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Physico-chemical Characteristics of Water Quality for Culturing the Freshwater Mussel Lamellidens marginalis in Pond and Laboratory

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Abstract: *Physicochemical characteristics viz., turbidity, pH, temperature, dissolved oxygen, salinity, hardness and alkalinity of water were studied in the pond and laboratory for culturing the Freshwater Mussel Lamellidens marginalis. The optimal ranges for the survival of Mussels were detected for the culture maintenance. The data on the ecological factors of the pond and laboratory water have been studied for a period of one year (from July 2013 to June 2014) and discussed with the light of similar work. The findings of the present study confirmed that the physico-chemical parameters appeared to be varied due to the nature of water as well as season.*

Keywords: *Freshwater mussel, Lamellidens marginalis, optimal ranges, physicochemical parameters.*

I. Introduction

Water is a soul of nature which covers seven tenth of the earth's surface. Water is an elixir of life, a precious gift of nature to mankind and millions of other species living on the earth. Water resources comprising of surface water viz., rivers, lakes and ponds, ground water, marine and coastal waters, support all living beings including human beings. India has vast fresh water resources in the form of both lentic and lotic ecosystems. The perennial reservoirs play an important role for domestic, agriculture and aquaculture as a valuable water resource. The lentic ecosystems have long attracted attention of ecologists, both for their importance as a source of drinking water and the development of fisheries [1].

Therefore, the attention is given on the physico-chemical factors which affect the aquatic inhabitants [2]. Wetlands are very productive ecosystems, which help in the regulation of biological cycles, maintenance of water quality, nutrient movement and support for food chains. In addition, they provide refuge for endangered species of plants and animals and economic benefits. The natural aquatic resources are causing heavy and varied pollution in aquatic environment leading to pollute water quality and depletion of aquatic biota [3]. Pollution refers to undesirable changes in the physical, chemical or biological characteristics of our environment. This has adversely affected the humans and other species of our biosphere directly or indirectly [4].

The Freshwater Molluscs constitute an important part of the ecosystem. Their participation in the way of life in many organisms has made them significant partners in the ecological communities [5]. Freshwater Mussels are widely distributed throughout the world occurring in both lotic and lentic systems [6]; [7]. In India , freshwater bodies show grate seasonal variations in the physicochemical factors which affect the natural populations of Freshwater Mussels and consequently, transmission of disease. In view of the above, the present study deals with the assessment of physic-chemical characteristics of a freshwater pond as well as the water present in the laboratory for the cultural and survival of the experimental animal Freshwater Mussel, L. marginalis.

II. Materials and Methods

The study was carried out in July 2013 to June 2014 in K. Sathanur, Moorthy Nagar pond located in Tiruchirappalli of Tamil Nadu and in the laboratory tap water. Water samples were collected for physico-chemical analyses in sterile bottles and taken to the laboratory aseptically. The collection was usually completed during morning hours between 6:00 a.m. to 10:00 a.m. For each sampling event, odour (Odo), turbidity (Tur), temperature (Tem), pH and dissolved oxygen (DO) were monitored at the sampling sites while total dissolved solids (TDS), salinity (Sali.), total hardness (TH), calcium (Ca), magnesium (Mg), sodium (Na) and potassium (K) were analyzed in the laboratory in accordance with the methods of FAO (1997) and APHA (1998).

III. Results and Discussion

The Physico-chemical data of the pond water situated at K. sathanur and laboratory tap water for 13 physico-chemical parameters are presented in Table-1 and Table-2 respectively. The obtained results were compared with Standard prescribed under APHA [8]. The two water samples of pond and laboratory are colourless and also with no objectionable odour. The turbidity of water samples ranged between 2.6 – 4.2 NTU for pond water and 5.0 – 7.0 NTU for laboratory water. Temperature is an important biologically significant factor, which plays an important role in the metabolic activities of the organism. It also influences the metabolic behavior of aquatic ecosystem [9]; [10]. The temperature was ranging from 25.40°C to 28.80°C during the study period in pond water and 26.00°C to 30.00°C in lab water. Lowest water temperature (25.40°C) was observed in December 2013 and highest temperature (30.00°C) value was observed in April and May 2013.

Table-1. Physico-chemical characteristics of pond water.

Period	Odo	Tur NTU	Tem °C	pH	DO mg/l	TDS mg/l	Sali. mg/l	TA mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l
July'13	U	3.2	27.5	7.4	5.9	280	282.5	560	275	61.4	80.2	45.7	5.6
Aug'13	U	4.0	26.4	7.1	6.2	320	294.2	488	320	67.5	99.5	40.8	6.3
Sept'13	U	2.8	26.8	7.7	6.8	270	267.9	519	240	71.2	84.7	35.4	5.8
Oct'13	U	2.6	27.1	7.5	5.8	360	250.8	399	310	64.3	72.1	39.6	5.0
Nov'13	U	3.1	26.0	7.2	6.4	345	269.1	423	280	60.9	86.9	43.3	6.1
Dec'13	U	3.4	25.4	7.8	6.0	310	257.5	572	295	63.1	64.8	37.5	5.3
Jan'14	U	2.8	26.2	7.4	5.8	285	274.6	496	260	59.0	85.6	43.2	5.9
Feb'14	U	2.6	25.8	7.9	5.4	270	298.3	534	270	58.9	80.9	37.4	6.2
Mar'14	U	3.5	27.3	7.2	6.5	325	283.7	401	300	64.2	71.4	44.6	5.4
Apr'14	U	3.1	28.6	7.5	5.3	350	251.9	578	275	69.7	69.8	40.7	4.9
May'14	U	4.2	28.8	7.8	5.9	310	282.3	594	265	63.7	94.2	44.8	5.6
Jun'14	U	3.3	27.4	7.3	6.2	280	250.6	428	310	68.4	98.5	41.7	6.2

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pH is a term used universally to express the intensity of the acid or alkaline condition of a solution. Most of the water samples are slightly alkaline due to presence of carbonates and bicarbonates. pH of bore water influenced by geology of catchment area and the buffering capacity of water. The pH variation is mostly due to diurnal interplay of photosynthesis and community respiration of the biota and also is one of the most important single factors, which influences aquatic production [11]. The pH values of water samples varied between 7.1 to 7.9 and 6.8 to 7.2 respectively were found for pond and lab water. In the pond water the values were more than 7.0 and impart the alkaline nature where as in lab water the hydrogen ion concentration was in acidic condition but within the limit prescribed. Dissolved Oxygen in water is essential for life. Deficiency of dissolved oxygen gives bad odour to water due to anaerobic decomposition of organic waste [12]. Dissolved Oxygen in this study ranges from 5.3 mg/l to 6.8 mg/l in pond water and 5.0 mg/l to 5.6 mg/l in the lab water. In any aquatic ecosystem the level of dissolved oxygen depends on the factors like temperature of water, concentration of dissolved solids and biological activity of all life. Total dissolved solids denote mainly the various kinds of minerals available in the water. In natural waters dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrate, calcium, magnesium, sodium, potassium and iron [13].

In the present investigation maximum value of total dissolved solids was recorded in October 2013 (360 mg/l) at pond water and minimum value of (155 mg/l) was observed in April 2014 at the laboratory water sample. The chloride concentration or salinity serves as an indicator of pollution by sewage. People accustomed to higher chloride in water are subjected to laxative effects [14]. In the present analysis, chloride concentration was found in the range of 250.6 mg/l to 298.3 mg/l in pond water. In laboratory water the minimum quantity was recorded as 114.8 mg/l in the month of March 2014 and the maximum of salinity was observed as 129.5 mg/l in the laboratory tap water in the month of July 2013. The pattern has also been recorded [15]; [16]. This again implies that all the waters studied were all of satisfactory quality in terms of their chloride contents and that chloride does not contribute to problems of taste in some of the waters. Alkalinity of water is its capacity to neutralize a strong acid and it is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium [17]. Total alkalinity was recorded as the range between 399.00 mg/l to 594.00 mg/l for pond water and 42.00 mg/l to 93.00 mg/l for laboratory water.

Hardness is the property of water which prevents the lather formation with soap and increases the boiling points of water. Hardness of water mainly depends upon the amount of calcium or magnesium salts or both [17]. Total hardness values of pond and laboratory water were studied and they vary between 240.00 mg/l to 320.00 mg/l and 69.00 mg/l to 98.00 mg/l respectively. Calcium is a soft gray alkaline earth metal which is

directly related to hardness. Calcium is the most abundant substances of the natural water. In aquatic environment calcium serves as one of the micronutrients for most of the organisms [18]. Calcium concentration ranged between 58.90 mg/l to 71.20 mg/l in pond water and 20.80 mg/l to 42.70 mg/l in the laboratory water.

Magnesium is one of the most abundant elements in nature and it is a significant member in water hardness, it gives an unpleasant taste to water. Magnesium content in the investigated water samples were ranging from 64.80 mg/l to 99.50 mg/l for pond water and between 31.50 mg/l to 41.80 mg/l for the laboratory water. Magnesium is essential for chlorophyll bearing organism, since it goes into composition of the pigments. Decrease value of magnesium may be due to plankton and algal uptake [17].

Table-2. Physico-chemical characteristics of laboratory tap water.

Period	Odo	TurN TU	Tem °C	pH	DO mg/l	TDS mg/l	Sali. mg/l	TA mg/l	TH mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l
July'13	U	5	28	7.0	5.1	195	129.5	60	98	28.4	38.4	18.6	3.2
Aug'13	U	4	26	6.8	5.6	192	118.4	54	87	34.9	34.6	14.9	2.8
Sept'13	U	4	26	7.1	5.2	164	115.7	42	93	42.7	32.0	22.7	2.6
Oct.'13	U	5	27	7.2	5.5	190	118.6	52	95	27.3	36.7	20.5	3.4
Nov.'13	U	3	28	7.0	5.3	160	115.7	85	84	20.8	39.2	17.8	3.9
Dec.'13	U	3	27	6.9	5.6	184	121.9	93	71	28.7	41.5	14.1	2.7
Jan.'14	U	5	28	7.1	5.0	178	124.8	84	83	26.3	35.8	21.5	1.9
Feb.'14	U	3	28	6.9	5.1	189	116.3	76	69	34.5	37.4	24.9	2.1
Mar.'14	U	4	29	6.8	5.4	167	114.8	72	82	30.9	31.5	18.7	3.6
Apr.'14	U	4	30	7.2	5.5	155	125.1	61	97	41.2	41.8	13.6	4.1
May'14	U	5	30	6.8	5.4	179	119.5	54	91	39.8	40.9	11.2	3.8
Jun.'14	U	4	28	7.1	5.3	183	123.2	47	86	35.1	37.5	24.8	2.9

The maximum value of sodium was recorded to be 45.70 mg/l in July month of 2013 at the water sample of pond and minimum 11.20 mg/l in May 2014 at sample of laboratory water. The maximum value of potassium was recorded to be 6.30 mg/l in August 2013 in pond water and the minimum value of 1.90 mg/l in January 2014 in the laboratory tap water. Potassium plays a vital role in metabolism of fish environment and is an important macronutrient. From the results obtained, it can be concluded that the K. Sathanur pond is a non-polluted freshwater body due to the block of municipal sewage discharge. Higher amount of nutrients leads to eutrophication. More nutrients in the water body and makes the water fit enough for the survival of aquatic organisms. Due to high organic matter contamination hydrophytes are growing drastically and deposited into the lake after death which consequently reducing the depth of the lake day by day. The results obtained from the present investigation of pond as well as laboratory fresh water shall be useful in culturing the Freshwater Mussel, L. marginalis It is also recommended that a periodical survey is essential to find out the water quality.

IV. Conclusion

The assessment of water quality is an important factor to assess of pollution levels. This study revealed that the water in the studied area is suitable for drinking and domestic purposes including the cultural performance of aquatic organisms at the physic-chemical level. The results were compared favourably with standards.

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