

## Diurnal Fluctuations in Physico-chemical Parameters at Madkot in Goriganga River from Kumaun Himalaya, India

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### Abstract

Field study was conducted to record Diurnal Fluctuations in Physico-chemical Parameters of Goriganga river at Madkot (about 1300 m above the sea level and 231 kms from University Campus) where Mandakni river joins Goriganga river. Some total eight Physico-chemical parameters, such as ambient temperature, water temperature, dissolved oxygen (D.O), free CO<sub>2</sub>, pH, carbonate, bicarbonate and total alkalinity were monitored at 4 hour interval for a period of 24 hours from 6 a.m. on the 25<sup>th</sup> of February-2008 to 2 a.m. of 26<sup>th</sup> of February-2008. The recorded data showed that ambient temperature fluctuated between 9.0<sup>o</sup>C to 20.4<sup>o</sup>C, water temperature 7.0<sup>o</sup>C to 11.0<sup>o</sup>C, dissolved oxygen 11.6 mg/l to 15.2mg/l, pH 7.0 to 8.39 carbonate 4.0mg/l to 5.0mg/l, bicarbonate 132mg/l to 170mg/l and total alkalinity between 138mg/l to 166mg/l. Free carbon dioxide (CO<sub>2</sub>) was completely absent throughout the study period i.e. for 24 hours. In the present study a positive relationship between water temperature and dissolved oxygen was observed.

**Keywords:** Diurnal, Fluctuations, Physico-chemicals, Madkot, Goriganga, Kumaun, Himalaya.

### Introduction

The present note deals with the study of diurnal fluctuations in some physico-chemicals parameters of Goriganga river, a glacial fed river which originate from Milam glacier at an altitude of 3600m<sup>1</sup>. The field study was made at Madkot at an altitude of 1300m where Mandakni river joins Goriganga river. The surface water of river was sampled at 4 hour interval for a period of 24 hours from 6 a.m. on the 25<sup>th</sup> of February-2008 to 2 a.m. of 26<sup>th</sup> of February-2008 when the weather was clear during day and night. The physico-chemical parameters like Ambient Temperature, water temperature, dissolved oxygen (D.O), free CO<sub>2</sub>, pH, Carbonate, Bicarbonate and Total alkalinity were estimated during the present study. Many researchers have worked on diurnal fluctuations in physico-chemicals parameters of various fresh water bodies, i.e. lakes, ponds, reservoirs and rivers<sup>2-10</sup>.

### Material and Methods

After the preliminary survey of the Goriganga river, the spot was selected keeping in mind its accessible position at night for the study of Diurnal fluctuations. The study was made at Madkot-1300msl. In order to investigate the diurnal fluctuations in physico-chemical parameters of glacial fed Goriganga river, the surface water samples were collected at 4 hour interval for a period of 24 hours from 6 a.m. on the 25<sup>th</sup> of February-2008 to 2 a.m. of 26<sup>th</sup> of February-2008 when the weather was clear both during day and night. Most of the analysis were made on the spot. The physico-chemical parameters like ambient

temperature, water temperature, dissolved oxygen, free carbon dioxide, pH, carbonate, bicarbonate and total alkalinity were estimated by using standard methods<sup>11-16</sup>.

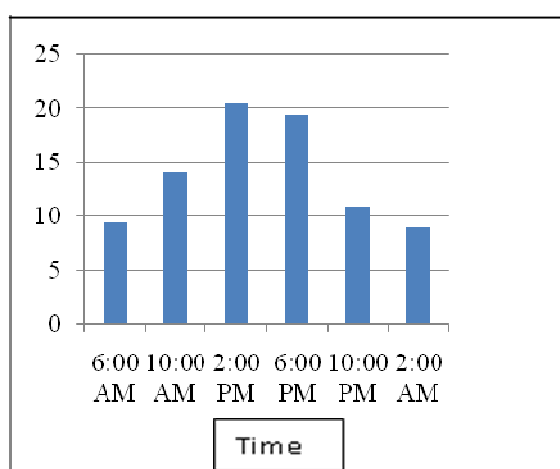
### Results and Discussion

Diurnal fluctuations in physico-chemicals parameters at Madkot (1300msl) of glacial fed mountainous Goriganga river recorded for 24 hours are tabulated in table-1. For the analysis of DIEL fluctuations in physico-chemicals, water samples were collected at the interval of 4 hours starting from 6 a.m. on the 25<sup>th</sup> of February-2008 to 2 a.m. of 26<sup>th</sup> of February-2008. Well marked DIEL variations have been recorded in most of the physico-chemical parameters.

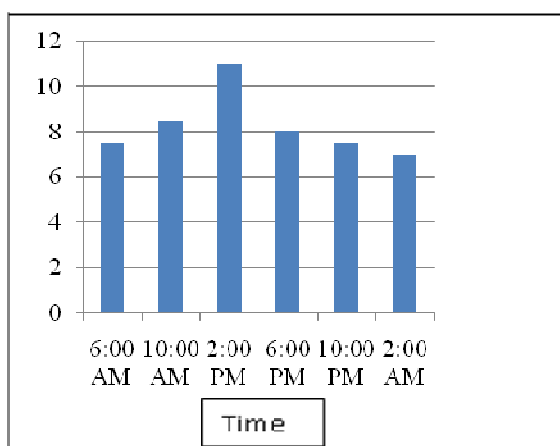
The parameter of temperature is basically important for its effects on the chemistry and biological reaction in the living organisms in water. A rise in temperature of the water speed up the chemical reaction in water, reduces the solubility of gases and amplifies the taste and odour. Atmospheric and water temperature varied between 9.0<sup>o</sup>C to 20.5<sup>o</sup>C and 7.0<sup>o</sup>C to 11.0<sup>o</sup>C. The maximum atmospheric temperature 20.5<sup>o</sup>C was recorded during the day hours at 2p.m. and relatively minimum atmospheric temperature 9.0<sup>o</sup>C was recorded during the night hours at 2a.m. figure-1. Surface water temperature followed the similar trend. The maximum water temperature 11.0<sup>o</sup>C was again recorded during the day hours at 2 p.m. whereas minimum water temperature 7.0<sup>o</sup>C was recorded during the night hours at 2a.m. figure-2.

**Table-1**  
**Diurnal fluctuations in physico-chemical Parameters at Madkot in Goriganga river**

Date	Time	Ambient Temperature °C	Water Temperature °C	Dissolved Oxygen (D.O)mg/l	Free CO <sub>2</sub> mg/l	pH	Carbonate mg/l	Bicarbonate mg/l	Total alkalinity mg/l
25/2/2008	6.A.M	9.5	7.5	13.6	Nil	8.0	4.0	148	160
25/2/2008	10.A.M	14.0	8.5	14.8	Nil	7.5	5.0	142	170
25/2/2008	2.P.M	20.5	11.0	15.2	Nil	7.72	4.0	132	142
25/2/2008	6.P.M	19.5	8.0	14.8	Nil	7.76	4.0	156	160
25/2/2008	10.P.M	11.0	7.5	12.0	Nil	7.0	4.0	170	166
26/2/2008	2.A.M	9.0	7.0	11.6	Nil	8.39	4.0	140	138



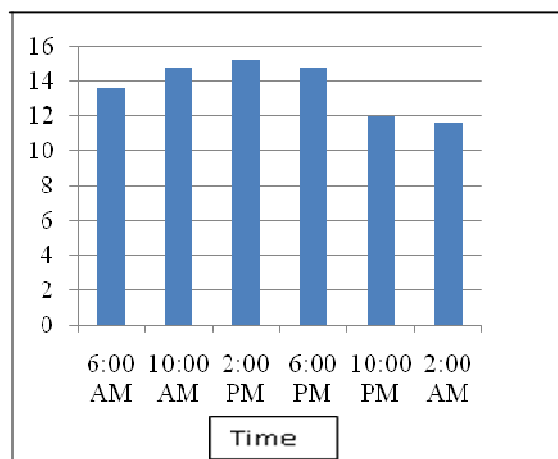
**Figure-1**  
**Diurnal Fluctuations in Ambient Temperature**



**Figure-2**  
**Diurnal Fluctuations in Water Temperature**

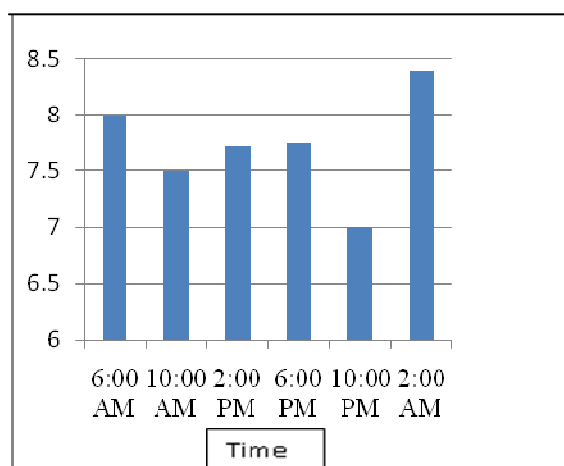
The dissolved oxygen produced during photosynthesis is essential for all the living organisms (aquatic and terrestrial) and considered to be the lone factor, which to a greater extent can reveal the nature of the whole aquatic ecosystem. The dissolved

oxygen fluctuated between 11.6mg/l to 15.2mg/l in the present study figure-3. Maximum value of dissolved oxygen 15.2mg/l was recorded during the day hours at 2pm when the water temperature was 11.0°C and minimum dissolved oxygen 11.6°C was recorded during the night hours at 2am when the water temperature was 7.0°C. It was observed that a positive relationship was observed between water temperature and dissolved oxygen during day and night hours. The present study further confirms the view of Singh et.al.<sup>17</sup> that increase in dissolved oxygen during the day hours may be due to the photosynthetic activity of the autotrophs and decrease during night hours might be due to the respiratory activity of the heterotrophs.



**Figure-3**  
**Diurnal Fluctuations in Dissolved Oxygen**

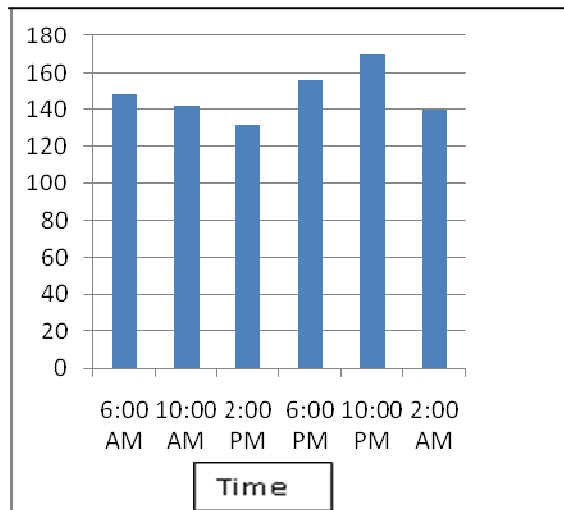
The pH is one of the most important factor in measuring water quality. Practically every aspect of water, like acid and base neutralization, water softening, precipitation, coagulation and acid disinfections is pH dependent. In the present study pH of water remained alkaline and fluctuated between 7.0 to 8.39 figure-4.



**Figure-4**  
**Diurnal Fluctuations in pH**

Free carbon dioxide (CO<sub>2</sub>) was completely absent throughout the study period i.e. for 24 hours. Carbonate fluctuated between 4.0mg/l to 5.0mg/l in the study.

The bicarbonate fluctuated between 132mg/l to 170mg/l figure-5. Maximum concentration of bicarbonate 170mg/l was recorded at 10pm where as minimum value of bicarbonate 132mg/l was recorded at 2 pm figure-5. The values of total alkalinity ranged from 138mg/l to 170mg/l figure-6.

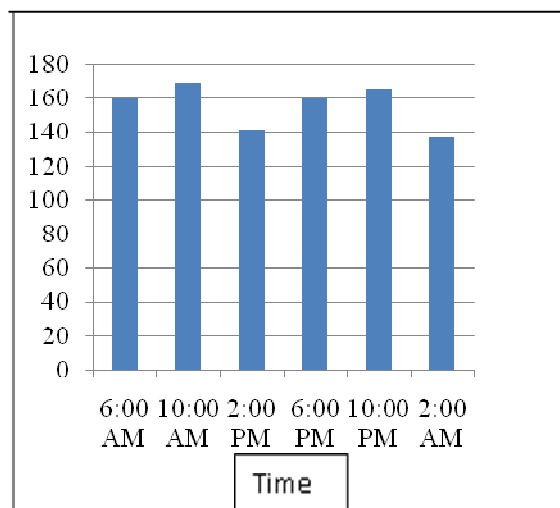


**Figure-5**  
**Diurnal Fluctuations in Bicarbonate**

## Conclusion

From the result, it can be concluded that dissolved oxygen increases with the increase in temperature and thus showed positive relation. Higher values of Dissolved oxygen (D.O) confirms the oligotrophic nature of goriganga river. Physico-chemical parameters under investigation indicated that water at the surface level was well within the permissible limits

prescribed by ISI, ICMR and WHO drinking water standards. Further, it is clear from the present study that some physico-chemical parameters of glacial fed mountainous Goriganga river under investigation for Diurnal fluctuations exhibit Diurnal pattern of fluctuation to some extent which are controlled by complex interaction of various environmental factors operating in the system e.g., light hours, photosynthetic activity, community respiration of aquatic biota present in the water. All these physico-chemical parameters also control each other and in turn influence the Diurnal pattern of plankton



**Figure-6**  
**Diurnal Fluctuations in Alkalinity**

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