Evaluation of physical and chemical parameters related to ofdifferent Season in the ponds ofTuticorin district of Tamil Nadu, India.

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Abstract

Water is the natural resource which are facing tremendous depletion in its quality because of increased consumption, ever growing population, industries etc,. The access of physiochemical parameters will have a clear knowledge on water quality standards in their different environmental conditions. The study accessed on Vallanadu pond, Udayairkulampond and DeviseyalPuram ponds of Tuticorin district of Tamil Nadu, India showed their physical examinations such as appearance, colour, odour are in acceptable range. Turbidity, TDS, electrical conductivity of the water samples are above permissible limits. The chemical examinations such as pH alkalinity$CaCo_3$,Total alkalinity, total hardness, Calcium, Magnesium, Manganese, Nitrate, fluoride, Sulphate, Phosphate, tidy test are within permissible limits in all the three ponds. The Parameters such as pH, Sodium, Potassium, iron, Ammonia, Nitrite are above the permissible limits in the study area and chloride contend in Vallanadu was above their acceptable limits. The fecal coliform exceeds the normal limit implies the water cannot be used for drinking or house hold usage.

Key words:

Water quality, pond waterand physico-chemical, Pond parameters, Seasonal variation of pond in Tuticorin.

Introduction

Water is the most abundant and non-renewable resource in the earth, which play an important role in all living organisms. Earth is the planet which accommodate 70% of water resources in its total area. The survival and growth of all living organism depends on water resources (Sarkar et al., 2020). It act as a significant tool to determine poverty among human, wealth of a country, educational limits, etc (Kangabam et al., 2017). Water from different resources directly or indirectly benefits human welfare and enrich the environment (Costanza et al., 1997, Kar, 2013).

Human being has direct contact with water in which no longer can be lived, all the cell and organelles required water for its functioning.In nature water is colorless, tasteless, odorless at room temperature, may exhibit as slight hint of blue. In addition of unsolicited substances their property changes.In rural areas groundwater is reliable resource for all progress. The reserved water can be re-used for irrigation, construction of buildings, industrial practice, domestic water

supply, fish culture, recreation, hydroelectricity generation and during water crises (Loucks and Beek, 2017). About 80% of freshwater is used mainly for irrigation and remaining parts are used for other purposes (Rakesh-Sharma and Ravichandran, 2021).

Physio-chemical parameters is the important component in aquatic system to indicate water quality of aquatic ecosystem (Singh and Singh, 2008). The addition of organic or inorganic materials will alters all the physical and chemical parameters.The contamination of water resources destroys their quality and their usage by human beings, animals, aquatic living organisms etc. It also cause eutrophication and pose serious health issues (Meitei and Bhargava, 2004) and also degrade the whole environment.Availability of toxic metals are considered to be most toxic substance in aquatic environment (Aladesanmi et al., 2014).Enormous usage of resources by human population, industrialization, sewage addition, fertilizers in agriculture and other man made activities has polluted the natural resource by waste disposal, pesticide or fertilizer accumulation and this becoming contaminated and harmful to the environment (Subba et al., 2012). The discharged effluent from industries which are added to natural resources, such as in rivers has impact on water quality (Raja et al., 2008; Mishra et al., 2020).

The living organisms which are present in the ecosystem can withstand their current environment when they are in permissible limits, beyond the limit it leads to unhealthy or death. Fishes present in the aquatic ecosystem can absorb metals present in the water through epithelial or mucosal surface of their skin, gills and gastrointestinal tract which influence the health (Jovanovic et al., 2011). This indirectly enters into food chain and affects human beings.These issues are most commonly faced by some developing countries including India.

In our study water samples were collected from threedifferent ponds, physical and chemical parameters were studied. This gives anintense idea on pond water resourcesof three different pond ecosystem in Tuticorin District .

Materials and methods

The water samples were collected from different ponds of Tuticorin districts of Tamil Nadu, India such as Vallanadupond 8.712627°N,77.852967°E,Udayairkulampond 8.704174°N,77.851954°E andDeviseyalPuram pond 8.737263,77.923459°E,. The water samples were collected every month throughout year (2020 to 2021) from all the sampling sites.

Physical parameters such as pH, temperature, conductivity were measured in the field condition. Chemical analysis such as nitrate, nitrite, chloride, were analysed by standard procedure described by American Public Health Association (APHA, 1998). Parameters such as dissolved oxygen, total alkalinity, hardness, sulphates and total dissolved solids etc were done by standard method in laboratory (APHA, 2005). Calcium and magnesium were analyzed by atomic absorption chromatography and sodium by flame photometry. The organic matter were determined by permanganate oxidation method (Wilson, 1959).

Results

The physiochemical parameters of water samples from vallanadu pond, Udhayarkulam pond and Devaseyalpuram pond showed varied in their properties.The changes observed in vallanadu, Udhayarkulam and Devaseyalpuram pond was tabulated in table 1-3. Thephysical

parameters such as appearance, colour, odour of the three water samples are within their permissible limits. The turbidity of the sample from vallanadu was within acceptable range for few months and are above permissible limit during February, June, July, September, October and November. The samples from Udhayarkulam pond was above their limits during the months of January, May and September. During our entire period the turbidity was above the permissible limits in Devaseyalpuram pond.

Total dissolved solids present in the water samples are higher throughout our study period in Vallanadu pond and the values are within their limits in UdhayarKulam pond and Devaseyalpuram pond during our entire study time.The electrical conductivity of the waters are above the permissible limits in entire study area throughout our study period.

The chemical parameters such as pH of the water samples are above their acceptable range in all the three samples during our entire study area. The pH alkalinity $CaCo_3$ concentration present in the samples are nil or absent in all the three study area throughout the year.

The total alkalinity of the samples are within permissible limit and above acceptable range in vallanadu pond and within their permissible limits in UdayarKulam ponds and in DeivaseyalPuram pond. Total hardness of the samples are within their acceptable limits in vallanadu pond and UdayarKulam ponds and above acceptable range in DeivaseyalPuram pond.

Calcium concentration of the water samples from Vallanadu was within the permissible limits during our study period. Samples from UdayarKulam and DeivaseyalPuram ponds are within their acceptable range. Magnesium concentration of Vallanadu and DeivaseyalPuram pond samples are within permissible limits and UdayarKulam pond samples are within their acceptable range.

The Sodium concentration present in the water samples are above the permissible limits in all the three samples throughout our study period. This increase in concentration leads tasteless nature and unsuitable for irrigation.Potassium concentration of the water samples are above the permissible limits in all the three water samples throughout our study period.

Iron concentration of the water samples are within the permissible limits in all the water samples throughout the study duration.Manganese concentration of the samples from all the three sites are above the permissible limits.

Free ammonia NH_3 present in the water samples from Vallanadu andUdayarKulamponds are above the permissible limits. The ammonium concentration are within permissible limits during the month of June, July and September in DeivaseyalPuram pond. In our study the nitrite NO_2 concentration of the water samples are above the permissible limits in all the three ponds during our entire study period.Nitrate concentration of the samples are within acceptable range during our entire sampling times.

Chloride concentration are higher in Vallanadu pond and it's under acceptable range in UdayarKulam and DeivaseyalPuram pond.Fluoride present in the water samples are under acceptable range in all the ponds during our study periods.Sulphateanalyzed in the water samples are within their acceptable range in all the three ponds.Phosphate analyzed from Vallanadu,

UdayarKulam and DeivaseyalPuram pond samples revealed the observation, which implies it's above permissible limit.

Tidys test performed in all the three water sources reveals presence, the bacteriological examination for presence of fecal coliform showed its presence in all the water resources throughout our sampling during entire study period.

Discussion

The water is the universal solvent required by all living organisms for their life. The contamination of water resources from natural calamities or manmade activities causes notable changes in their ecosystem.Changes in their physical and chemical parameters of the water shows the contamination.

Physical parameters such as appearance, colour, odour are under permissible limits implies the water resources are not contaminated with addition of organic, inorganic matters. Turbidity of the analyzed water samples increase in few months may due to addition of clay, solid matters, slit, organic matter, planktons and other microorganisms. Similar statement was stated by Verma and Summarwar, (2012).

Total dissolved solids in the water was higher in their analyzed data throughout the study year. Higher in TDS concentration is due to addition of dissolved solid substances (Agbaire et al., 2015). Reports revealed addition of artificial food diets also increase the concentration (Ogbeibu and Edutie, 2006). Reports on conductivity reveals their range are above the permissible limits. This indicates contamination of manmade human activities. Similar report was stated by Kane et al., (2013) reveals conductivity of the water samples above 100 µscm-1 indicates human activities.

The pH of the water plays a vital role in growth of living organisam present in an ecosystem. Our reports reveals pH range of all the study area are within permissible limits. Earlier reports reveals changes in pH range has negative effects on usage due to insolubility of toxic metals (Dey et al., 2021). The growth of plankton is mainly depends on pH of the water, thus becomes important Parameter (Chisty, 2002).

The alkalinity of the water are above permissible limits in vallanadu pond, earlier reports reveals the alkalinity of the water ranges higher during monsoon season and lower in winter season (Plum et al., 2010; Reza and Singh, 2010).Higher alkalinity improves decomposition, throughout which CO_2 is produced which react with water to produce bicarbonate (Bellos and Sawidis, 2005).

Total hardness of the water are above the permissible limits which was revealed through report, this may due to evaporation of water during summer seasons. Observence of hardness above the permissible limits may due to presence of carbonate and bicarbonate salt of calcium and magnesium (Hujare, 2008).

Calcium concentration of UdhayarKulam and DeivaseyalPuram ponds showed above their permissible limits and are in acceptable range. The increase in calcium concentration in water leads to poor lathering, deterioration of clothes, incrustation in pipes and scale formation (Malar, 2018).

Magnesium concentration of the water samples from UdhayarKulam pond are above permissible limits and are within acceptable range. It's reviewed and reported that water is in range of soft and moderately soft category due to presence of low concentration of calcium and magnesium (Deepak, 2018).

Potassium concentration in the study area are above the permissible limits throughout the study periods. This excess presence of metal in water bodies may lead to chronic disease towards aquatic animals. The presence of toxic metals in the aquatic environment will indirectly reaches human being by food chain, through absorbed water through irrigation, producers which are eaten by herbivores (Adnan, 2010).

Manganese concentration are above the permissible limits in all the three study area. This helps the ecosystem healthier. Manganese deficiency in animals leads to bone deformation and inhibited growth, in natural environment deficiency was not observed because the required quantity enters food chain (Niemiec and Wisniowska-Kielian, 2015).

Nitrite concentration in the ponds are higher throughout the year,Vallanadu pond, Udaiyarkulam pond and Deviseyalpuram pond it reduces to nitrate which may cause toxic effect on aquatic organisms. Nitrite is a reduced form of Nitrate is toxic towards aquatic organisms due to the hemoglobin damage (Camargo and Alonso, 2006). Nitrate showed its presence in acceptable range. The presence of nitrate in aquatic source is due to atmospheric deposition, surface and groundwaterrunoff, dissolution of nitrogen-rich geological deposits, nitrogen fixation by certain prokaryotic organisam (cyanobacteria), biological degradation of organic matter (Rabalais, 2002).

Chloride content in the water sample of Vallanadu was higher may due to agricultural runoff. Similarly earlier reports reveals increase in concentration of chlorine may due to addition of inorganic fertilizers, landfill, septic tank effluents, animal feed, industrial effluents (Pal and Chakraborty, 2017). Fluoride concentration of the analysed samples from all the sites are under acceptable range. This helps inhibit or enhance the growth of algae population, depending upon fluoride concentration, exposure time and algal species (Camargo, 2003).

Sulphate content in the samples are within their permissible limits. This presence in the water resources may occur through mineral weathering, volcanoes, decomposition, combustion of organic matter, and sea salt (Meays and Nordin 2013).

Phosphate concentration in the water helps to maintain the fertility of the pond. Our reports reveals the phosphate content in the water samples are above the permissible limits. This helps to have significant growth of algae and eutropication (Nama and Raj, 2018).

The bacteriological examination of the water samples revealed the samples are contaminated throughout our study period. This implies the water is polluted,with domestic sewage as well as septic tank sepapes. Fecal coliforms like Escherichia coli, Salmonella spp causes water borne diseases (Schets and de RodaHusman, 2014). They were less during Monsoon implies the dilution due to rainwater.

Conclusion

The Physico-Chemical characteristic study of pond water from three different sites of Tuticorin District such as Vallanadu, DeveisayalPuram, and Udaiyarkulam suggest the variation in the Physico-Chemical properties throughout our study period. The Result reveals in Udaiyarkulam is less contaminated compared tovallanadu and devisayalpuram. Even though these areas are away from cities shows pollution rate. Based on the study the pollution or contamination can be controlled to avoid serious effect on organisms living the pond as well as people around this area.This will take the for future generation to a pollution free environment and the organism which are present in the aquatic pond ecosystem as a healther and rich in flora and fauna.

References

Adnan., Amin., Taufeeq., Ahmad., Malik., Ehsanullah., Irfanullah., Muhammad., Masror., Khatak., Muhammad., Ayaz., Khan., (2010). Evaluation of industrial and city effluent quality using physicochemical and biological parameters, *Electronic Journal of Environmental, Agricultural and Food Chemistry*, 9(5), 931-939

Agbaire P.O, Akporido S.O and Emoyan, O.O (2015). Determination of some physiochemical parameters of water from artificial concrete fish ponds in Abraka and its environs, Delta State, Nigeria. International Journal of Plant, Animal and Environmental Sciences, 5(3): 70-76

Aladesanmi, O.T., Adeniyi I.F., Adesiyan I.M. 2014. Comparative Assessment and Source Identification of Heavy Metals in Selected Fishpond Water, Sediment and Fish Tissues/Organs in Osun State, Nigeria. Journal of Health & Pollution. 4: 42-53.

APHA, (1998). Standard Methods for the Examination of Water and Wastewater, American Public Health Association, Washington, DC, USA, 18th edition.

APHA. (2005). Standard methods of examination of water and waste water. American public health association. 19th ed. Inc. New York: 1170.

Bellos D., Sawidis T. 2005. Chemical pollution monitoring of the river Pinios (Thes9salia-Greece) J. Environ. Manag., 76, 282-292

Camargo J.A. 2003. Fluoride toxicity to aquatic organisms: a review. Chemosphere 50; 251–264

Camargo JA, Alonso A. 2006. Ecological and toxicological effects of inorganic nitrogen pollution in aquatic ecosystems: A global assessment. Environ Int. 32(6):831-49.

Chisty. N., (2002). Studies on Biodiversity of Freshwater Zooplankton in Relation to Toxicity of selected Heavy Metals. Ph. D. Thesis submitted to M.L SukhadiaUniveristy Udaipur.

Costanza R, d'Arge R, De Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neill RV, Paruelo J, Raskin RG, Sutton P, Van Den BM (1997) The value of the world's ecosystem services and natural capital. Nature 387:253–259

Deepak S, 2018. Assessment of Physiochemical Properties of Pond Water in Bemetara Town of Chhattisgarh State. Journal of Emerging Technologies and Innovative Research. 5:112-120

Dey S., Botta S., Kallam R., Angadala R., Andugala J., 2021. Seasonal variation in water quality parameters of Gudlavalleru Engineering College pond, Current Research in Green and Sustainable Chemistry, 4, 100058

Hujare, M.S. (2008) Seasonal Variation of Physico-Chemical Parameters in the Perennial Tank of Talsande, Maharashtra. Journal of Ecotoxicology and Environmental Monitoring, 18, 233-242.

Jovanovic B., Mihaljev Z., Maletin S., Palic D. 2011. Assessment of heavy metal load in chub liver (Cyprinidae - Leuciscuscephalus) from the Nišava River (Serbia) Biologica, 2 (1) 51-582010

Kane S, Flora Q, Pranvera L, Lirim B. The effects of physicochemical parameters and Nutrients on fish growth in Narta lagoon fish ponds, Abania. Journal of Hygienic Engineering and Design 2013; 4(2):201-215

Kangabam R.D., Bhoominathan S.D., Kanagaraj S., Govindaraju M., 2017. Development of a water quality index (WQI) for the Loktak Lake in India. DOI 10.1007/s13201-017-0579-4

Kar D (2013) Wetlands and lakes of the world. Springer, London

L.M. Plum, L. Rink, H. Haase The essential toxin: impact of zinc on human health Int. J. Environ. Res. Publ. Health, 7 (2010), pp. 1342-1365

Loucks, D.P. and Beek, E.V. (2017). Water Resources Planning and Management: An Overview. In: Water Resource Systems Planning and Management. Springer, Chem. 1-9.

Malar O.V.S, Kokila P., Isac-Sobana-Raj C. 2018. Physico chemical parameters of water of some selected areas of Tamirabaraniriver, Tirunelveli, Tamilnadu. International Journal of Scientific Research and Management. 6: 111-117.

Meays, C. &Nordin, R. 2013 Ambient Water Quality Guidelines for Sulphate. Technical appendix. Ministry of Environment, Province of British Columbia, Canada.

Meitei, N. S., & Bhargava, P. P. M. (2004). Water quality of Purnariver in Purna town, Maharastra. Journal of Aquatic Biology, 19, 77–78

Mishra A.R, Mardani A, Rani P, Zavadskas E.K. 2020. A novel EDAS approach on intuitionistic fuzzy set for assessment of health-care waste disposal technology using new parametric divergence measures. Journal of Cleaner Production. 272:122807

Nama.P., Raj, D. 2018. Water quality assessment using physico-chemical parameters of palasani pond, Jodhpur district, Rajasthan, India. - International Journal of Research and Analytical Reviews. 5: 2349-5138

Niemiec M, Wiśniowska-Kielian B. 2015. Accumulation of manganese in selected links of food chains in aquatic ecosystems. Journal of Elementology. 20(4): 945-956.

Ogbeibu, A. E. and Edutie, C. O. (2006). Effect of Brewery Effluent on the Water Quality and Rotifers of Ikpoba River, Southern Nigeria. Ecoserve Publishers 1 – 17.

Paul S., Chakraborty K. 2017. Different Aspects of Chloride In Freshwater: A Review. International Journal of Current Trends in Science and Technology. 7: 20295-20303.

Rabalais, N.N., 2002. Nitrogen in aquatic ecosystems. Ambio 31, 102–112.

Raja P, Amarnath MA, Elangovan R, Palanivel M (2008). Evaluation of physical and chemical parameters of river Kaveri, Tiruchirappalli, Tamil Nadu, India, J. Environ. Biol. 29(5):765-768

Rakesh-Sharma and Ravichandran, 2021. Appraisal of seasonal variations in water quality of river Cauvery using multivariate analysis. Water Science. 35:49-62.

Reza R., Singh G. 2010. Heavy metal contamination and its indexing approach for river water Int. J. Environ. Sci. Technol., 7, 785-792

Sarkar, R.; Ghosh, A.R. and Mondal, N.K. (2020). Comparative study on physicochemical status and diversity of macrophytes and zooplanktons of two urban ponds of Chandannagar, WB, India. Applied Water Science. 10: 63

Schets, F.M., De RodaHusman, A.M., 2014. [Infections following recreational activities in lakes, rivers and canals: present and future risks of transmission in the Netherlands]. Ned. Tijdschr. Geneeskd., 158(0): A7969

Singh, D.K. and Singh, I. (2008). Interrelationship of certain physico-chemical parameters with plankton community of Motipur Ox-bow lakes (Muzaffarpur, Bihar). Environment and Ecology. 26: 800-803

Subba, R.M.V.; Dhilleswara, R.V. and Bethapudi, S.A.A. (2012). Assessment of quality of drinking water at Srikurmam in Srikakulam district, Andhra Pradesh, India. International Research Journal of Environment Sciences, 1: 13-20.

Verma S and Summarwar S (2012) Analysis of Water of Pushkar Lake Before, DuringandAfter The Pushkar Fair. Int. J. Life Sc. Bt& Pharm. Res. Vol. 1, No. 4, pp 25-41

Wilson, A.L. (1959). Determination of organic matter in water by oxidation with potassium permanganate. Journal of Applied Chemistry. 9: 51.