Study on Some Cyanobacteria Species in Municipal Water Supply Tanks in Pyay Area, Pyay Township, Bago Region

Hein Htet[1], Khin Mar Win[2]

Abstract

Blue green algae – Cyanobacteria – also called Cyanophyta are gram-negative bacteria that obtain energy via photosynthesis. But some Cyanobacteria have been identified as toxin producer. In present study, the Blue green algae population from (4) sampling sites of municipal water supply tanks were collected during December (2022) to February (2023). The study sites lies between North Latitudes of 18° 49' 28" and East Longitude of 95° 12' 45". Totally (12) Cyanobacteria species, *Chroococcus tenax* (Kirchn)Hieron, *Chroococcus turgidus* (Kuetzing) Naegeli, *Merismopedia elegans* (A.Braun) Kuetzing belong to Family- Chroococcaceae; *Oscillatoria amoena* (Kuetzing) Gomont, *Oscillatoria subbrevis* Schmiddle, *Oscillatoria splendid* Greville belong to Family- Oscillatoriaceae; *Spirulina subsalsa* Oersted, *Spirulina subtilissima* (Kuetzing) Gomont, *Arthrospira plantensis* (Nordst) Gomont, *Phormidium inundatum* (Kuetzing) Gomont, *Phormidium mucicola* Naumann & Huber Pestalozzi belong to Family- Phormidiaceae; *Nostoc caeruleum* Lyngbye being to Family- Nostocaceae identified up to specific level with the help of available literature. These species indicated that Municipal Water Supply Tanks are free from cyanotoxins, because the collected Cyanobacteria species were not recognized as toxic algae. The aim of current study is to examine the Municipal supplying water contaminated with cyanotoxin. If they make toxin, they harm people, to recommend the conventional water treatment can generally remove intact cyanobacterial cells and low levels of cyanotoxin from source waters.

Keywords: Municipal Water Supply Tanks, Cyanobacteria, Cyanotoxin

Introduction

Phycology or algology is the study of the algae. The word phycologyis derived from the Greek word *phykos*, which means “seaweed.” The algae are thallophytes (plants lacking roots, stems, and leaves) that have chlorophyll *a* as their primary photosynthetic pigment and lack a sterile covering of cells around the reproductive cells. This definition encompasses a number of plant forms that are not necessarily closely related, for example, the cyanobacteria which are closer in evolution to the bacteria than to the rest of the algae (Robert Edward Lee 2008).

The term algae refers to microscopically small, unicellular organisms, some of which form colonies and thus reach sizes visible to the naked eye as minute green particles. These organisms are usually finely dispersed throughout the water and may cause considerable turbidity if they attain high densities. Although many species of freshwater algae proliferate quite intensively in eutrophic waters, they do not accumulate to form dense surface scums (often termed blooms) of extremely high cell density, as do some cyanobacteria. The toxins that freshwater algae may contain are

[1] U, Demonstrator, Department of Botany, Pyay University.
[2] Daw, Lecturer, Department of Botany, Dagon University.

therefore not accumulated to concentrations likely to become hazardous to human health or livestock (Chorus & Bartram 1999).

There are two basic types of cells in the algae, prokaryotic and eukaryotic. Prokaryotic cells lack membrane-bounded organelles (plastids, mitochondria, nuclei, Golgi bodies, and flagella) and occur in the Cyanobacteria. The remainder of the algae are eukaryotic and have organelles. A eukaryotic cell is often surrounded by a cell wall composed of polysaccharides that are partially produced and secreted by the Golgi body (Robert Edward Lee 2008).

According to Graham and Wilcox (2000), the algae had been on interesting group for investigation because of their very primitive nature and a worldwide distribution which was due to their capability to exist under most varied environmental conditions. Algae is considered important biological organisms. They are source of oxygen and the first ring of the food chain in aquatic systems. Algae might be more than 25,000 species found living everywhere, rivers, lakes, ponds, puddles. They could take place photosynthesis by the sunlight like higher plants because algae possess chlorophyll.

Smith (1950) reported that algae are important indicators of ecosystem health and integrity because they form the base of most aquatic food chains. Virtually all aquatic animals are dependent on this primary producer. They are also excellent indicator of water quality, as their abundance and community composition most often reflects (and has the capacity to affect) the chemical properties of water such as pH and nutrient levels.

Water supply is very important for the health of people. It is needed to survey and search the contaminants of water supply. Algae are used as bio-indicators of water quality in nature. Therefore, the present study was emphasized on some algal species found in Municipal Water Supply Tanks in Pyay.

The aim of the present study is to determine quality of water and to examine the fresh water algae found in Municipal Water Supply Tanks. The objectives are to collect and identify of fresh water algae and to give valuable information concerning with the water quality of Municipal Water Supply Tanks.

Materials and Methods

Collection and Identification of Algae

Study Area

Pyay Township is situated Pyay District in Bago Region. This Township lies between the North latitudes of 18˚49'28" and the East longitude of 95°12'45".

Collection of the Algae Specimens

Algae specimens were collected from Municipal Water Supply tanks. Collection of algal samples was done during December 2022 to February 2023. Algae samples

were collected from upper surface and attached algae from other sides of tanks were also taken.

Data collection of pH, GPS, Water Temperature

The position of all sampling sites were measured by Global Position System (GPS), temperature of water was measured by thermometer and pH of water was measured by pH meter.

Laboratory Observation and Classification of Algae

Laboratory observations and sketching on algae samples was made by using compound microscope at Department of Botany, Pyay University. The size of algae was measured by using Occular micrometer. All species were presented by photomicrographs. Then, the algae were identified up to specific level based on their distinguished characters. The identification and taxonomic description have been done by referring on Skuja (1949), Prescott (1962), Vinyard (1979), Komarek (1985-1989), Dillard (1982- 2000) and John *et al*., (2000). All the collected resulting species were systematically arranged and stated by construction of the artificial keys.

Results

In this study, altogether the collected species belonging to 12 species, 7genera, 4 families, 3 orders, 1classes and 1divisions were collected in Sampling sites. They are in sampling site were shown in the following .

Key to the Genera:

1. Cells arranged to form a colony of distinctive shape in rectilinear series -------- ---------- *Merismopedia*
1. Cells not arranged in colony of distinctive shape ---------- *Chroococcus*

Key to the species

1. Not distinctly lamellated ---------- *Chroococcus turgidus*
1. Very distinctly lamellated ---------- *C. tenax*

***Chroococcus tenax* (Kirchn) Hieron**

Cells mostly in groups of 2-4, blue-green or olive colored,without sheath 16.0-21.0 µm, with sheath 20.0-26.0 µm in diameter; sheath colorless, very thick, very distinctly lamellated in figure-1.

***Chroococcus turgidus* (Kuetzing) Naegeli**

Cells spherical or ellipsoidal, in groups of mostly 4, seldom many, blue-green, without sheath 13.0-32.0 µm, with sheath 8.0-15.0 µm in diameter, sheath colorless, not distinctly lamellated in figure-2.

***Merismopedia elegans (*A. Braun) Kuetzing**

Colony irregularly quandrangular, 16-32 celled, cells spherical or oblong, more or less closely arranged, 5.0-6.5 µm in diameter, and 5.0-8.5 µm long; contents bright blue-green in figure-3.

Key to the Genera:

1. Trichome with a prominent sheath ---------- *Phormidium*
1. Trichome without a sheath ---------- 2.
   2.Cells of trichome not visible, unicellular ---------- *Spirulina*
   2. Cells of trichome clearly visible, multicellular ---------- *Arthrospira*

Key to the species:

1. Trichome very tightly coiled ---------- *Spirulina subsalsa*
1. Trichome loosely coiled ---------- *S. subtilissima*

***Spirulina subsalsa* Oersted**

Trichomes very tightly coiled, spirals 2.0 µm wide, often so tightly coiled that there is no space between the turns in figure-4.

***Spirulina subtilissima (*Kuetzing) Gomont**

Trichomes regularly spirally coiled, bright blue-green, spirals 1.5-2.5 µm in wide, distance between the spirals 1.25-2.0 µm in diameter in figure-5.

***Arthrospira plantensis* (Nordst.) Gomont**

Trichomes slightly constricted at the cross walls, more or less regularly spirally coiled; cells rearly as long as broad; 6.0-8.0 µm wide; 2.0-6.0 µm long, cross-walls granulated; end-cells broadly rounded in figure-6.

Key to the species

1. Trichome straight and parallel, not constricted at the cross wall ----------
   ---------- *Phormidium incudatum*
1. Trichome scattered, constricted at the cross wall ---------- *P. mucicola*

***Phormidium inundatum* (Kuetzing)Gomont**

Filaments forming a blue green, gelatinous; individual sheaths scarcely discernible, diffluent; trichome straight and parallel, tapering at the apices to form a conical apical cell, which is not capitates; cell quadrate, 3.0-5.0 µm in diameter, 4.0-8.0 µm long; not constricted at the cross wall, which are granular; cell contents granular, especially at the cross walls in figure-7.

***Phormidium mucicola* Naumann & Huber- Pestalozzi**

Filaments short; sheaths thin, inconspicuous, trichomes scattered; not tapering at the apices, which are broadly rounded; cells quadarate to short-cylindric, 1.5-2.0 µm in diameter, 1.8-3.0 µm long; constricted at the cross walls, often separated one another; cell contents pale blue-green in figure-8.

Key to the species

1. Calyptra present ---------- *Oscillatoria amoena*
1. Calyptra absent ----------2.
   2.end- cell rounded ----------*O. subbrevis*
   2. end- cell capitate ----------*O. splendid*

***Oscillatoria amoena* (Kuetzing) Gomont**

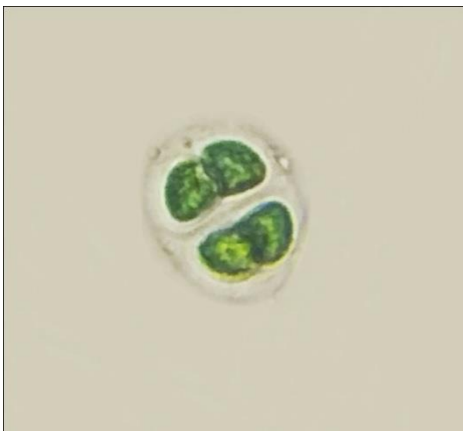

Figure1.*Chroococcustenax (Kirchn.) Hieron*

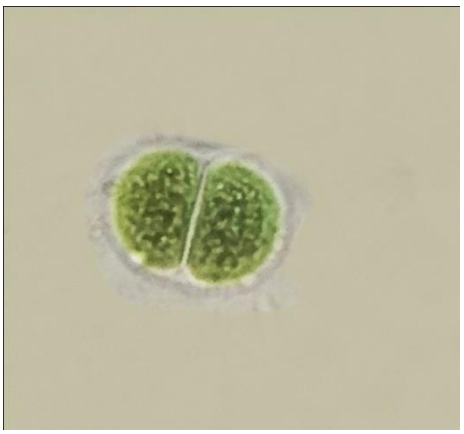

Figure2.*Chroococcusturgidus (*Kuetzing) Naegeli

Figure3. *Merismopedia elegans (A.Braun)* Kuetzing

Figure4. *Spirulina subsalsa Oersted*

Figure 5*Oscillatoria splendida* Greville

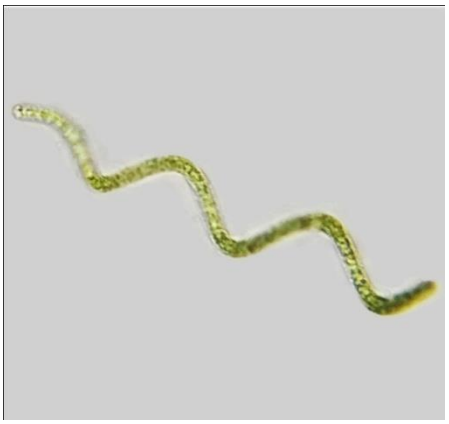

Figure 6. *Arthrospira plantensis* (Nordst.) Gomont

Trichomes straight, 2.5-5.0 µm broad, ends gradually attenuated, cells 2.5-4.2 µm long, septa granulated, end cells capitates, calyptra present in figure-9.

***Oscillatoria subbrevis* Schmidle**

Trichomes single, 5.0-6.0µm broad, nearly straight, not attenuated at the apices; cells 1.0- 2.0 µm long, not granulated at the cross-walls; end-cell rounded, calptra absent in figure-10.

***Oscillatoria splendida* Greville**

Trichomes straight, 2.0-3.0µm broad, ends gradually attenuated, cells 3.0-9.0µm long, septa often granulated, end cells capitate, calyptra absent in figure-11.

***Nostoc caeruleum* Lyngbye**

Trichomes densely entangled; cells subspherical or barrel-shaped; 5.0-7.0 µm in diameter; heterocysts spherical, 8.0-10.0 µm in diameter in figure-12.

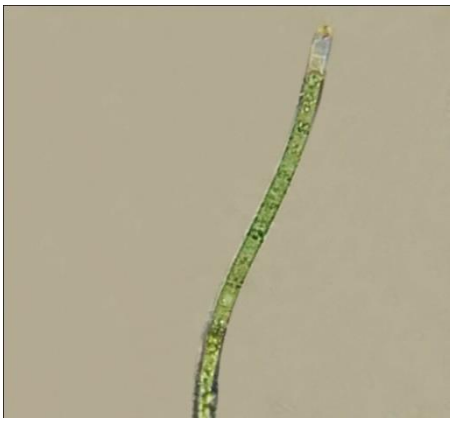

Figure-7.*Spirulina subsalsa* Oersted

Figure-8. *Spirulina subtilissima (*Kuetzing) Gomont

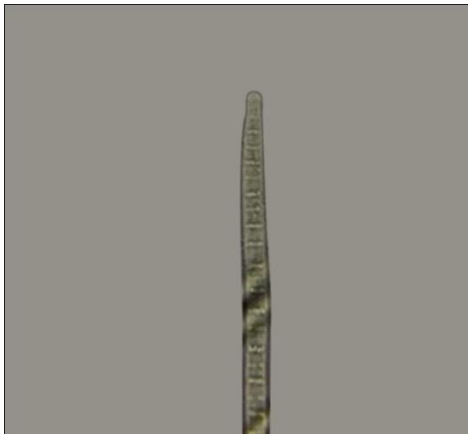

Figure-9. *Oscillatoria amoena* (Kuetzing) Gomont

Figure-10. *Oscillatoria subbrevis* Schmidle

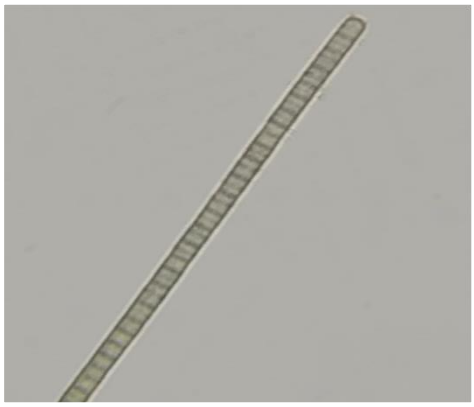

Figure 11. *Oscillatoria splendida* Greville

Figure 12. *Nostoc caeruleum* Lyngbye

Discussion and Conclusion

In the present study, algae samples were collected from municipal water supply tanks in Pyay area. All the collected species belonging to 12 species, 7genera, 4 families, 3 orders, 1classes and 1divisions were observed.

According to Smith (1950), the temperature rarely plays a direct role in the climate adaption of algae in new localities, but it has a very important effect in the acceleration or retardation of growth and reproduction. The diversity of algae is mainly based on the environmental factors such as temperature and pH. Sometimes the temperature of the water is also of importance in determining the nature of algal flora. In the present study, the water temperature of municipal water supply tanks from 20°C to 34°C and the pH 7 to 10. In study periods, some species of the Bacillariophyceae are found to be the highest algal population and the second Chlorophyceae is observed more algal population than Cyanophyceae and Cryptophyceae.

Nowadays, algae are widely used all over the world in many purposes such as medicine, functional food, aquaculture, cosmestics, biofertilizer and biofuel. According to literature *Spirogyra* is used not only as a popular local food as salad dishes but also as their food supplement in preparing soups, rice soups and rice rolls as food in Myanmar (Aye Aye Than 2008) and other countries.

According to the results of the present study, algae population of*Spirogyra* and diatoms are maximum density in these tanks. The other genera were observed minimum density among these tanks during study period. Different growth of algal population was depended on the temperature and pH value of water and other factors. According to literatures, some algae such as *Microcystis, Cylindrospermopsis,*

Nodularia, Anabaena and dinoflagellates are toxic algae. They can form blooms in the surface of water of water supply. In this study, these algae were not observed in the water. It is obvious that the water from this water supply can be used safely.

Temperature of water is one of the most important environmental factors that determine the growth and survive of microorganisms. Each organism has a characteristic range of growth with minimum, optimum and maximum temperature values.

In the present study, the water temperature varied from 20°C to 34°C. This temperature is suitable for Cyanobacterial growth. The pH of water is a measure of the hydrogen ion (H^+) concentration. The pH of water is important to the chemical reactions that take place within water, and pH values that are high or low can inhibit the growth of microorganisms. Microalgae show a wide variation, with different phytoplankton species being adapted to acid (often oligotrophic) or alkaline (often eutrophic) water (Brock 1973; Shapiro 1973 a).

In this study, under blooms conditions in nutrient-rich water, the tanks water may become highly alkaline, pH 10. Turbidity affects the growth rate of algae (micro-aquatic plants) and other aquatic plants in streams and lakes because increased turbidity causes a decrease in the amount of light for photosynthesis. Turbidity can also increase water temperature because suspended particles absorb more heat. These factors lead to a decrease in dissolved oxygen. Many common contaminants that increase turbidity can also change the taste and odors of the water (Lloyd 1987).

In this study, the turbidity of water varied from 0.1 to 412.Some important nuisance algal species causing diverse problems are *Spirulina*, *Oscillatoria*, *Merismopedia*, and *Chroococcus* (blue-green algae); They have been implicated in most problems of water quality (Goel 1997). This finding agreed with the observations of the present study.

According to the results of the present study, Blue-green algae population of *Oscillatoria, Spirulina, Chroococcus, Arthrospira* are maximum density in the present study. These species indicate that Municipal Water Supply Tanks are free from cyanotoxins, because the collected Cyanobacteria species were not recognized as toxic algae, especially *Anabaena flosaquae, Aphanumenon flosaquae, Microcystic aeragiaosa and Nodularia Spp.* This research provides information on the identification of water microalgae.

It is hoped that this research provides information on the identification of water microalgae and their monthly occurrence. This information will be useful for professionals in the food and water industry, and those who working in public health and environmental ecology. Clearly, studies of changes in algal composition, bloom dynamics, increasing temperatures and other environmental factors associated with global warming are of great importance to study in nature. It can be concluded that the outcome of this research contributes some valuable information to academic field and national interest.

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