Seasonal variations on Physico-Chemical characteristics of water in some selected paddy fields of Kanyakumari district, Tamilnadu, India

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ABSTRACT

In the present investigation, an attempt was made to study the physico-chemical characteristics of water in eight paddy fields of Kanyakumari District for the period of 6 months during monsoon season (September 2010 to February 2011) and post monsoon season. A total of 11 parameters in water sample were recorded during the study period. The qualitative study showed that the present status of the physico-chemical parameters, which is very useful to evaluate the health of the paddy field environment and also to take precautionary measures to save the paddy ecosystem.

Key words: Physico-chemical parameter, Paddy field, water, monsoon season, post monsoon season.

1. Introduction

Paddy field ecosystem is a farming system composed of paddy, animals, microbes and other environmental factors in specific time and space, with particular temporal and partial. India has the largest paddy output in the world and also the second largest exporter of rice in the world. Rice among the cereals is the most stable food crop and occupies about 39.6 million hectares or 37% of the total area under cereal cultivation in India [1,2]. Paddy is the major food crop of Tamil Nadu. In 1985, 5000 traditional varieties of paddy in Tamil Nadu and 83 traditional varieties in Kanyakumari District. At present only six varieties were existing. The rice production depends on water supply characteristics such as salinity, acidity, and soil alkalinity, nutrient contents etc. The district has a favourable agro–climatic condition which is suitable for growing a number of crops [3,4].

Water is one of the most important and abundant compounds of the ecosystem. The study of fresh water system with respect to physical, chemical, geological and biological parameters is termed as Limnology. Physico-chemical Parameters is very essential and important to test the water before it is used for drinking, domestic, agricultural or industrial purpose. Water must be tested with different physico-chemical parameters. The density and diversity of phytoplankton are controlled by several physico–chemical factors of water. There are a number of important physico-chemical factors of water bodies like temperature, light, pH, alkalinity, organic matter, inorganic nutrients etc. which control the algal productivity [5,6]. The objective of this study was to assess the physico–chemical characteristics of water in the selected paddy fields of Kanyakumari district, Tamilnadu.

2. Materials and methods

2.1. Study area

The eight paddy fields were selected for the present work from Parvathipuram (2 fields) of Agastheeswaram Taluk, Thottiyode (2 fields) of Kalkulam Taluk, Thovalai (2 fields) of Thovalai Taluk and Padanthalumoodu (2 fields) of Vilavancode Taluk in Kanyakumari District.

2.2. Physico-Chemical parameters

The present study was carried out for a period of six months from September 2010 to February 2011. Sampling of water was done between 7 to 8 am in the paddy fields. Physico-chemical analysis of water collected from the paddy fields in bottles were brought to the laboratory for analysis as per the standard methods [9].

3. Results and Discussion

3.1. Water analysis

Water samples were collected from the experimental rice fields of different area to record the pH, Electrical Conductivity, Dissolved Oxygen, Biological Oxygen Demand, Temperature, Bicarbonate, Chlorine, Calcium, Magnesium, Sodium and Potassium (Table 1 and 2).

Table 1. Physico-chemical Parameters of water samples recorded from the study fields during monsoon season

Sl. No	Parameters	Study area (Paddy field)							
		I	II	III	IV	V	VI	VII	VIII
1	pH	7.0 ± 0.33	6.9 ± 0.33	6.8 ± 0.32	7.0 ± 0.33	6.7 ± 0.32	6.9 ± 0.33	6.7 ± 0.32	5.3 ± 0.28
2	Temperature ("C)	27.3 ± 0.65	23.8 ± 0.60	24.6 ± 0.61	21.9 ± 0.58	23.2 ± 0.60	26.4 ± 0.64	25.2 ± 0.62	22.9 ± 0.59
3	Electrical conductivity (dSm^{-1})	0.62 ± 0.07	0.50 ± 0.08	0.16 ± 0.05	0.37 ± 0.07	1.07 ± 0.12	1.12 ± 0.13	0.24 ± 0.06	0.16 ± 0.05
4	Dissolved Oxygen (mg/l)	4.62 ± 0.26	4.21 ± 0.25	4.56 ± 0.26	4.28 ± 0.25	3.81 ± 0.24	4.73 ± 0.27	3.57 ± 0.23	4.12 ± 0.25
5	Biological oxygen demand (mg/l)	0.98 ± 0.12	1.28 ± 0.14	1.32 ± 0.14	1.41 ± 0.14	0.87 ± 0.11	1.73 ± 0.16	1.48 ± 0.15	1.60 ± 0.15
6	Bicarbonate (mg/l)	3.6 ± 0.23	2.8 ± 0.20	1.0 ± 0.125	3.1 ± 0.22	3.7 ± 0.24	3.7 ± 0.24	1.0 ± 0.125	1.0 ± 0.125
7	Chloride (mg/l)	2.6 ± 0.20	2.4 ± 0.19	0.7 ± 0.10	0.7 ± 0.10	7.1 ± 0.33	7.5 ± 0.34	1.6 ± 0.15	0.6 ± 0.09
8	Calcium (mg / l)	1.9 ± 0.17	1.0 ± 0.125	0.9 ± 0.11	1.5 ± 0.15	3.2 ± 0.22	3.8 ± 0.24	0.8 ± 0.11	0.2 ± 0.05
9	Magnesium (mg/l)	1.2 ± 0.13	1.0 ± 0.125	0.3 ± 0.06	1.3 ± 0.14	1.9 ± 0.17	0.7 ± 0.10	0.5 ± 0.08	0.5 ± 0.08
10	Sodium (mg/l)	2.5 ± 0.19	2.6 ± 0.20	0.30 ± 0.06	0.71 ± 0.10	4.46 ± 0.26	5.1 ± 0.28	0.81 ± 0.11	0.2 ± 0.05
11	Potassium (mg/l)	0.32 ± 0.07	0.17 ± 0.05	0.05 ± 0.02	0.02 ± 0.01	0.2 ± 0.55	0.1 0.03	0.2 ± 0.05	0.12 ± 0.04

Table 2. Physico-chemical Parameters of water samples recorded from the study fields during post-monsoon

Sl. No	Parameters	Study area (Paddy field)							
		I	II	III	IV	V	VI	VII	VIII
1	pH	6.90 ± 0.32	6.77 ± 0.32	6.67 ± 0.32	6.76 ± 0.32	6.51 ± 0.31	6.82 ± 0.32	6.67 ± 0.32	5.94 ± 0.30
2	Temperature (°C)	30.6 ± 0.69	29.5 ± 0.67	31.0 ± 0.69	27.1 v 0.65	26.5 ± 0.64	29.2 ± 0.67	28.7 ± 0.66	26.0 ± 0.63
3	Electrical conductivity (dSm⁻¹)	0.23 ± 0.59	0.13 ± 0.04	0.11 ± 0.04	0.15 ± 0.04	0.04 ± 0.025	1.15 ± 0.13	0.47 ± 0.08	0.28 ± 0.06
4	Dissolved Oxygen (mg/l)	4.31 ± 0.25	4.47 ± 0.26	4.97 ± 0.27	4.01 ± 0.25	4.25 ± 0.25	4.69 ± 0.27	3.60 ± 0.23	3.59 ± 0.23
5	Biological oxygen demand (mg/l)	2.52 ± 0.19	2.39 ± 0.19	2.82 ± 0.20	1.80 ± 0.16	2.31 ± 0.18	2.64 ± 0.20	1.43 ± 0.14	1.70 ± 0.16
6	Bicarbonate (mg/l)	0.7 ± 0.10	0.4 ± 0.07	0.6 ± 0.09	1.0 ± 0.125	2.4 ± 0.19	3.1 ± 0.22	1.6 ± 0.15	2.1 ± 0.18
7	Chloride (mg/l)	1.6 ± 0.15	0.9 ± 0.11	0.5 ± 0.08	0.5 ± 0.08	3.1 ± 0.22	2.9 ± 0.21	1.8 ± 0.16	1.6 ± 0.15
8	Calcium (mg / l)	1.8 ± 0.16	0.3 ± 0.06	3.7 ± 0.10	0.9 ± 0.11	2.6 ± 0.20	2.9 ± 0.21	0.9 ± 0.05	0.6 ± 0.09
9	Magnesium (mg/l)	0.3 ± 0.06	0.8 ± 0.11	0.2 ± 0.05	0.3 ± 0.06	1.7 ± 0.16	0.9 ± 0.11	1.2 ± 0.13	1.0 ± 0.125
10	Sodium (mg/l)	0.09 ± 0.03	0.14 ± 0.04	0.16 ± 0.05	0.32 ± 0.07	2.19 ± 0.18	2.72 ± 0.20	0.51 ± 0.08	0.10 ± 0.03
11	Potassium (mg/l)	0.01 ± 0.0125	0.01 ± 0.0125	0.01 ± 0.0125	0.1 ± 0.03	0.15 ± 0.04	0.26 ± 0.06	0.19 ± 0.05	0.20 ± 0.05

The physicochemical characteristics of water are an important determinant of the aquatic system which is greatly influenced by general composition of water. The pH maintenance is one of the most important factors of aquatic system, since all the biochemical activities depend on pH of the surrounding water. In the present study the pH was in the acidic range throughout the study period and pH value of water ranged from 5.3 to 7.0. Maximum mean pH was recorded during monsoon season (7.0 ± 0.33) in field I and IV and

the present observation is inconsistence with the earlier reports of rice field from Kanyakumari District [10].

Temperature is one of the important factors in an aquatic ecosystem, which control the physiological behaviour and the distribution of biota [11,12]. In the present observation maximum temperature was recorded during post monsoon season (31.0 ± 0.69) in field III. Sinha and Swaminathan [13] studied the impact of high temperature in rice production in India.

Dissolved salts in water are responsible to conduct electric current. Electrical conductivity of the study area varied from 0.16 – 1.15 dSm^{-1}. Maximum mean electrical conductivity was recorded during monsoon season (1.15 ± 0.13) in field VI. Generally, ground water tends to have high electrical conductivity due to the presence of high dissolved salts [14].

Dissolved oxygen is one of the most important water quality parameters and very important for the existence of flora and fauna in the aquatic environment. In the present study, maximum value of dissolved oxygen was recorded during post monsoon season (4.97 ± 0.27) in field III. In the study area DO ranged between 3.57 – 4.97 mg / l. Thus DO in most of the water sample was not in desirable quantity and the lowest value indicates the presence of bacteria in very large number [15]. A maximum of 5 mg/l dissolved oxygen concentration is recommended for healthy growth of fish and other planktonic population [16].

Biological oxygen demand is of great importance in water quality assessment and it is an index of pollution by nutrients [17]. In the present study the values ranged between 0.87 – 2.82 mg / l. Maximum BOD was observed in field VIII and the mean value of 1.60 ± 0.15. High levels of pollutants, mainly organic matter in water cause an increase in BOD, COD and other dissolves solids and they make after unsuitable for drinking, irrigation or any other use [18].

The maximum Bicarbonate value observed in monsoon season ranged from a minimum mean value of 1.0 ± 0.125 in field III and VI to the maximum mean value of 3.7 ± 0.24 in field V and VI. The Chloride value ranged from a minimum mean value of 0.6 ± 0.09 in field VIII to the maximum mean value of 7.5 ± 0.34 in field VI. The lowest value of chloride recorded during monsoon seasons 98mg/l due to the dilution of lake water by rain [19,20].

Calcium is found in greater abundance in all natural water as its main source is weathering of rocks from which its leaches out. The maximum calcium value was observed in post monsoon season, from a minimum mean value of 0.3 ± 0.06 in field II to the maximum mean value of 2.9 ± 0.21 in field VI (Table 2). Sulabha and Prakasan [21] also

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