UNVEILING THE POTENTIAL OF *Cymbopogon* SPECIES-MEDIATED METAL NANOPARTICLES

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ABSTRACT

Sustainable or green chemistry primarily eliminates the usage of harsh and hazardous chemicals. This chemistry has its usage over nanotechnology. Being a multidisciplinary field, the technology finds its application in different aspects of human life. Therefore, it shows further growth and a promising future. Nanoparticles are one of the byproducts of this technology and their size range (1-100 nm) makes them incredibly potent. Nanoparticles can be produced from a variety of methods one of which is green synthesis. This method can be used to create metal nanoparticles that contain metal ions integrated within their structures. There has been the utilization of a variety of metals for the creation of metal nanoparticles like gold, silver, etc.

Cymbopogon species are extensively cultivated for their essential oils. These oils have various therapeutic and non-therapeutic values. The usage is seen not only in the traditional medicine systems around the world; but also in modern medicine. This review aims to consolidate the available information regarding the different *Cymbopogon* species in the field of metal nanoparticles. Additionally, the review will paint the future of the formulation and utilization of the *Cymbopogon* species-mediated metal nanoparticles.

Keywords: Nanoparticles, Metal Nanoparticles, Green Chemistry, *Cymbopogon* species.

INTRODUCTION

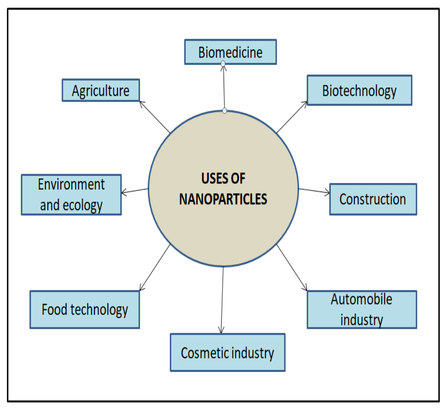

Fig: The various fields in which nanoparticles can be used

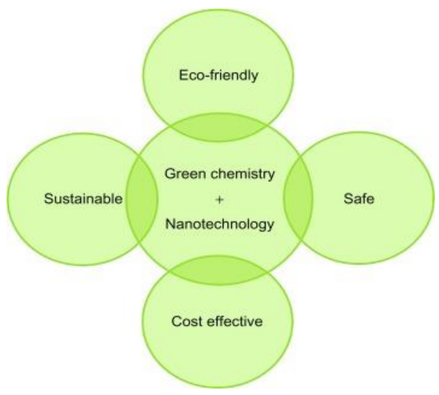

Fig: Benefits of applying Green Chemistry in Nanotechnology

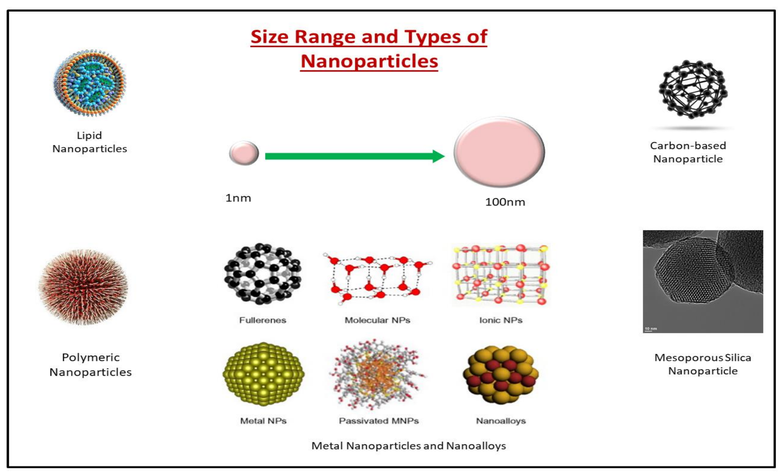

Fig: The size range and different types of nanoparticles

SYNTHESIS OF NANOPARTICLES

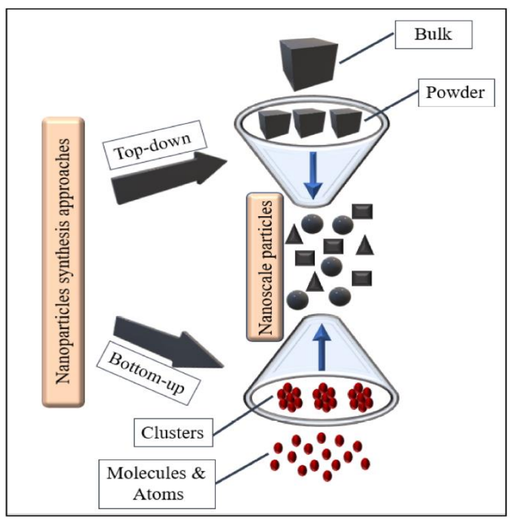

Fig: The different approaches that can be taken for the synthesis of nanoparticles

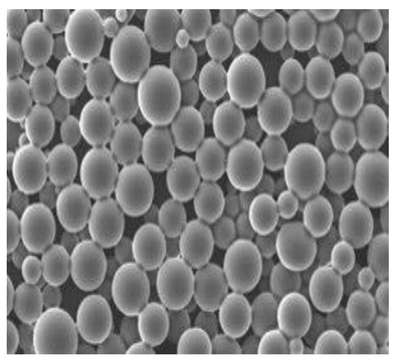

Fig: Picture showing prepared nanoparticles

GREEN SYNTHESIS OF METALLIC NANOPARTICLES

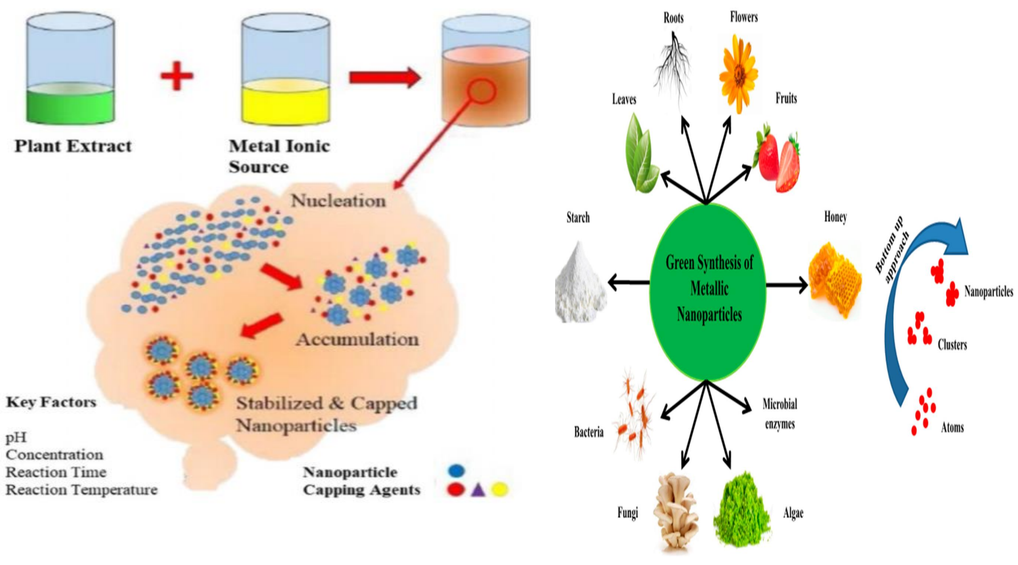

Fig: The process of formation of metal nanoparticles with the help of Green Synthesis

OVERALL VIEW ON *Cymbopogon* SPECIES

Fig: (From the left) *Cymbopogon* plant; Leaves from the plant; Essential oil extracted from *Cymbopogon* plant

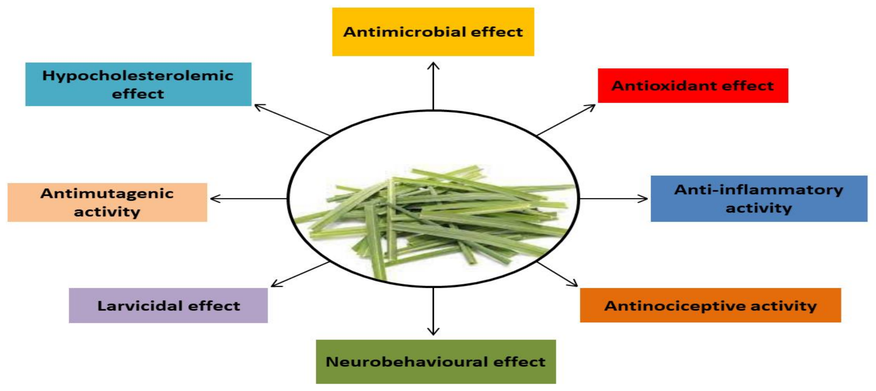

Fig: Different therapeutic uses of the members of the *Cymbopogon* species

METAL NANOPARTICLES SYSTHESIZED FROM *Cymbopogon* SPECIES

NP	SPECIES	PLANT PART	CHARACTERZATION TOOLS	CHARACTERISTICS OF NP		APPLICATIONS	REFERENCES
				SIZE (in nm)	SHAPE		
Copper-ferrite	C. *citratus*	Essential oil	DLS, XRD, SEM, TEM, Magnetic measurements, Raman Spectroscopy, UV-VIS	70	Spherical	Antimicrobial activities	Liakos, Abdellatif, et al. (2016)
Silver	C. *citratus*	Aqueous leaf extract	UV-VIS, NTA, TEM, EDX	32	Spherical	Antimicrobial activity	Masurkar, Chaudhari, et al. (2011)
	C. *citratus* & C. *martini*	Essential oil was mixed with the AgNPs during the formulation	TEM, FTIR, NTA, UV-VIS	15-35	Spherical	Antimicrobial activity	Bansod, Bawaskar, et al. (2015)
	C. *citratus*	Leaf	UV-VIS, NTA, TEM, FTIR, Zetasizer analysis	31	Spherical	Antifungal activity	Jogee, Ingle, et al. (2017)
	C. *citratus*	Aqueous leaf extract	UV-VIS, XRD, DLS, FTIR, TEM, EDX	121.1	Spherical	Antimicrobial and Anticarcinogenic activity	Chen, Ye, et al. (2019)
	C. *citratus*	Aqueous leaf extract	XRD, FTIR, SEM, EDXRF	35	Cuboidal	Antimicrobial and Cytotoxic activity	Basera, Lavania, et al. (2019)
Copper	C. *citratus*	Aqueous leaf extract	UV-VIS, AAS, STEM, FTIR, HR-TEM, EDS	3	Spherical	-	Brumbaugh, Cohen, et al. (2014)
	C. *citratus*	Aqueous leaf extract	XRD, SEM, EDS, GC-MS, FTIR, UV-VIS	31.1	Spherical	Antibiotic activity	Cherian, Saquib et al. (2020)
Gold	C. *citratus*	Methanolic leaf extract	UV-VIS, TEM	10-15	Spherical	Antioxidant activity	Viela, Castañeda, et al. (2015)
	C. *citratus*	Aqueous leaf extract	XRD, TEM, EDX, FTIR, UV-VIS	20-50	Spherical, triangular, hexagonal, and rod shapes	Larvicidal activity	Murugan, Benelli, et al. (2015)
Silver and Gold	C. *citratus*	Leaf	UV-VIS, TEM, EDX, SEM	10-20	Spherical	-	Prasad and Krishna (2014)
Aluminium oxide	C. *citratus*	Aqueous leaf extract	SEM, XRD, HR-TEM, DLS, AFM	9- 180	Spherical	Antimicrobial activity	Ansaru, Khan, et al. (2015)

Table: The past work carried out on *Cymbopogon* species mediated metal nanoparticles

CONCLUSION

- There have been several applications of the metal nanoparticles that are synthesized with the help of the *Cymbopogon* species like antimicrobial, cytotoxic, etc.
- The process of synthesizing the metal nanoparticles are also the same.
- Not much work has been done with the essential oils of the plant, and therefore, there is a huge scope of research.