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Mangrove Associated Cyanobacteria *Phormidium tenue* from Parangipettai Environment Collection Isolation Identification and Elemental Analysis

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ABSTRACT

Background and Objective: Cyanobacteria are an important coastal resource for the mangrove ecosystem along the tropical coast. Cyanobacteria grow photolitho-autotropically using light for energy, water for electrons and carbon dioxide for carbon. The objective of the study is the isolation, identification and elemental analysis of cyanobacteria *Phormidium tenue* from Parangipettai mangrove ecosystem. **Materials and Methods:** Cyanobacteria were collected from Parangipettai mangrove environment. The cyanobacteria were isolated under aseptic conditions. Cyanobacteria were morphologically identified and cultures were maintained in an aseptic laboratory condition and determined the CHNS analysis. **Results:** The result revealed that *Phormidium tenue* was identified from the southeast coast of India by using morphological and molecular techniques. The species were non-heterocystous forms of *Phormidium tenue* as confirmed by microbial examination and molecular identification. Element content CHNS was analyzed. **Conclusion:** It is concluded that marine cyanobacteria *Phormidium tenue* has a rich element content of carbon, hydrogen, nitrogen and sulphur, respectively.

KEYWORDS

Phormidium tenue, carbon, nitrogen, sulphur, parangipettai mangrove ecosystem

INTRODUCTION

Carbon, hydrogen, nitrogen and sulfur are basic building blocks that are analyzed in marine research. Fluctuations in the concentration ratio and/or the content of carbon, nitrogen and sulfur provide information about the origin of the marine samples, the depositional environment and the diagenetic transformation of the source material[1]. Nitrogen capabilities as a proscribing nutrient within the oceans, the worldwide carbon cycle and therefore, atmospheric CO_2 are tightly coupled to the nitrogen cycle. Therefore, modifications inside the length of wells and glued nitrogen resources within the oceans can substantially impact global climate. The organic fixation of nitrogen, denitrification and nitrate consumption with the aid of phytoplankton are the principal biological approaches to the global nitrogen cycle. Changes in ocean circulation and nutrient delivery, which arise in response to adjustments in environmental conditions, have an impact on the relative importance and spatial volume of the most important nitrogen cycle pathways[1].

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The increasing Carbon Dioxide (CO_2) attention within the atmosphere has been developing numerous poor environmental influences, consisting of climate alternate and international warming. There are numerous methods to mitigate CO_2 inside the atmosphere including physical or chemical strategies but the value of these methodologies is pricey. One powerful method to reduce CO_2 is organic procedures which include the use of photosynthetic cyanobacteria that devour CO_2 as a sole carbon substrate to provide biomass and valuable merchandise[2]. Hydrogen is taken into consideration as an environmentally friendly gasoline and energy vector used in the future[3]. Hydrogen garage is one of the most crucial technologies in power garage[4]. Hydrogen storage may be accomplished by adsorption, liquefaction, compression, or chemical bonding within the form of steel hydrides. Activated carbons based on carbon substances may be prepared from a massive number of precursors, which consist of vegetables, minerals and in simple terms synthetic sources[5].

Marine cyanobacteria constitute an integral and major component of the microbiota in mangrove ecosystems[6]. They colonize any submerged surface of sediments, roots, aerial roots, branches and trunks of mangroves[7]. The marine cyanobacteria are much focused for their potential in biotechnological applications[8] and hence, the isolation and identification of the cyanobacteria is a very important aspect. Knowledge of cyanobacterial diversity and identification is insufficient for mangrove biotopes, especially restored systems. Hence, the present study investigates marine cyanobacteria collection, isolation, identification and elemental analysis.

MATERIALS AND METHODS

Study area: The study was carried out from December, 2011 to July, 2012. The Vellar River Estuary is situated in Parangipettai mangrove forest one of the fertile estuaries, located in Southeast India. The River Vellar originates from Sarvarayan Hills in Salem District which is about 480 km meanders into the Bay of Bengal. A southern channel arising near the mouth of Vellar Estuary leads to Killai backwaters and Pitchavaram mangroves, which in turn is connected to the Coleroon estuary that branches off from the river estuary. The average depth of the estuary is 2.5 m and width of 100 to 200 µ. The sand bars appear at the mouth of the estuary. Their position and extent vary frequently due to tidal effect and water flow due to flooding during monsoons resulting in erosion and later accretion in summer. The large wetlands surrounding the estuarine complex are used for agricultural and aquaculture purposes. Drainage canals from aquaculture farms and domestic sewage are discarded into the Vellar estuary.

Sample collection and identification: The cyanobacteria were collected from a mangrove environment in Parangipettai located at Latitude 11°29'N and Longitude 79°46'E along the southeast coast of India during the year 2011. The flask was sufficiently stirred to allow sand particles to settle and the supernatant was added to any other 50 mL seawater container. From the flask, 10 mL of the sample was taken, drawn and observed in the microscope.

For the study area, five random samples have been chosen. Cyanobacterial samples are isolated in aseptic situations with the use of a marine nutrient medium developed by Rippka *et al*.[9]. Cyanobacteria had been characterized in morphology with the subsequent reference[10]. Cultures were maintained under laboratory conditions, a stationary growth phase the cultures were harvested and used for various experimental purposes

Elemental analysis: The CHNS/O determination of marine samples followed by standard methods[1].

RESULTS AND DISCUSSION

The *Phormidium tenue* species were morphologically identified and it is non-heterocystous forms observed under the 100 X Light microscope as shown in Fig. 1.

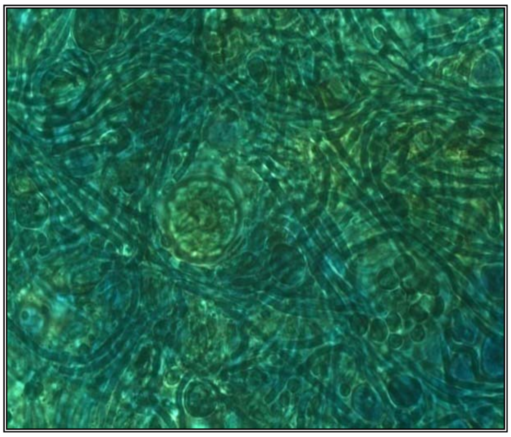

Fig. 1: *Phormidium tenue* under light microscope

- **Kingdom:** Bacteria
- **Phylum:** Cyanobacteria
- **Class:** Cyanophyceae
- **Order:** Oscillatoriales
- **Family:** Phormidiaceae
- **Genus:** *Phormidium*
- **Species:** *Phormidium tenue*

Key characters: The colour of the thallus is blue-green. The mass is composed of thin, entangled filaments. The sheath is very thin and fragile, somewhat imperceptible and diffluent at the end. The trichome is 1-2 mm in diameter. It is straight or slightly curved. The apex is slightly tapering and slightly narrowed at the cross walls. The cells are 2-3 mm in width and 2-4 mm in length. They are separated by pelleted dessipiment. The apical cell is somewhat cylindrical or blunt. The cell contents are homogeneous and pale blue-green.

Molecular identification: Accession Number: HM217075.

Elemental analysis: Marine cyanobacteria *Phormidium tenue* carbon content was 4.79%, hydrogen content 1.28%, nitrogen content 0.84% and sulfur content 0.59%, respectively from Parangipettai mangrove ecosystems shown in Fig. 2.

Cyanobacteria are photosynthetic prokaryotic microorganisms. In the present study, mangrove-associated marine cyanobacteria *Phormidium tenue* was identified at morphology and molecular level. It is a non-heterocystous type of cyanobacteria species. The cyanobacteria *Phormidium tenue* produced the highest percentage of elements. Among the elements, carbon content has the highest percentage produced and lowest in nitrogen, hydrogen and sulphur contents.

The non-heterocystous cyanobacteria dominate in the saline condition[11-14]. The present study found non-heterocystous forms of *Phormidium tenue*. A similar trend was observed in the mangroves of Southeast Queensland, Australia[15].

The aerobic phototrophs include blue-green algae. The vitamin B12 is an important nutrient required for cyanobacteria, which are primarily of marine origin. One or more of a confined variety of natural in pure culture assists the aerobic increase of huge numbers of cyanobacteria inside the dark. Heterotroph increase in the amount of those compounds could be very slow, usually a whole lot slower than

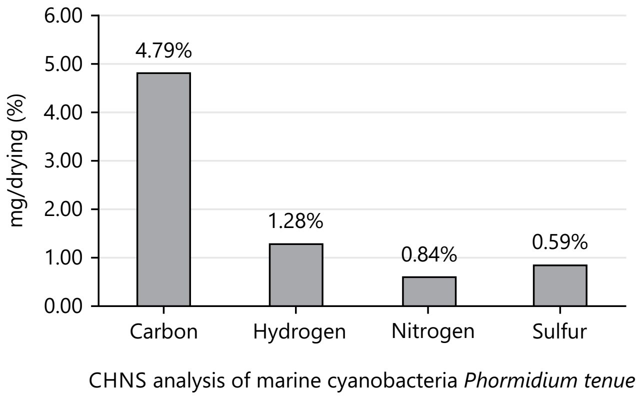

Fig. 2: CHNS analysis of marine cyanobacteria *Phormidium tenue* mg/drying

phototroph increase. It is incubated under a suitable light source and temperature is suggested for the increase of cyanobacteria. As a well-known rule, cyanobacteria are taken into consideration as aerobic phototrophs except definitive proof to the opposite is provided[9].

The previous study reported that microalgal species contain carbon 49.31-53.91%, oxygen 31.95-35.67%, nitrogen 5.32-271 7.01% and sulphur 0.17-0.55% content, respectively[16]. Only a few studies reported elemental analysis of cyanobacteria species. Present study findings marine cyanobacteria *Phormidium tenue* had carbon, hydrogen, nitrogen and sulfur content of 4.79, 1.28, 0.59 and 0.84%, respectively from Parangipettai mangrove ecosystem. So, this study was carried out with CHNS analysis of marine cyanobacteria *Phormidium tenue*.

CONCLUSION

In this study, marine cyanobacteria *Phormidium tenue* at morphological and molecular levels have been identified. The diagnosed samples of CHNS elements have been analyzed using an auto analyzer. The cyanobacteria *Phormidium tenue* has rich element content material in Parangipettai mangrove ecosystem. *Phormidium tenue* has wealth in hydrogen content material. In this observation, sulphur content has a mile's essential position in microbial metabolic strategies. The cyanobacteria changed into a capability business hobby. The willpower for the evaluation of marine cyanobacteria presents superb reproducibility. The correct detection of the factors is therefore done.

SIGNIFICANCE STATEMENT

The discovery of the study mangrove associated cyanobacteria isolation, identification, culture and quantify CHNS content. Globally most pharmaceutical and other companies are looking for potential compounds from marine organisms only because these organisms are distributed at higher temperatures. The research work is helpful for the researcher because few works only discover areas of elemental analysis of marine cyanobacterial species. This study identified morphological and molecular levels. The identified cyanobacteria were maintained under laboratory conditions. The present study observed that marine cyanobacteria *Phormidium tenue* have rich carbon, hydrogen, nitrogen and sulphur content. In the future, low-cost biofuel products, nutrient products and pharmaceutical products will be found. The research work benefits individuals, industries and government because it is product-oriented research.

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