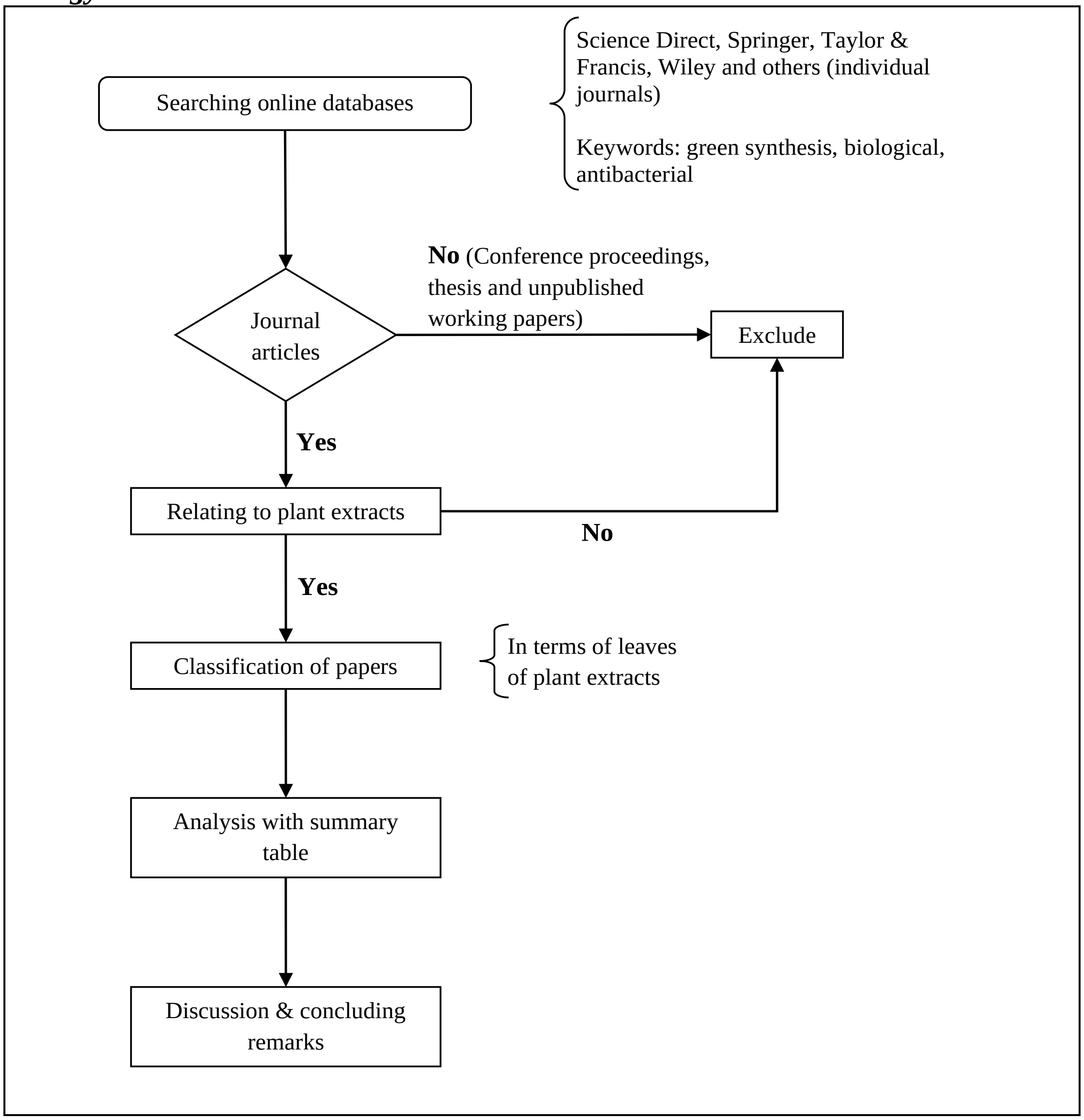
Abstract:
This review is a comprehensive contribution in a field of green synthesis, characterization and antibacterial activity of silver nanoparticles (AgNPs) using various plant sources. Green synthesis of AgNPs is an environmentally friendly synthesis methods which is becoming more and more popular in field of nanotechnology, with the aim is to avoid hazardous byproduct. Other important advantages of green synthesis of AgNPs lies in its cost effective and in the abundance of raw materials. Use of plants in synthesis of AgNPs among all other green method available is preferred due to their various metabolites which not only act as reducing but as stabilizing or capping agents. Characterization of the synthesized AgNPs performed through TEM, SEM and AFM were comparatively analyzed for their size in term of nanometer and their shape. Besides, the clinically significant of the AgNPs conferring the antibacterial activity by studied against some pathogenic gram-positive and gram-negative bacteria and some pathogenic fungus. This can conclude that due to these unique properties, AgNPs will have a key role in many of the nanotechnology-based processes. This review will help researchers to develop novel AgNPs based drugs using green technology.

***Keywords*:**
green synthesis, silver nanoparticles, plant extract, characterization, antibacteria

Objectives:

- To study the physicochemical properties of silver nanoparticles from plant extract
- To study the antibacterial properties of silver nanoparticles from plant extract

Methodology:



Results:

Plant	Reducing and capping agent	Average size (nm)	Shape	Reference
Coptidis rhizome	Leaves extract	15	Spherical	[56]
Chenopodium murale	Leaves extract	40	Spherical	[57]
Tithonia diversifolia	Leaves extract	18	Spherical	[58]
Euphorbia hirta	Leaves extract	45	Spherical	[59]
Salvia spinosa	Leaves extract	5.13	Spherical	[60]
Impatients balsamina	Leaves extract	24	Spherical	[61]
Murraya koenigii	Leaves extract	13	Spherical	[62]
Eucalyptus globulus	Leaves extract	15	Spherical	[63]
Pedalium murex	Leaves extract	50	Spherical	[64]

Cerasus serrulata	Leaves extract	20	Spherical	[65]
Amaranthus gangeticus Linn	Leaves extract	13	Spherical	[66]
Phlomis	Leaves extract	25	Spherical	[67]
Tectona grandis Linn	Leaves extract	27	Spherical	[68]
Origanum majorana	Leaves extract	55	Spherical	[69]
Citrus sinensis	Leaves extract	41	Spherical, Cubical	[69]
Psidium guajava	Leaves extract	30	Spherical	[70]
Putranjiva roxburghii wall	Leaves extract	5.74	Spherical	[71]
Azadirachta indica	Leaves extract	34	Spherical	[72]
Zingiber officinale rhizome	Leaves extract	3.6	Spherical	[73]
Justicia adhatoda	Leaves extract	15	Spherical	[74]

Plant	**Reducing and capping agent**	**Antibacterial Activity**	**Reference**
Coptidis rhizome	Leaves extract	*Escherichia coli, Staphhylococcus aureus*	[56]
Chenopodium murale	Leaves extract	*Staphhylococcus aureus*	[57]
Tithonia diversifolia	Leaves extract	*Escherichia coli, Salmonella typhimurium, Salmonella enterica, Bacillus subtilis*	[58]
Euphorbia hirta	Leaves extract	*Bacillus cereus, Staphhylococcus aureus*	[59]
Salvia spinosa	Leaves extract	*Bacillus subtilis, Bacillus vallismortis, Escherichia coli*	[60]
Impatients balsamina	Leaves extract	*Staphhylococcus aureus, Escherichia coli*	[61]
Murraya koenigii	Leaves extract	*Staphhylococcus aureus, Escherichia coli*	[62]
Eucalyptus globulus	Leaves extract	*Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*	[63]
Pedalium murex	Leaves extract	*Klebsiella pneumoniae, Mariniluteicoccus flavus, Pseudomonas aeruginosa, Bacillus pumilus, Staphylococcus aureus*	[64]
Cerasus serrulata	Leaves extract	*Streptococcus mutans, Staphylococcus aureus*	[65]
Amaranthus gangeticus Linn	Leaves extract	*Bacillus subtilis, Shigelle flexineri,*	[66]
Phlomis	Leaves extract	*Staphyloccocus aureus, Bacillus cereus,*	[67]

		Salmonella typhi, Escherichia coli	
Tectona grandis Linn	Leaves extract	*Escherichia coli, Staphylococcus aureus*	[68]
Origanum majorana	Leaves extract	*Escherichia coli*	[69]
Citrus sinensis	Leaves extract	*Bacillus subtilis*	[69]
Psidium guajava	Leaves extract	*Pseudomonas aeruginosa*	[70]
Putranjiva roxburghii wall	Leaves extract	*Staphylococcus aureus, Escherichia coli, Candida albicans, Candida tropicalis*	[71]
Azadirachta indica	Leaves extract	*Escherichia coli, Staphylococcus aureus*	[72]
Zingiber officinale rhizome	Leaves extract	*Staphylococcus aureus, Escherichia coli*	[73]
Justicia adhatoda	Leaves extract	*Bacillus subtilis, Klebsiella pneumonia, Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus*	[74]

Conclusion:

It is concluded that during the last decade many efforts have been made for the development of green synthesis of AgNPs. The green synthesis of AgNPs using plant extract have many advantages over chemical and physical methods as they are simple, cost effective, easily scaled up and environmentally friendly. It is especially suited for making nanoparticles that must be free of toxic contaminants as required in therapeutic applications. Sufficient volume of published literature is available on the synthesis of AgNPs through green method. Several characterizations methods have been used for AgNPs synthesis and confirmation. The AgNPs synthesized using biological reducing and capping agents have shown wide variation in size and shape. The characterization analysis proved that the particles so produced in nanodimensions would be equally effective as antibiotics and other drug in pharmaceutical applications. Among applications, the antibacterial activity of AgNPs has been widely studied. The synthesized AgNPs using plant extract have great antibacterial activity against both pathogenic gram-positive and gram-negative bacteria and some pathogenic fungus. This can conclude that due to these unique properties, AgNPs will have a key role in many of the nanotechnology-based processes. This review will help researchers to develop novel AgNPs based drugs using green technology.