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RESEARCH ARTICLE

ENVIRONMENTAL IMPACT ON PHYSICOCHEMICAL PARAMETERS FROM STAGNENT WATER BODY, EKRUK TANK, SOLAPUR

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ABSTRACT

The present investigation is focused on effect of environmental variations as well as human interference on physicochemical parameters from Ekruk tank, Solapur.The correlation is established between various physicochemical parameters during specified period 2010 -2012.In our study it is revealed that all parameters showed correlation with each other and seasonal fluctuations heavily influenced the variations found in native freshwater body. Our results are discussed in the context with influence of season as well as human interference.

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INTRODUCTION

Water is considered as important element of universe. It has played vital and essential role in fundamental life processes. Now a days quality of water is changing drastically due to it's need for various commercial, industrial and domestic purposes of human beings, thus limiting access to pure and safe water supply. This unprecedented development of today's era has now critically underlying importance, maintenance and conservation of freshwater resources. Solapur city is one of the historical and textile place situated at South – West of Maharashtra. Drinking need of this city is fulfilled by a freshwater tank, known as Ekruk tank along with Ujani dam.Ekruk tank was constructed during British times in the year 1867. This artificial tank was built mainly for irrigation and drinking purpose, having about 7 ¼ square miles of water surface area. This tank is situated at Ekruk village, 5km away from Solapur city. Ekruk tank is considered as home for thousands of migratory birds during winter season. Thus making this tank as a rich biodiversity centre and hotspot for environmentalists. In the present study, physicochemical parameters were studied during 2010 -2012 to analyse changes occurring in water quality. Potability of water is mainly dependent on physicochemical parameters present in it.

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According to Jadhav *et al*., (2013) excessive human interference and unplanned exploitation in and around natural aquatic ecosystem lead to the pollution problem. As aquatic habitats are considered as diverse ecosystem in the world supporting rich and diverse flora and fauna (Shukla *et al*., 2013).Padate *et al.,* (2014) studied water quality of Lotus lake, Tornamal (M.S) underlying importance of water quality assessment. Similar studies were done by Nithyavathy *et al*., (2014). Therefore the present investigation is undertaken to study the impact of various parameters and their interrelation for the water quality of the Ekruk tank.

MATERIALS AND METHODS

Ekruk tank is situated (Lat 17^0 43.443. 393|N; Long $075^0$54.675| E – Lat $17^0$43.576| N: Long $075^0$40.322| E) at Ekruk village. In present work, after surveying entire tank, five different study sites were selected. Site I is known as "Dhobi ghat". This site is frequently exposed to various human activities such as washing clothes, vehicles and cattle as well as bathing. Site II is occasionally used by humans and is about 100 meters away from site I. Site III is located around 200 meters away from Site II. Site IV is situated at the rear end of this tank and is connected to dry land area. Both sites III and IV were often explored by local fishermen for fishing as well as visited by local aquatic and semi aquatic birds.

Table 1. Correlation matrix of physicochemical parameters at site-I during December 2010 - November 2012

Site I	Air Temp	Water Temp	pH	DO	BOD	COD	Total Alkalinity	Total Hardness	Calcium	Chlorides	Fluorides	Nitrate	Phosphates	Ammonia	Turbidity
Air Temp	1	0.96	0.27	-0.64	-0.04	-0.13	0.08	0.21	0.22	0.18	-0.03	-0.12	-0.39	-0.10	0.60
Water Temp		1.00	0.19	-0.63	-0.06	-0.12	0.02	0.22	0.23	0.16	-0.04	-0.17	-0.30	-0.15	0.69
pH			1	-0.29	-0.06	0.08	-0.26	0.15	-0.18	-0.31	-0.27	-0.07	-0.39	-0.13	0.02
DO				1	0.07	0.06	0.33	-0.20	-0.07	0.05	0.30	-0.29	0.10	0.40	-0.69
BOD					1	0.73	-0.02	0.16	0.33	0.07	0.14	-0.03	0.27	-0.06	0.04
COD						1	-0.06	0.07	0.02	0.10	0.06	0.06	0.18	0.04	-0.06
Total Alkalinity							1	-0.19	-0.06	0.38	0.22	-0.21	-0.15	0.10	-0.37
Total Hardness								1	0.06	-0.37	-0.20	0.07	0.03	-0.36	0.03
Calcium									1	0.15	0.34	-0.06	-0.06	0.28	0.22
Chlorides										1	0.16	0.16	-0.20	0.12	0.23
Fluorides											1	0.10	-0.03	0.38	-0.15
Nitrate												1.00	0.08	0.21	0.00
Phosphates													1.00	-0.02	-0.16
Ammonia														1.00	-0.18
Turbidity															1

Table 2. Correlation matrix of physicochemical parameters at site-II during December 2010 - November 2012

Site II	Air Temp	Water Temp	pH	DO	BOD	COD	Total Alkalinity	Total Hardness	Calcium	Chlorides	Fluorides	Nitrate	Phosphates	Ammonia	Turbidity
Air Temp	1	0.91	0.12	-0.67	-0.18	-0.14	-0.35	0.46	0.40	-0.05	-0.31	-0.19	-0.32	-0.56	0.25
Water Temp		1.00	0.12	-0.70	-0.18	-0.09	-0.33	0.31	0.48	-0.08	-0.22	-0.15	-0.30	-0.63	0.40
pH			1	-0.43	-0.50	-0.35	-0.20	0.08	0.30	-0.13	-0.07	-0.43	-0.46	-0.24	0.41
DO				1	0.30	0.19	0.27	-0.21	-0.53	0.10	0.16	0.25	0.60	0.59	-0.55
BOD					1	0.73	0.12	-0.16	-0.28	0.27	0.22	0.23	0.68	0.17	-0.18
COD						1	-0.12	-0.04	-0.20	0.06	0.11	0.11	0.69	0.12	-0.13
Total Alkalinity							1	-0.15	-0.12	0.25	0.28	-0.08	0.01	0.12	-0.16
Total Hardness								1	0.26	-0.32	-0.32	0.01	-0.12	-0.06	-0.30
Calcium									1	0.18	0.11	-0.03	-0.45	-0.37	0.23
Chlorides										1	0.49	0.49	0.11	0.10	-0.09
Fluorides											1	0.22	-0.06	0.21	0.07
Nitrate												1.00	0.36	0.49	-0.21
Phosphates													1.00	0.33	-0.43
Ammonia														1.00	-0.36
Turbidity															1

Table 3. Correlation matrix of physicochemical parameters at site-III during December 2010 - November 2012

Site III	Air Temp	Water Temp	pH	DO	BOD	COD	Total Alkalinity	Total Hardness	Calcium	Chlorides	Fluorides	Nitrate	Phosphates	Ammonia	Turbidity
Air Temp	1	0.91	0.07	-0.56	0.01	-0.13	-0.14	0.47	0.51	-0.13	-0.24	-0.22	-0.13	-0.51	0.04
Water Temp		1.00	0.16	-0.69	-0.01	-0.12	-0.12	0.37	0.55	-0.07	-0.15	-0.23	-0.15	-0.55	0.12
pH			1	-0.29	0.25	0.30	0.00	-0.10	0.06	-0.15	-0.17	0.31	0.34	-0.13	0.26
DO				1	0.24	0.26	-0.11	-0.18	-0.66	-0.10	0.11	0.31	0.30	0.51	-0.30
BOD					1	0.92	0.01	-0.22	-0.36	-0.05	-0.19	0.42	0.47	0.02	-0.01
COD						1	-0.05	-0.29	-0.46	-0.11	-0.16	-0.16	0.62	0.11	-0.10
Total Alkalinity							1	-0.03	-0.05	0.17	0.05	-0.19	0.02	0.18	-0.28
Total Hardness								1	0.63	-0.23	0.22	-0.15	-0.11	0.01	-0.36
Calcium									1	0.17	0.16	-0.17	-0.33	-0.29	0.10
Chlorides										1	0.33	0.33	0.13	0.37	0.20
Fluorides											1	-0.12	0.01	0.29	-0.16
Nitrate												1.00	0.45	0.47	0.27
Phosphates													1.00	0.37	-0.33
Ammonia														1.00	-0.15
Turbidity															1

Table 4. Correlation matrix of physicochemical parameters at site-IV during December 2010 - November 2012

Site IV	Air Temp	Water Temp	pH	DO	BOD	COD	Total Alkalinity	Total Hardness	Calcium	Chlorides	Fluorides	Nitrate	Phosphates	Ammonia	Turbidity
Air Temp	1	0.90	0.34	-0.58	0.39	0.10	-0.46	0.13	0.33	-0.22	-0.30	-0.12	-0.27	-0.23	0.10
Water Temp		1.00	0.30	-0.66	0.27	0.09	-0.48	0.00	0.42	-0.17	-0.22	-0.11	-0.25	-0.24	0.22
pH			1	-0.50	0.17	-0.03	-0.04	-0.21	0.06	-0.29	-0.16	0.17	-0.43	-0.05	0.28
DO				1	-0.26	-0.11	0.09	0.24	-0.35	-0.03	-0.13	-0.04	0.22	0.28	-0.30
BOD					1	0.67	-0.17	0.00	0.40	0.13	0.00	0.04	0.26	0.02	-0.09
COD						1	0.01	-0.23	0.18	0.06	0.06	0.06	0.46	0.22	-0.09
Total Alkalinity							1	-0.14	0.01	0.02	0.10	0.25	0.18	0.39	-0.18
Total Hardness								1	0.16	-0.16	-0.10	-0.10	-0.21	0.13	-0.57
Calcium									1	0.38	0.50	0.22	0.11	0.02	0.03
Chlorides										1	0.54	0.54	0.50	0.05	0.18
Fluorides											1	0.17	0.38	-0.09	0.14
Nitrate												1.00	-0.01	0.55	-0.06
Phosphates													1.00	-0.01	0.13
Ammonia														1.00	-0.34
Turbidity															1

Table 5. Correlation matrix of physicochemical parameters at site-V during December 2010 - November 2012

Site V	Air Temp	Water Temp	pH	DO	BOD	COD	Total Alkalinity	Total Hardness	Calcium	Chlorides	Fluorides	Nitrate	Phosphates	Ammonia	Turbidity
Air Temp	1	0.89	-0.02	-0.38	-0.01	-0.09	-0.20	0.32	0.20	0.05	-0.18	-0.27	-0.42	-0.52	0.00
Water Temp		1.00	-0.04	-0.45	-0.09	-0.13	-0.06	0.38	0.29	0.03	-0.34	-0.40	-0.46	-0.51	-0.01
pH			1	-0.06	0.17	0.17	-0.44	-0.14	0.11	-0.01	-0.27	-0.05	-0.04	-0.07	0.36
DO				1	0.47	0.53	0.32	-0.03	-0.38	0.10	0.42	0.64	0.64	0.61	-0.33
BOD					1	0.82	0.16	-0.19	-0.32	-0.17	0.03	0.27	0.19	0.03	-0.09
COD						1	0.14	-0.26	-0.43	0.03	0.14	0.14	0.53	0.11	-0.09
Total Alkalinity							1	-0.19	0.14	-0.18	0.38	0.10	0.14	0.37	-0.67
Total Hardness								1	0.18	-0.04	-0.32	0.10	0.04	-0.02	-0.04
Calcium									1	0.11	-0.48	-0.07	-0.27	-0.06	0.28
Chlorides										1	0.37	0.37	0.16	-0.13	0.40
Fluorides											1	0.11	0.26	0.14	-0.26
Nitrate												1.00	0.73	0.64	-0.12
Phosphates													1.00	0.53	-0.24
Ammonia														1.00	-0.36
Turbidity															1

While Site V is exclusively visited by migratory birds in winter season in search of food and breeding. This site is found near by 4 to 5 kms from remaining four study sites. Water samples were collected during morning hours at respective study sites. Various physicochemical parameters viz. Temperature, pH, DO (Dissolved Oxygen), BOD (Biological Oxidable Demand), COD (Chemical Oxidable Demand) ,Total alkalinity, Total hardness, calcium, chlorides, fluorides, nitrates, phosphates, ammonia and turbidity were estimated by using Standard methods (APHA 2005 and Trivedi and Goel 1986).

RESULTS AND DISCUSSION

The correlation coefficient is a quantitative measure of correlation and dependence for randomly observed data variables. In the study, correlation coefficient of water quality provides rapid monitoring and the status of it. The correlation matrix is the outcome of analysis of correlation coefficient values, between two variables and is a simplified format. The correlation matrix of five sites were shown in Tables (1 – 5). In present study, both air temperature and water temperature overall from all the five sites reveals that after application of correlation matrix analysis there was positive correlation established with pH, total hardness and turbidity. While there was negative correlation was noticed with DO, BOD, nitrates, phosphates and ammonia. Dissolved oxygen showed negative correlation with temperature due to higher temperature during summer season. This is because minimum mixing of atmospheric oxygen into water. pH influencing water temperature values, high positive correlation value between pH and water temperature showed that pH increases with increase in water temperature. Similar results were reported by Milana *et al*., (2013). pH remained alkaline throughout study period. pH showed positive correlation between calcium and turbidity. While it showed negative correlation with DO, BOD, total alkalinity, chlorides, fluorides, nitrates, phosphates and ammonia.

Dissolved oxygen is very important parameter influencing growth of aquatic organisms. In present study overall DO showed positive correlation with total alkalinity, phosphates and ammonia while DO is negatively correlated with BOD, total hardness and turbidity. Higher increase in BOD values resulted in reduction of DO. BOD is a measure of oxygen consumption required to breakdown of biologically oxidable organic matter. Higher BOD values resulted in reduced amount of DO in present study. Similar results were observed by Agarwal *et al*. (2013). Overall BOD showed positive correlation with COD, phosphates, ammonia and nitrates while BOD and DO showed inverse relationship in present study.BOD shows positive correlation with COD. Salahuddin *et al*. (2014) noticed similar results. Overall COD showed positive correlation with chlorides, nitrates, phosphates and ammonia while this parameter showed negative correlation with total alkalinity, total hardness and turbidity.

COD measures load of organic pollutants in water body. COD measure of amount of oxygen required for breakdown of chemically oxidable matter present in water. Similar results were reported by Agarwal and Agarwal (2013). Total alkalinity and total hardness showed more positive correlation with nitrates while negative correlation was noticed with turbidity. Calcium and chlorides did not follow any definite trend throughout study period. These parameters showed much more fluctuations in present investigation. Calcium showed positive correlation with chlorides while it showed negative correlation with nitrates, phosphates and ammonia. Chlorides showed positive correlation with phosphates and nitrates. Fluorides and ammonia showed insignificant variations during present study and showed positive correlation with each other. Nitrates and phosphates are generally present in lower quantities in water bodies. The main sources of nitrates are domestic sewage, natural runoff from rain water and also from agricultural wastes. Phosphates occur in aquatic ecosystem in both organic and inorganic form. Inorganic nitrates in excess quantity leads to eutrophication (Trivedi and Goel 1988). In present study phosphates showed strong positive correlation with nitrates.

Turbidity is referred as murkiness of a fluid caused by total dissolved solids. Extreme turbidity in water impede photosynthetic activity. In present study turbidity showed negative correlation with DO, interfering photosynthetic activity. Maximum turbidity was recorded in rainy season. Similar results were reported by Indresha and Patra (2014).

Conclusion

The physicochemical parameters analysis of Ekruk tank showed seasonal variations. Changing environmental conditions as well as noticeable human interference has greater influence on physicochemical factors present in water. The strong positive correlation between chlorides, nitrates and phosphates as well as continuous variations in calcium, total hardness and total alkalinity has revealed exploitation of this tank by human beings. However, majority of parameters found to be within the permissible limits as per guidelines of WHO standards. Low values of nitrates and phosphates indicates overall healthy condition of this tank. Our study revealed that all the parameters are within desirable range which is suitable for potability. However desirable values of some potential chemical parameters like total alkalinity, chlorides, nitrates, phosphates, DO, BOD and COD have not exceeded beyond their standard limits during entire investigation. Exceeding values of these parameters will create a threat to water quality as well as diverse aquatic species of this tank in future. So it is great responsibility of all of us to aware people about importance and conservation of this historical and beautiful artificial lake.

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