

# A Study on Cyanobacteria in Freshwater; with Special Reference to Nanoparticle Synthesis

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**Abstract –** The Metallic nanoparticles synthesis by cyanobacteria presents sequential logical outcomes on a standout amongst the most unique subject concerning biogenic generation of nanoparticles. After an extremely short and general introduction of nanoparticles and cyanobacteria, with regards to (bio) nanotechnology, an abstract on cyanobacteria use to deliver metallic nanoparticles is displayed, centered on their organic ramifications, preferences and hindrances, just as on future prospects. The methods of synthesis of silver (Ag) nanoparticles by the cyanobacteria *Spirulina platensis* and *Nostoc linckia* were contemplated. A complex of biochemical, phantom, and investigative methods was utilized to describe biomass and to survey changes in the principle segments of biomass (proteins, lipids, sugars, and phycobilin) during nanoparticle arrangement. The size and state of Ag nanoparticles in the biomass of the two kinds of cyanobacteria were resolved. Neutron initiation examination was utilized to contemplate the gathering elements of the Ag amount. The expository outcomes recommend that the significant decrease of Ag fixation in arrangements and the expansion in biomass happen inside the initial 24 h of investigations. While in this time interim minor changes in the *N. linckia* and *S. platensis* biomass occurred, a critical decrease of the dimensions of proteins, sugars, and phycobiliproteins in the two societies and of lipids in *S. platensis* was seen after 48 h. In the meantime, the antiradical action of the biomass diminished.

**Keywords:** Silver, Nanoparticles, Green Synthesis, Fresh Water

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## 1. INTRODUCTION

Nanostructure materials have unique physical and compound qualities and are applicable in various fields, for instance, biomedical sciences, optics, appealing, mechanics, catalysis, and essentialness sciences. Different pieces of this novel technology comprise the age, depiction, and control of Nano scale structures. Nanoparticles are grabbing reputation as multifaceted materials showing novel or moved properties appeared differently in relation to greater particles. Nano biotechnology is a multidisciplinary field of science like biotechnology, nanotechnology, material science, science, and material science.

Nanoparticles are metal particles with size 1-100 nm and show different shapes like round, triangular, bar, etc. Research on synthesis of nanoparticles is the recurring pattern zone of energy as a result of the exceptional evident properties (substance, physical, optical, etc.) of nanoparticles differentiated and the mass material. Bio nanotechnology has ascended as compromise among biotechnology and nanotechnology for making biosynthetic and biological welcoming development for synthesis of

nanomaterial's (5, 10). Synthesis of nanoparticles has pulled in a lot of thought due to their peculiar optical, photo electrochemical and electronic properties.

Both unicellular and multicellular living thing have been known to make inorganic materials either intra-or extra cell. Microorganisms reaching out from infinitesimal creatures to developments have been used of late to make non-perilous and condition big-hearted procedures to coordinate nanoparticles similarly as nanoparticles joined by microorganisms will all in all be offset by peptides, for instance, phytochelators, likewise thwarting accumulation. The common administrators as green development, plants and microorganisms have ascended as a capable contender for the synthesis of nanoparticles. This mix of nanoparticles with natural particles has incited the improvement of demonstrative contraptions, separate administrators, and huge mechanical assemblies in threatening development treatment. The silver nanoparticles have predicted wide applications for business applications, in the field of cultivating applications using bacteria, cyanobacteria, algae, plant that cutoff point's

hazard and waste will be fundamental for the advancement of Nano science disclosures to business consequence of nanotechnology. The AgNPs have phenomenal antimicrobial property diverged from various salts in light of their staggeringly immense surface zone which outfits better contact with microorganisms. Silver particles and nanoparticles are especially risky and hazardous to microorganisms. The AgNPs have various applications; for example, they might be used awfully specific coatings for daylight based imperativeness osmosis and intercalation material for electrical batteries, as optical receptors, as catalysts in manufactured reactions, for biolabelling and as antimicrobials.

The nanoparticles use for biomedical applications, for instance, medicine and quality movement, biosensors, sickness treatment and scientific instruments, which have extensively analyzed all through the earlier decade. Starting late, nanoparticles have grabbed significance in the field of biomedicine.

Microphytes or Microalgae are small green development, routinely species which exist independently, or in chains, or social affairs. Microalgae, prepared for performing photosynthesis, are huge for life on earth. The substance game plan of microalgae is definitely not a characteristic reliable factor anyway changes over a wide range, both depending upon species and on improvement conditions. Research has really revolved around prokaryotes those strategies for synthesis of metallic nanoparticles. Cyanophycophyta division fuses the blue – green development which are the primary acknowledged oxygen making prokaryotes, each and every piece of it species are joined into a single class Cyanophyceae or Myxophyceae, and the people from this class are viewed as the least troublesome, living autotrophic plants. Only all the blue-greens are minute, extensively spread in the maritime condition with some natural species. The maritime structure for the most part occurs in fresh water and few are marine. The cyanobacteria are prokaryotes, which have nomembrane bound organelles, including chloroplasts.

They have unstacked thylakoids, phycobiliprotein hues, and cyanophycean starch and peptidoglycan structures. Cyanobacteria address an old, anyway different and ample social occasion of microorganisms that have prokaryotic (bacterial) cell structure and dominantly CO<sub>2</sub>-subordinate oxygen-propelling photosynthesis. Rather than all other green development, cyanobacteria are gathered inside the Eubacteria on account of their clear, prokaryotic cells and gram-negative (peptidoglycan) cell dividers. Cells contain chlorophyll-an and a couple of phycobilin protein structures. Gloeocapsa, it is a person from the family Chroococcaceae, there are different lamellate sheaths in Gloeocapsa and

the cells occur in wide coagulated masses. The cells in the mass are planned in families. Each cell is basically round in structure and the young lady cells may be held together by the sheath of the mother cell. Alga recreates just by cell division in three planes at right edges to one another. Lacking society conditions provoking the loss of various morphological characteristics. Both course of action structures for the cyanobacteria-the bacteriological technique similarly as the standard home grown strategy depend mainly on morphological characteristics of cells and regions and don't generally provoke the ID of phylogenetically insightful taxa.

At all arranged measurements above species, the progression examination of characteristics encoding little subunit ribosomal RNA (16S rRNA ) is at present the most promising strategy for the phylogenetic gathering of cyanobacteria

## 2. REVIEW OF LITERATURE

**Woese, (1987)[1]** the overwhelming systematic view is that comparative examinations of the innate constitution of the cyanobacteria will as of now contribute essentially to the update of their logical classification. Significant request should reflect as eagerly as possible the phylogenetic associations as, encoded in 16S or 23S rRNA progression data The consolidation of phenotypic, genotypic and phylogenetic information render possible an understanding sort of logical arrangement known as polyphasic logical order.

**Castenholz and Waterbury, (2012) [2]** The names "cyanobacteria" and "blue green development" (Cyanophyceae) are genuine and flawless orderly terms. This social occasion of littler scale animals includes unicellular to multicellular prokaryotes that have chlorophyll an and perform oxygenic photosynthesis related with photosystems I and II

**Fay, (2015) [3]** The vast majority of cyanobacteria are high-sway photoautotrophs. Their life systems require simply water, carbon dioxide, inorganic substances and light. Photosynthesis is their principal strategy for imperativeness processing. In the regular living space, in any case, it is understood that a couple of creature gatherings can persevere through broad stretches in complete cloudiness. In addition, certain cyanobacteria exhibit an indisputable limit with respect to heterotrophic sustenance

**Whitton, (2012) [4]** Cyanobacteria are every now and again the vital plants to colonize uncovered locales of shake and soil. Modifications, for instance, splendid holding sheath hues, increase their health in the for the most part revealed land condition. Various species are fit for living in the

soil and other terrestrial living spaces, where they are noteworthy in the down to earth methodology of organic frameworks and the cycling of enhancement parts

**Gallon et al., (2016) [5]** the undeniable regions of cyanobacteria are limnic and marine circumstances. They flourish in water that is salty, saline or new, in cold and hot springs, and in conditions where no other microalgae can exist. Most marine structures create along the shore as benthic vegetation in the zone between the raised and low tide marks. The cyanobacteria include a huge piece of marine modest fish with overall scattering. Different freshwater species are moreover prepared to withstand commonly high combinations of sodium chloride. It makes the feeling that various cyanobacteria withdrew from shoreline front circumstances persevere through saline conditions (for instance are halotolerant) rather than require saltiness (for instance are halophilic). As unremitting colonizers of euryhaline (saline) circumstances, cyanobacteria are found in salt works and salt swamps, and are fit for improvement at joined salt concentrations as high as 3-4 molar mass. Freshwater domains with various trophic states are the obvious normal surroundings for cyanobacteria. Different species normally possess, and can inconsistently direction, both close surface epilimnic and significant, euphotic, hypolimnic waters of lakes. Others colonize surfaces by associating with rocks or sediment, sometimes surrounding mats that may tear free and float to the surface.

**Van Landingham, (2015) [6]** Cyanobacteria have an astounding ability to colonize desolate substrates, for instance, volcanic searing remains, desert sand and shakes. They are exceptional excavators; boring hollows into limestone and unprecedented sorts of sandstone another astonishing segment is their ability to persevere through high and low temperatures. Hot springs Mountain streams Arctic and Antarctic lakes and snow and ice. The cyanobacteria moreover consolidate species that experience the entire extent of water types, from polysaprobic zones to katharobic waters

**Douglas, (2014) [7]** Cyanobacteria also structure agreeable association with animals and plants. Agreeable relations exist with, for example, developments, bryophytes, pteridophytes, gymnosperms and angiosperms. The hypothesis for the endosymbiotic origin of chloroplasts and mitochondria should be referenced in this particular condition.

The formative course of action of a photosynthetic eukaryote can be explained by a cyanobacteria being overpowered and codeveloped by a phagotrophic have

### 3. RESEARCH OBJECTIVES

1. Isolation and development of cyanobacterial strains from Jaipur region of Rajasthan.
2. Attempt of organic synthesis of nanoparticles by cyanobacteria.
3. Characterization of various nanoparticles by utilizing spectroscopy strategies like UV-Vis.
4. Spectroscopy or Fourier change infrared (FTIR) spectroscopy, Transmission electron microscopy (TEM) and Scanning electron microscopy (SEM).

## 4. RESEARCH METHODOLOGY

### Materials and Methods

#### Segregation and Culture of Cyanobacteria

The unicellular, commonplace freshwater blue green development *Gloeocapsa* sp. test was accumulated from Mosul freshwater, Iraq. It was refined and kept up in Chu 10 soup medium (27, 28). An axenic culture of cyanobacterium can be get by wash the model normally in clean refined water with centrifuged them and after that made a debilitated game plan from which we culture the precedent on Chu 10 in number medium by using steak technique to get an axenic culture from a lone unadulterated state.

Starting there ahead, the settlement of green development moved by sterile hover to a liquid media to gain soup culture. The lifestyle were created at temperature of  $25 \pm 2^\circ \text{C}$  under photoperiod light (16:8 – light: diminish).

#### Distinguishing proof of cyanobacteria

The first and basically system for ID it, was morphological technique by using light amplifying focal point (OPTICA, Microscopes, ITALY) with cyanobacteria ID key books (2,3,4). The second, was innately approach by used nuclear – based instruments like 16S rDNA quality sequencing (29).

#### Separation of Cyanobacteria Genomic DNA

The DNA extraction was finished by using cyanobacterial culture in 14 days age, we take 10 ml of the lifestyle to plane chamber and cells accumulated by centrifugation at 6,000 rpm for 10 min and the pellet was viably set with liquid N<sub>2</sub> and a while later ground to a fine powder with a mortar and pestle (30). This pellet of cyanobacterial cells was used for DNA extraction with Wizard® Genomic DNA Purification Kit show (Promega). This Genomic Kit contain: A) Nucleolysis course of action. B) RNase game plan. C) Protein precipitation course of action. D) DNA

rehydration course of action. The unit of genomic DNA was done as gram-negative show. The methods are:

1. Use 1 ml of pellet cells (masterminded as of now), that hurry (13,000-16,000 rpm\*) for 2 min by cooled little scale pivot ( Nuve nf 800R/Turkey) and the supernatant was discard.
2. Adding 600µl of Nucleilysis answer for the pellet in eppendorf tube with well shaking.

### Electrophoresis Steps:

#### 1-Gel preparation

Weight agarose (1.2 gm) and add it to 100 ml TBE support (1 X). By then warmth the carafe in a microwave for 10 sec. intervals until all agarose valuable stones are melted and separated. Hold up until its temperature accomplishes 50°C. Select an appropriate gel tossing plate and supplement a precedent brush around which fluid agarose is poured to casing test wells in the gel.

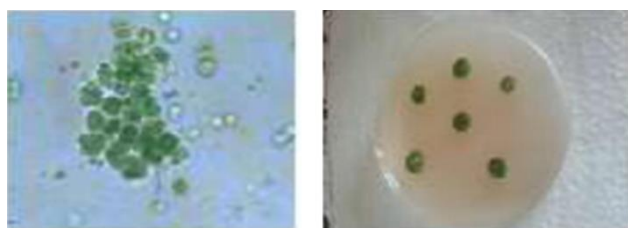
After the gel has solidified, the brush is cleared, using care not to tear the base of the wells. The gel, still in its plastic plate, is inserted on a dimension plane into the electrophoresis camper and hardly verified with Tris Borate EDTA (1 X-TBE) pad.

### Electrophoresis Run

Mix reagents containing DNA Ladder (4 µl), 6X stacking shading game plan (2 µl). This DNA Ladder contains DNA with different lengths that should be used as a sort of viewpoint for affirmation of genomic DNA or PCR things length. We mixed ( 5-7 µl ) of PCR things with ( 1 µl ) of 6X stacking shading freely, and move them into individual brush places ( wells). The top and power leads are joined to the contraption. Turn on the power supply using 50 volt at 75 min., watching air pockets leaving the terminals insists that current is spilling. DNA will migrate towards the positive cathode.

## 5. DATA ANALYSIS

Morphological characters: The cyanobacterium strain was distinguished under light magnifying instrument.



**Fig 1 Morphological shape of Gloeocapsa sp. cells-A and its culture- B**

## UV-VIS SPECTROSCOPY

Characterization surface Plasmon assimilation groups at range 400-450 nm were seen inside various groupings of AgNO<sub>3</sub> arrangements (Table 1)

**Table 1 O.D. values for Gloeocapsa sp. in different (1-5) mM concentration**

Co.	24 hour				72 hour			
	Light		Dark		Light		Dark	
	Wav.Len.	O.D.	Wav.Len.	O.D.	Wav.Len.	O.D.	Wav.Len.	O.D.
1	740	0.263	-	-	714	0.232	252	0.637
	680	0.261	-	-	618	0.231	-	-
	436	0.275	-	-	554	0.242	-	-
	-	-	-	-	348	0.287	-	-
3	726	0.323	764	0.178	758	0.234	728	0.141
	438	0.347	724	0.178	674	0.298	688	0.139
	404	0.345	644	0.185	628	0.250	516	0.166
	-	-	434	0.237	430	0.267	256	0.360
	-	-	410	0.239	370	0.269	-	-
5	-	-	386	0.241	-	-	-	-
	792	0.277	672	0.194	714	0.275	494	0.174
	708	0.272	418	0.251	616	0.276	258	0.338

## 6. CONCLUSION

It is construed that the assembled cyanobacterium strain from freshwater was Gloeocapsa sp. PCC 7428 and have course of action ID (Accession number) in NCBI GeneBank, cp003646.1, that perceived by 16S rDNA quality sequencing. This strain of cyanobacterium exhibited the limit with regards to biosynthesis of silver nanoparticles under light and diminish conditions with showcase the best creation in light for all intents and purposes indistinguishable with diminish condition. This cyanobacterium is incredible hotspot for eco-obliging and fiscally negligible exertion for nanomaterial's age. The extracellular making of AgNPs by Gloeocapsa sp. is a viable and clear methodology and the conveying AgNPs are exceptionally consistent in game plan because of garnish of silver nanoparticles by proteins produced from the cyanobacterium.

The strategy portrayed out in this section does not cover each and every conceivable condition. Swimmers may be in contact with benthic cyanobacteria after a whirlwind disjoins groups of filaments or cyanobacterial tangles typically isolate from the residue and are amassed on shorelines.

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