Study on Relation of Some Algae Species and Water Quality in Karboo Dam Kantbalu Township

Tin Tin Moe[*], Eaint Yu Ya Tun[**] and Shwe Zin Ei[***]

Abstract

In this study, algae specimens were collected from upper surface of three sampling sites, Karboo Dam, Kantbalu Township during September 2018 and October 2019. All the collected specimens had been listed by the classification system of John *et al.* (2002). The total 36 algal species were found in this study area. Among them 6 species, 5 genera, 4 families belonging to 3 orders of Cyanophyceae; 4 species, 2 genera, 1 family belonging to 1 order of Euglenophyceae; 7 species, 7 genera, 5 families belonging to 1 order of Bacillariophyceae; 19 species, 12 genera, 6 families belonging to 2 orders of Chlorophyceae had been identified, described and recorded. The physico–chemical characters of water quality were analyzed at the Water Laboratory; Water and Sanitation Department Committee, Public Health Laboratory, Mandalay. The present study can inform the relationship between the algae and physico–chemical parameter of water and distribution of algae in Karboo Dam.

Key words: Algae, Flora and Water Quality

Introduction

Algae can also serve as indicators of environmental problems in aquatic ecosystems. Because algae grow quickly and are sensitive to changing environmental conditions, they are often among the first organisms to respond the changes (Alan, 2000). Limnology deals with the biological productivity of inland water and with all its causal influences which involves Physical, Chemical and Biological factors, “which determine the quality and quantity of Biological production”. Physico–chemical analysis indicates the changes in different factors and their influence on biological status of the system as shown by Sharma *et al.* (2008).

Water is one of the most important compounds to the Ecosystem. Better quality of water is described by its Physical, Chemical and Biological characteristics. But some correlation was possible among these parameters and the significant one would be useful to indicate quality of water. The natural aquatics resources are causing heavy and varied pollution in aquatic environment leading to water quality and depletion of aquatic biota. The physico–chemical parameters of water and the dependence of all life process of these factors make it desirable to take as an environs as shown by Manjare *et al.* (2009).

The aims of this research are to study the algal species composition of water bodies in Karboo Dam, Kantbalu Township, to reveal the relationship between algae and physico–chemical parameters and to provide the information for other applied researchers.

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Materials and Methods

Study Area

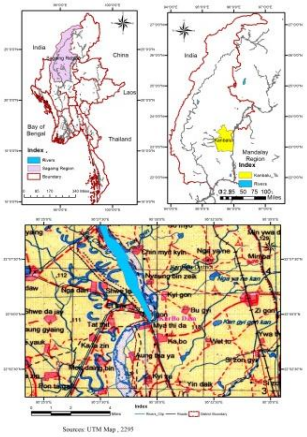
Karboo Dam is situated in Kantbalu Township, Sagaing Region. It lies between 22° 54′ and 22° 55′ N Latitude and between 95°29′ and 95° 30′ E Longitude. It has an area of 12355 km^2. Algae samples were collected from Karboo Dam during the periods September 2018 and October 2019. The location map of study area was shown in Figure 1 and sampling sites of Karboo Dam were shown in Figure 2.

Collection of Algal Specimens

Water samples were taken from the upper surface of the study area. The positions of all sampling sites were measured by Global Position System (GPS), temperatures were measured by thermometer and pH of water was measured by using pH meter. Algal populations were counted under the microscope by using Fuchs– Rosenthal haemocytometer by Lavens and Sorgeloose (1996). The collected algal specimens were examined by using compound microscope (Olympus) in laboratory, Department of Botany, Shwebo University.

Laboratory Observation and Classification of Algae

The collected algae were examined and identified. The measurements of algae were taken by using micrometer. After that they were recorded by digital camera. Then, the samples were identified with the thallus shape, size, colour, chloroplast, pyrenoids and sinus structure. Some collected specimens had been listed by the classification system of John *et al*. (2002). The taxonomic descriptions of algae have been done by the references, Smith (1950), Prescott (1962), Komarek & Anagnostidis (1985–1989) and Dillard (1982–2000).



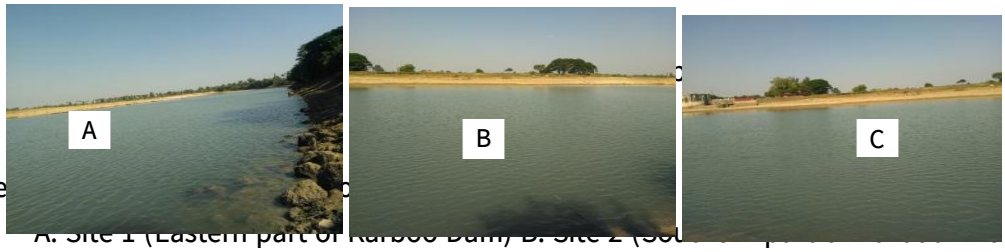


Figure [illegible]
A. Site 1 (Eastern part of Karboo Dam) B. Site 2 (Sou[illegible]m)
C. Site 3 (Northern part of Karboo Dam)

Results

The samples of algae were collected from three sampling sites in Karboo Dam. The identified specimens were expressed. The total 36 algal species had been described and recorded in this study area. Among them 6 species, 5 genera, 4 families belonging to 3 orders of Cyanophyceae; 4 species, 2 genera, 1 family belonging to 1 order of Euglenophyceae; 7 species, 7 genera, 5 families belonging to 1 order of Bacillariophyceae; 19 species, 12 genera, 6 families belonging to 2 orders of Chlorophyceae respectively. The classification of algae was mentioned in Table 1. The water temperature of sampling sites and pH of water in sampling sites found in Karboo Dam, Kantbalu Township were also stated in (Table 2 & Figure 3–4). Then, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), calcium, magnesium, chloride, sulphate values, information on the report of analysis of water were analyzed at the Water Laboratory; Water and Sanitation Department Committee, Public Health Laboratory, Mandalay (Figure 5–10).

Table 1 Classification of some algae found in Karboo Dam, Kantbalu Township

Division	Class	Order	Family	Genus	Species
Cyanobacteria	Cyanophyceae	Chroococcales	Chroococcaceae	*Chroococcus*	*Chroococcus minor* (Kutzing) Nageli
		Oscillatoriales	Oscillatoriaceae	*Oscillatoria*	*Oscillatoria limosa* Agardh ex Gomont
					O. prolifica (Gomont) Anagnostidis & Komarek
			Phormidiaceae	*Phormidium*	*Phormidium ambiguum* Gomont
				Spirulina	*Spirulina major* Kutzing
		Nostocales	Nostocaceae	*Anabaena*	*Anabaena constricta* (Szafer) Geitter
Euglenophyta	Euglenophyceae	Euglenales	Euglenaceae	*Euglena*	*Euglena gaumei* Allorge et Leaves
					E. minuta Prescott
				Phacus	*Phacus acuminatus* Stokes
					P.longicauda (Ehrenberg) Dujardin
Chrysophyta	Bacillariophyceae	Pennales	Fragilariaceae	*Fragilaria*	*Fragilaria pectinalis* (Muller) Lyngbye
			Gomphonemataceae	*Gomphonema*	*Gomphonema herculeana* Agardh
			Naviculaceae	*Pleurosigma*	*Pleurosigma elongatum* Smith
				Gyrosigma	*Gyrosigma spenceri* (Bailey ex Quekett) Griffith & Henfrey
				Stauroneis	*Stauroneis phoenocentron* Ehrenberg
			Nitzschiaceae	*Nitzschia*	*Nitzschia linearis* Smith
			Surirellaceae	*Surirella*	*Surirella splendida* (Ehrenberg) Kutzing
Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	*Tetraedron*	*Tetraedron minimum* (Braun) Hansgirg
					T. trigonum (Nageli) Hansgir
			Oocystaceae	*Ankistrodesmus*	*Ankistrodesmus falcatus* (Corda*)* Ralfs
			Scenedesmaceae	*Coelastrum*	*Coelastrum astroideum* Notaris

Table 1 Continued

Division	Class	Order	Family	Genus	Species

			Scenedesmus	*Scenedesmus arcuatus* Lemmermann
		Hydrodictyaceae	*Pediastrum*	*Pediastrum duplex* var. *reticulatum* Lagerheim
				P. tetras (Ehrenberg) Ralfs
				P. tetras var. *tetraodon* (Corda) Rabenhorst
	Zygnematales	Zygnemataceae	*Spirogyra*	*Spirogyra pseudofloridana* Prescott
			Zygnema	*Zygnema pectinatum* (Vaucher) Agardh
		Desmidiaceae	*Closterium*	*Closterium baillyanum* Brebisson
				C. dianae Ehrenberg
				C. parvulum Nageli
			Cosmarium	*Cosmarium granatum* Brebisson ex Ralfs
				C.rociborskii Lagerheim
			Staurastrum	*Staurastrum manfeldtii* Delponte
				S. pseudobacillare Groenblad
			Euastrum	*Euastrum spinulosum* Delponte
			Desmidium	*Desmidium occidentale* West & West

Table 2. Water Temperature (°C) and pH

Sampling Site	Water Temperature °C			pH		
	Rainy Season	Winter Season	Summer Season	Rainy Season	Winter Season	Summer Season
Karboo Dam (East)	26	23	36	6.8	7.1	7.6

Karboo Dam (South	29	24	34	6.7	7.3	7.8
Karboo Dam (North)	28	21	32	6.5	7.4	7.7

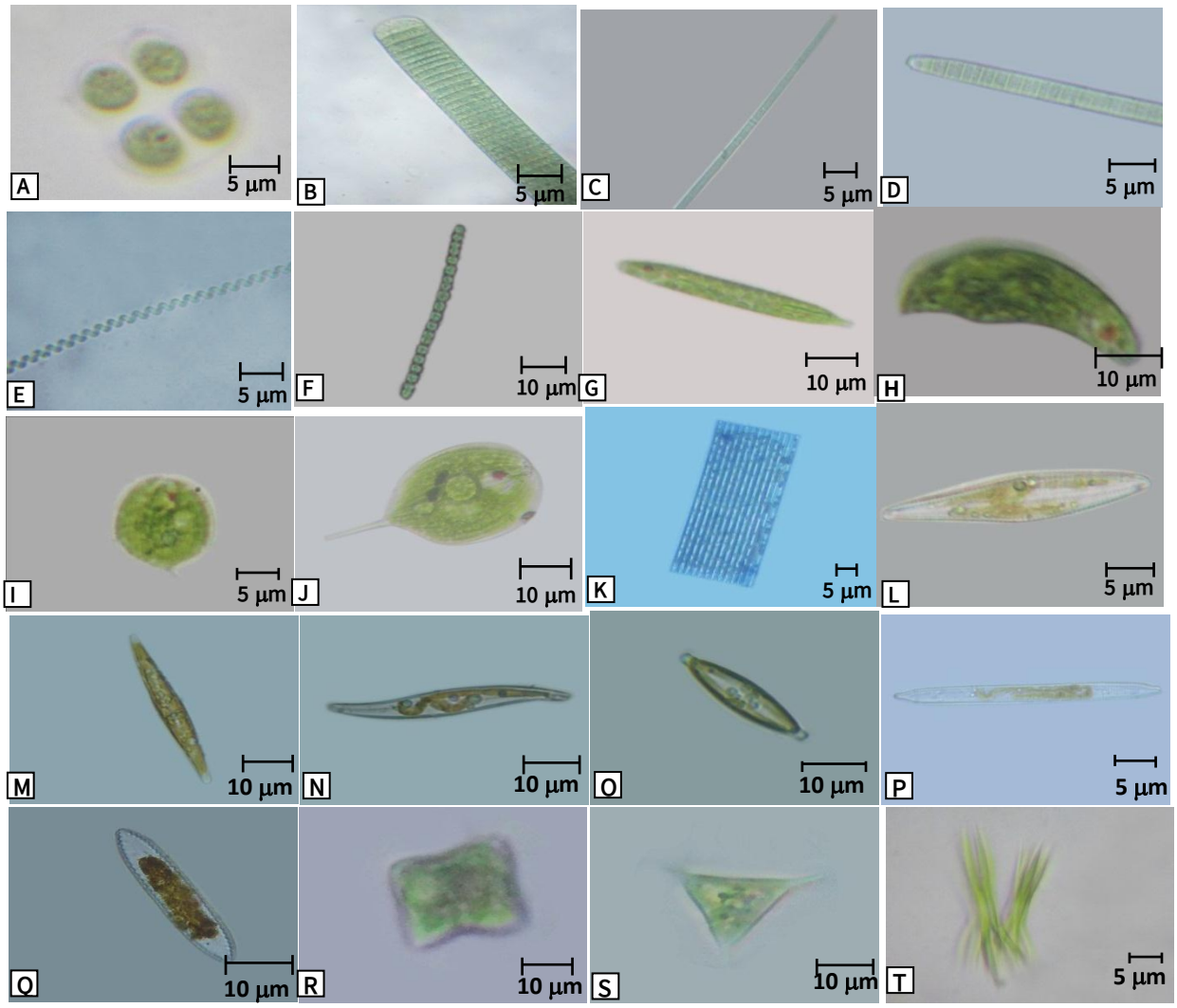


Figure 3. A. *Chroococcus minor* (Kutzing) Nageli B. *Oscillatoria limosa* Agardh ex Gomont
C. *O. prolifica* (Gomont) Anagnostidis D. *Phormidium ambiguum* Gomont & Komarek
E. *Spirulina major* Kutzing F. *Anabaena constricta* (Szafer) Geitler
G. *Euglena gaumei* Allorge et Leaves H. *E. minuta* Prescott
I. *Phacus acuminatus* Stokes Anagnostidis & Komarek J. *P.longicauda* (Ehrenberg) Dujardin
K. *Fragilaria pectinalis* (Muller) L. *Gomphonema herculeana* Agardh Lyngbye
M. *Pleurosigma elongatum* Smith N. *Gyrosigma spenceri* (Bailey ex Quekett) Griffith & Henfrey
O. *Stauroneis phoenocentron* Ehrenberg P. *Nitzschia linearis* Smith
Q. *Surirella splendida* (Ehrenberg) Hansging R. *Tetraedron minimum* (Braun) Kutzing
S. *Tetraedron trigonum* (Nageli) Hansgirg T. *Ankistrodesmus falcatus* (Corda) Ralfs

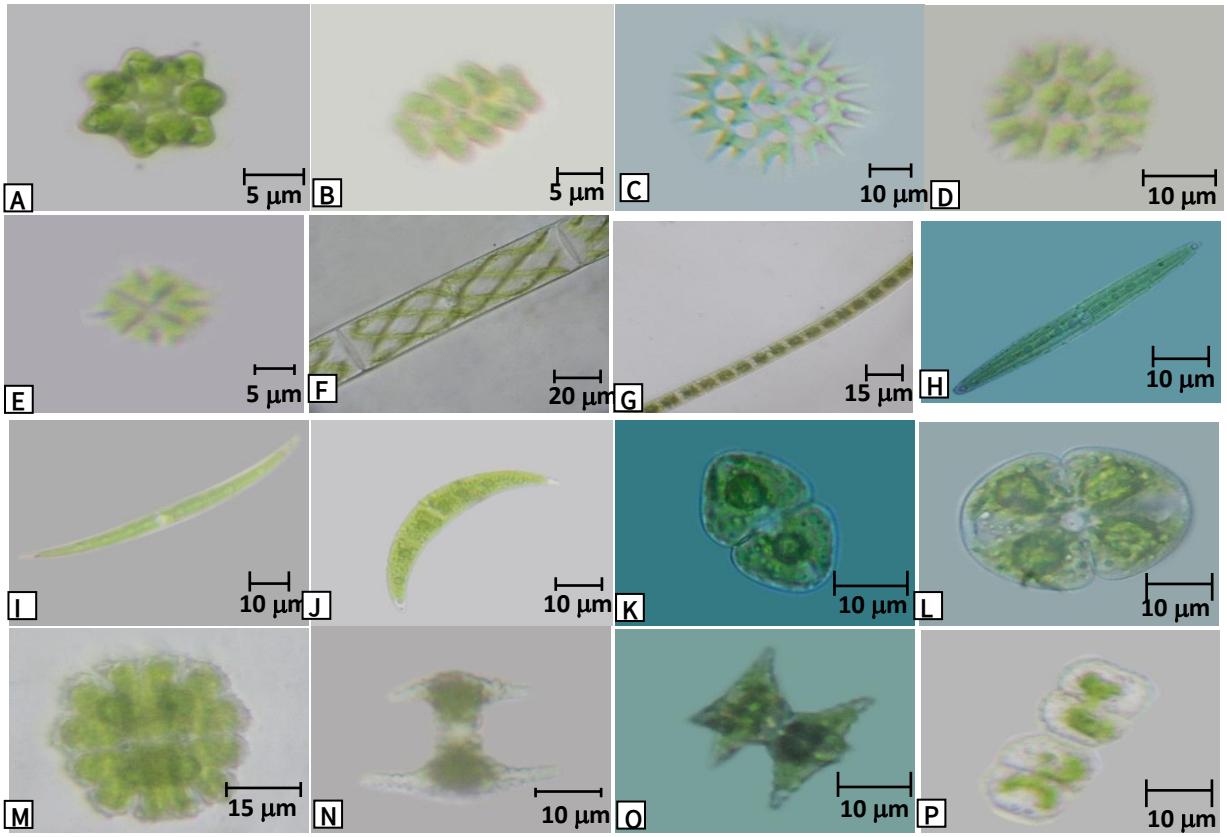


Figure 4. A. *Coelastrum astroideum* Notaris B. *Scenedesmus arcuatus* Lemmermann

C. *Pediastrum duplex* var. *reticulatum* Lagerheim D. *P. tetras* (Ehrenberg) Ralfs

E. *Pediastrum tetras* var. *tetraodon* (Corda) Rabenhorst F. *Spirogyra pseudofloridana* Prescott

G. *Zygnema pectinatum* (Vaucher) Berbisson H. *Closterium baillyanum* Agardh

I. *C. dianae* Ehrenberg J. *Closterium parvulum* Nageli

K. *Cosmarium granatum* Brebisson ex Ralfs L. *C. rociborskii* Lagerheim

M. *Euastrum spinulosum* Delponte N. *Staurastrum manfeldtii* Delponte

O. *S. pseudobacillare* Groenblad P. *Desmidium occidentale* West & West

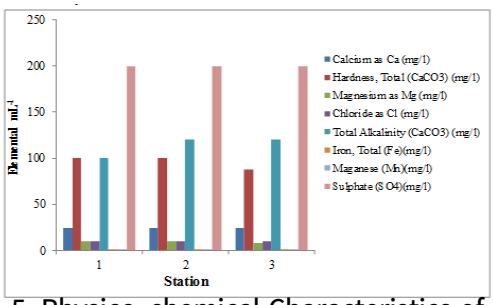


Figure 5. Physico–chemical Characteristics of Karboo Dam (Summer Season)

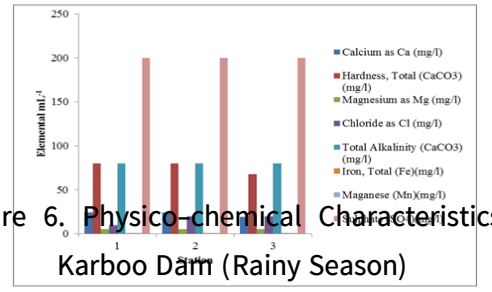


Figure 6. Physico–chemical Characteristics of Karboo Dam (Rainy Season)

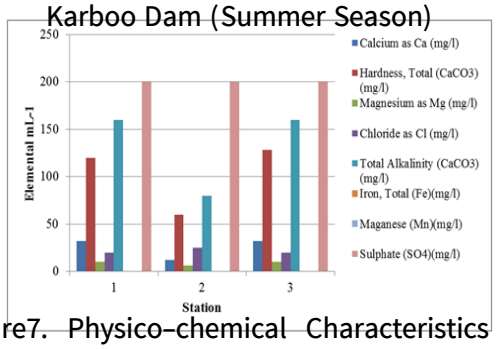


Figure7. Physico–chemical Characteristics of Karboo Dam (Winter Season)

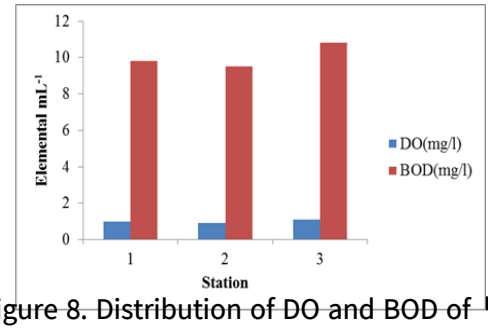


Figure 8. Distribution of DO and BOD of Karboo Dam (Summer Season)

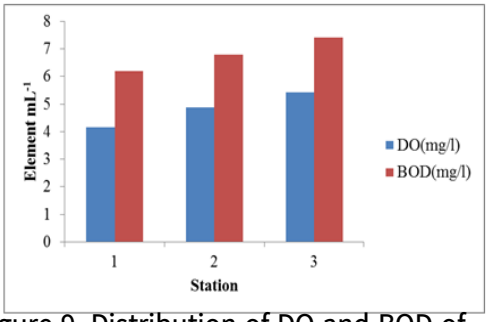


Figure 9. Distribution of DO and BOD of Karboo Dam (Rainy Season)

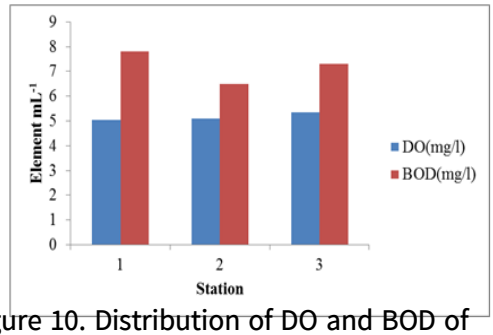


Figure 10. Distribution of DO and BOD of Karboo Dam (Winter Season)

Discussion and Conclusion

In this study, three sampling sites from Karboo Dam and its surrounding area were selected for study of algae flora. In the study, all of the collected species belonging to 36 species, 26 genera, 16 families, 7 orders, 4 classes and 4 divisions were observed. When the number of algal species assigned to respective orders was taken into consideration, it was displayed that Chlorophyceae comprised 52.8%, followed by Bacillariophyceae 19.4%, Cyanophyceae 16.7% and Euglenophyceae 11.1% each.The diversity of algae is mainly based on the environmental factors such as temperature and pH. In the studied area, the range of temperature was between from 26˚C to 29˚C in rainy season, 21˚C to 24˚C in winter season and 32˚C to 36˚C in summer season. The pH was 6.5–6.8 in rainy season, 7.1–7.4 in winter season and 7.6–7.8 in summer season.

Lembi *et al.* (1988) stated that the filamentous green algae *Spirogyra* occurs in a wide range of habitats, where it is typically attached to stable substratum (as periphyton) but also occur as

free floating mat. In the present study, *Spirogyra* species were found abundantly in the surface water of Karboo Dam. Thus, these observations are in agreement with the statement of Lembi *et al*. (1988). According to Bellinger & Sigee (2010), in many temperate lakes, diatoms dominate the phytoplankton population in spring. In the present study, diatoms occurs abundantly eastern part of Karboo Dam in winter. Thus, this finding is in agreement with Bellinger & Sigee (2010). According to Prescott (1962), the greatest number of forms is Chlorophyta 652 species. In the present study, green–algae like *Tetraedron, Coelastrum, Scenedesmus, Closterium* and *Cosmarium* are found abundantly in all stations. Thus, this study is in agreement with Prescott (1962).

According to WHO (2004), water is a tasteless, odourless liquid at standard qualities. Water is transparent, and thus aquatic plants can live within the water because sunlight can reach them. Only strong UV light is slightly absorbed. Drinking water or potable water is water of sufficiently high quality that it can be consumed or used without risk of immediate or long term harm. Parameters of drinking water quality typically fall under three categories: chemical, physical and microbiological. Chemical and physical parameters include heavy metals, trace organic compounds, total solids and turbidity. Temperature is one of the most important and essential parameter of aquatic habitats because almost all the physical, chemical and biological properties are governed by it. It influences the oxygen contents of water quantity and quality of autotrophs, while affecting the rate of photosynthesis and also indirectly affecting the quantity and quality of heterotrophs as shown by Barnable (1994).

Dissolved oxygen (DO) is an important indicator of ability of a water body to support necessary for the life of fish and other aquatic organisms. Low DO concentration (<3mg/l) in fresh water aquatic system indicates higher pollution causing negative effects on aquatic ecosystem as shown by Shilpa *et al*. (2011). The DO content in water samples were found between 0.91–1.11 mgL^{-1} in summer season, 4.16–5.43 mgL^{-1} in rainy season and 5.05–5.36 mgL^{-1} in winter season. Thus, the algal population may be related with DO concentration. The biochemical oxygen demand (BOD) depends on the temperature of the environment and on the particular kinds of microorganisms and nutrients present. BOD measures the role of oxygen consumption by organisms and was of the most commonly used terms in water quality and pollution control technology. BOD levels at a stations site with slower, deeper waters might be higher for organic and inorganic material than the levels for a similar site in high aerated water. BOD directly affected the amount of DO in water bodies. The BOD content in water samples were occurred between 9.50–10.80 mgL^{-1} in summer season, 6.20–7.40 mgL^{-1} in rainy season and 6.50–7.80 mgL^{-1} in winter season. BOD is more than maximum permissible limits of WHO guidelines values of portable water.

According to the results of the present study, it may be concluded that, the data also revealed that there was variation in the abundance and distribution of algal population with the variation of the physico–chemical factors. The algal community maintains a good diversity and good quality and provides aquatic products.

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