IMPACT OF CLIMATE CHANGE ON WATER QUALITY INDEX

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ABSTRACT

Water is a basic requirement to every life on Earth and is also essential for sustainable development. Drinking pollutant free water and sanitationare human basic rights. It is obvious in our planet that weather and climate patterns are being changed and will prolong to shift, which may raise extreme weather conditions and it will modify the normal balance of water bodies and also the ecosystems, which leads to the degradation of water quality. The science is clear that the global climate change ruin is increasing in irregular manner in the water cycle. It reduces the predictability of water availability on earth, demand of water and it also affects the water quality. Climate change will affect water quality and even the water ecosystems. While all regions of the globe are getting affected, the impacts of climatechange are highly variable and uneven in each and every area. Drinking water plays a vital role in human health conditions it is important to be contaminant free. Climate change has adverse effects on quality of water which may cause severe health effects and poor sanitation. It is important to have pollutant free healthy water in our day to day life.

KEYWORDS: Water resources, water quality, climate change, eco system.

1. INTRODUCTION

Water plays an important role in the world's economy, which is tasteless, transparent, odorless, inorganic and nearly a colorless chemical substance, water is the main constituent of Earths hydrosphere. Even though it provides no calories or organic nutrients it plays a vital role for all the known forms of life. Chemical formula of water is H2O it indicates that each of its molecules contains one oxygen atom and two hydrogen atoms which are connected by the covalent bonds. At an angle of $104.45°$, the hydrogen atoms are attached to the oxygen atom. Water covers just about of 70.9% of the Earth's surface, mostly in seas and oceans. 1.7% of water occurs as groundwater, other 1.7% water occurs in the ice caps and glaciers of the Antarctica and Greenland and also 0.001% water occurs in the air as vapor, clouds (consisting of ice and liquid water which are suspended in air), and precipitation.

Water is a fundamental need to human body. Every one of the cells, organs and the tissues of human body use the water to help with the regulation of the temperature, keeping hydrated and also in maintaining bodily functions. In addition to this water also acts as a lubricant and cushions to the joints in human body. Drinking of water is great for the overall health of human body. Each and every person on the Earth requires at least of about 20 to 50 liters of clean and safe water a day for drinking and simply keeping

themselves clean. Polluted water is not just a dirty one it's really deadly. Drinking water also known as potable water comes from surfaces and ground sources which are treated to levels that attain a state and the federal standards for consumption. Water from natural sources is treated for bacteria, viruses, algae, microorganisms, toxic chemicals and fecal matter. Water that is safe to drink should be clear with no odor or bad taste. While cloudy water is not necessarily dangerous to human health, it could be a sign of presence of unsafe pathogens or chemicals present in water. The water must meet up with the required chemical, biological and also the physical quality standards at the point of supply to the consumers.

In quality of water, the parameters for drinking water fall within three categories such as physical, chemical and microbiological. Physical and chemical parameters comprise of heavy metals, trace organic compounds, turbidity and also the total suspended solids. Chemical parameters tend to create more of a chronic health risks through the buildup of heavy metals while some components like nitrates or nitrites and arsenic can have more direct impact on human body. Physical parameters may affect the aesthetics and also the taste of drinking water and it complicates the removal of microbial pathogens. Microbiological parameters include coliform bacteria, E.coli and particular pathogenic species of bacteria, viruses and protozoan parasites. Initially, fecal contamination was determined by the presence of coliform bacteria, an accurate indicator for a class of harmful fecal pathogens. The presence of fecal coliforms like E.Coli serves as a sign of contamination by sewage. Microbial pathogenic parameters are typically of greatest distress because of their instant health risk. The most common standards are used to monitor and evaluate the water quality which conveys the quality of water, health of the ecosystem and the condition of the water to consume or not.

Water quality index (WQI) is a vital tool to determine the quality of drinking water in rural, urban and industrial area. Water quality index is defined as an index which reflects the composite influence of different water quality parameters which is measured and taken for the calculation of water quality index (WQI). Water Quality Index is a solitary number which can be easily calculated and used for overall report of the quality of water bodies.

1.1 Statement of the problem

Water is a precious and limited resource. It is important to protect water resources. Anthropogenic activities and some natural calamities affect the quality of water. Other than this climate change also have an impact on quality of water it affects the runoff of water, dissolved oxygen content in water, temperature of water and also cause erosion and sedimentation. In addition to this climate change also have an

impact on algae. Warm water due to change in climate might help harmful algae to bloom in many ways. This situation may finally lead to pollution of the water resources and is also deadly affects the ecosystem.

1.2 Objective of the study

The objective of the study is to find the impact of climate change on water quality index.

2. STUDY AREA

Perungudi, a Village in Thirumayam Taluka, Pudukkottai district and State of Tamil Nadu. Perungudi C.D. Block name is Arimalam. Perungudi village Pin code is 622506. Total population of Perungudi village is 6076 and number of houses Present are 1503. Female Population is 50.4%. Village literacy rate is 63.9% and the Female Literacy rate is 27.7%. The study was conducted in Pudukottai district as the water sample is collected from oorani. The drinking water in the respected area is polluted in the locality by Oedogonium algae. It was taken for testing and purified in the laboratory. Perungudi Village Gram Panchayath name is Perungudi; Munasandai; Kadayakudi; Vanniyampatt. From Sub District Headquarter of Thirumayam, Perungudi is 15 km in distance. It is 11 km distance from the District Headquarter of Pudukkottai. Nearest Statutory Town is Arimalam in 8 km Distance .Perungudi Total area is 763.55 hectares, Non-Agricultural area is 1075.1 hectares and Total irrigated area is 759.77 hectares. Hand Pump and Tube Wells or Boreholes, Covered well are the other Drinking Water sources. Closed Drainage System, Open Drainage System are available in this Village. There is no system to collect the garbages on the street. Drain water is discharged into sewer plant.

FIGURE1-PERUNGUDI VILLAGE LOCATION

FIGURE 2

FIGURE 3

3. WATER QUALITY INDEX (WQI)

Water quality index is an Associate degree index reflecting the composite influence of various water quality parameters. WQI was first developed by Horton within the early 1970s, is largely a mathematical approach of conniving one worth from multiple take a look at results. The results of this index represent the extent of water quality in an exceedingly given water bodies like rivers, lakes, streams, etc., its additionally used as a tool in comparison water quality of various sources that it offers the general public and general plan of the potential downside of explicit region. From these the water quality may be assessed by victimization physical, chemical, and biological parameters that point the boundaries to human health that is being established at international or national scale (WHO, EPA, MECC).

By observing these programs together with frequent water sampling at varied locations, the determination of chemical science parameters is met out. Likely Tamilnadu is expected to rise concerning 2100 million liters per day. The government has to style associates in the nursing authority UN agency manage a correct water quality management system particularly in urban center. Restoration of our valuable water bodies is that the primary part of our water management. So, this study is aimed to calculate and compare the parameters analyzed in testing of stream water samples in urban city.

WQI gathers a huge number of water quality parameters and then expresses the quality of water in a understandable manner such as "poor", "good", "very good" etc. India stands about 120th on the water quality index. Water quality index can be easily found by the following method.

$$q_i = \frac{c_i}{s_i} * 100$$

$$SI_i = w_i * q_i$$

$$WQI = \sum SI_i$$

Where,

q_i = quality rating scale

W_i = relative weight

SI_i = is the sub index of the ith parameter

If WQI is between 0-45 it is rated as good, if WQI between 45-60 it is rated as fair and if WQI is above 60 it is rated as poor.

4. IMPACT OF CLIMATE CHANGE ON WATER QUALITY

The need of good quality of water has been growing concern in all over the world. Anthropogenic activities and some natural calamities affect the quality of water. Anthropogenic activities affects the quality of water which includes impacts due to agriculture, use of manures, fertilizers and pesticides, inefficient irrigation practices, animal husbandry activities, aquaculture, deforestation of woods, pollution caused by industrial effluents and by mining, domestic sewage, recreational activities. Natural calamities which include hurricanes, floods, tornadoes, tsunamis and earthquakes can interrupt and pollute the water. Disasters like floods can spoil the drinking water wells and it leads the wells to contaminate by Chemicals, Human sewage, livestock waste and the other form of impurities.

Other than this climate change also have an impact on the quality of water. Climate change will affect the quality of water and even water ecosystem. Specific effects will differ among different regions and different types of the water bodies. Climate change affects the runoff of water, while in rainy season runoff of water may increase and in summer it may decrease which lead in erosion and sedimentation. Climate change also affects dissolved oxygen content in water which causes risks to aquatic species, in summer most of the oxygen gets evaporated and get decreased which makes oxygen deficiency to aquatic species. And then change in climate also has an impact on the temperature of water. In addition to this climate change also have an impact on algae. Warmer temperature reduces the viscosity of the water it allows small organisms to move easier and migrate which makes algae to float to the surface faster. Algal blooms absorb sunlight and makes water more even warmer and it also promotes more blooms, these algal blooms affect the aesthetic and taste of the water and it makes water become polluted.

5. OEDOGONIUM

Oedogonium, genus of filamentous green algae commonly found in quiet bodies of fresh water. They often are attached to other plants or exist as a free floating mass. After testing, this type of algae is found in oorani.

The optimum observed temperature for biomass production by Oedogonium at the study site was around 22 °C. Warmer temperatures prevent water from mixing and it allows algae to grow thicker and faster. Warmer water makes easier for small organisms to move all the way through and it allows algae to float to the surface more rapidly. These algal blooms absorb sunlight, making water even warmer and promoting more algal blooms.

6. METHODOLOGY
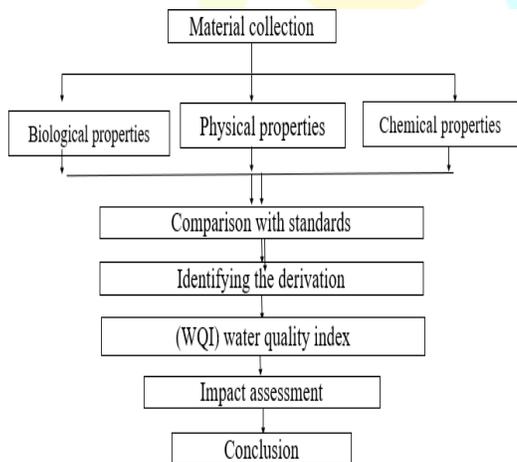
7. TEST CONDUCTED

Various simple tests were performed on the collected sample from the Pond. The tests conducted are as follows

7.1 Litmus paper test

Litmus paper is a type of paper that is treated with a specific indicator of the mixture of ten to fifteen natural dyes which are obtained from the lichens (mainly *Roccella tinctoria*).The inference that we achieve from this test is that if the sample is acidic, the blue litmus paper turns to red color. Similarly, if the sample isbasic in nature then the red litmus paper turns blue in color and when the pH is neutral (pH = 7) then the dye is purple. This test was made on all the four test samples. The test was conducted and the result was that the sample from locality was found to be slightly basic.

FIGURE 4

7.2 pH Test

Ph refers to the negative logarithmic of hydrogen ion concentration in the particular sample. The test was conducted by simply inserting the pH meter into the test samples and the value was noted for each sample. According to this test, Solutions with a pH less than 7 are contained in a liquid in molecular, ionized or micro-granular (colloidal sol) suspended form. This test was conducted on the samples and the results were tabulated.

FIGURE 5

7.3 TDS Test

TDS states to total dissolved solids, It is the measure of combined content of all the inorganic and organic substances that are contained in a liquid in ionized, molecular or micro-granular (colloidal sol) suspended form. Commonly the operational definition is that the solids must be small enough to survive the filtration through a filter which contains two-micrometer (smaller, nominal size) pores. Total dissolved solids (TDS) are usually conversed only in the freshwater systems, as salinity contains some of the ions which constitutes the definition of TDS. The

principal application of TDS is in the study of water quality for rivers, lakes and Streams. Even though Total dissolves solids is not generally considered as a primary pollutants it is used as an indication of aesthetic characteristics of the drinking water and it is also used as an aggregate indicator of the presence of a broad array of the chemical contaminants.

FIGURE 6

6.4 Total hardness test

Total hardness is a measurement of the mineral content Present in a water sample that is irreversible by the boiling effect. Hence, total hardness can be equal to the total magnesium and calcium hardness. By using the testing kit of total hardness the sample was classified into hard water or soft water. The test was conducted by using a series of reagents like RTH 1, RTH 2, and RTH 3 etc. For hard water the inference is got by observing the color change as to from pink to blue and vice versa for soft water.

FIGURE 7

8. TESTING RESULT

S.NO	PARAMETER	STANDARDS	RESULTS	WEIGHTAGE (Wi)
1.	COLOUR	COLOURLESS	COLOURLESS	-
2.	ODOUR	ODOURLESS	ODOURLESS	-
3.	PH	6.5-8.1	7.8	4
4.	TDS	500mg/lit	336mg/lit	5
5.	EC	1000	182.13	4
6.	TURBIDITY(NTU)	1-5	3NTU	2
7.	TOTAL ALKALINITY	200-600	210mg/l	2
8.	TOTAL HARDNESS	200	160mg/l	2
9.	IRON	0.3	0.21mg/l	4
10.	CALCIUM	75	40	2
11.	BORON	0.5	<0.1	3
12.	CHLORIDE	250	126	3
13.	ZINC	5	<0.01	1
14.	CHROMIUM	0.05	<0.01	5
15.	NITRATE	45	0.51	5
16.	FLUORIDE	0.6-1.2	0.03	4
17.	FREECHLORINE	0.2	NIL	3
18.	COD	250	89	2
19.	BOD	30-100	16.2	3
20.	MPN COLIFORM FOR 100ml	200	1100	-
21.	E.COLI	ABSENT	PRESENT	-

9. COMPARISON OF THE TESTS UNDERTAKEN

The appropriate tests were conducted from the sample taken the waste water samples. The treated is compared with the original sample from Oorani. The test results show that the values of the treated sample are slightly variable than that of the other samples. This shows that sample after treatment is contaminant free and ready for drinking purpose. The risk of unsafe contaminants present in drinking water should not be ignored. The relationship between the contaminated drinking water and many significant diseases and the health problem associated with it should not be ignored. Thus home treatment replacements can purify the drinking water to a greater extent than the city treatmentplants. Obviously, municipal water treatment facilities have dropped the presence of many harmful contaminants, and the EPA has the maximum contaminant levels, also which it is assumed that the contaminants may be safely ingested into the human body. Municipal treatments facilities are not the wrong one and the EPA levels did not representthe safety level for each and every person. Children, the aged, and the individuals who already have the weakened immune systems, are mostly at risk to the contaminants present in the drinking water. Two most volatile drinking water contaminants are chlorine and fluoride, are actually the treatment additives. Also lead the another one of the more harmful contaminants which enters the drinking water after treatment and it cannot be regulated by municipal water systems. Therefore municipal water systems should not be trusted to provide healthy and clean drinking water.

After test results it is identified that the water sample collected from oorani is safe for drinking purpose. The resultant water is clear and made available for drinking in which the herbals would normally purify contaminants and that feed nutrients into the healthy drinking water. The drinking water has been treated with the help of naturally available material such as strychnospotatorum, cocos nucifera, hemidesmus indicus, vetiverazizanioides, riversand and charcoal. Thus after the treatment the water is free from fecal contaminants and is ready to use for drinking purpose.

10. CONCLUSION

Climate change affects water systems and quality of include changes in runoff, river flow and groundwater storage, temperature and growth in algal blooms. In addition to this quantitative aspect, some of the water quality parameters are also expected to change. If climate change increases the runoff of water, it also creates soil erosion and some of the parameters like this will also change in the future. In many areas, increase in water temperatures will lead to eutrophication and excess algal growth, which will reduce drinking water quality. These changes in quality the water not only affect the economic and social welfare. It also the affects the sustainability of vital environmental flows, biodiversity and ecosystem. The current paper dealt with drinking water quality parameters and criteria of oorani in perungudi district which is polluted by Oedogonium algae after the testing result it is found that the water is safe for consumption after purified. More scientific understanding is needed to speak the physical, chemical, biological and socio-economic impacts of climate change on water quality index that current and expected climate change have and which will continue to have an impact on the quality of the world's freshwater resources.

REFERENCES

1. Poole, G.C. and Berman, C.H. (2001) An Ecological Perspective on in-Stream Temperature: Natural Heat Dynamics and Mechanisms of Human-Caused Thermal Degradation. Environmental Management, 27, 787-802. http://dx.doi.org/10.1007/s002670010188

2. Caissie, D. (2006) The Thermal Regime of Rivers: A Review. Freshwater Biology, 51, 1389-1406. http://dx.doi.org/10.1111/j.1365-2427.2006.01597.x

3. Parks Canada (1999) Climate Change Scenario, Summer and Winter Temperatures, 2090. Air Issues Bulletin No. 100, Air Quality, Climate Change and Canada's National Parks, Ottawa.

4. IPCC (2008) Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 210 p.

5. Meisner, J.D. (1990) Potential Loss of Thermal Habitat for Brook Trout, Due to Climatic Warming, in Two Southern Ontario Streams. Transactions of the American Fisheries Society, 119, 282-291.

6. Webb, B.W. (1996) Trends in Stream and Water Temperatures. Hydrological Processes, 10, 205-226.

7. Li, Z., Buchberger, S.G., Clark, R.M. and Yang, Y.J. (2010) Customizing Climate Change Adaptation at Drinking Water Treatment Plants. Water Distribution System Analysis 2010, Tucson.

8. Arheimer, B., Andréasson, J., Fogelberg, S., Johnsson, H., Pers, C.B. and Persson, K. (2005) Climate Change Impact on Water Quality: Model Results from Southern Sweden. Ambio, 34, 559-566.

9. Cruise, J.F., Limaye, A.S. and Nassim, A.-A. (1999) Assessment of Impacts of Climate Change on Water Quality in the Southeastern United States. Journal of the American Water Resources Association, 35, 1539-1550. http://dx.doi.org/10.1111/j.1752-1688.1999.tb04236.x

10. Marshall, E. and Randhir, T. (2008) Effect of Climate Change on Watershed System: A Regional Analysis. Climatic Change, 89, 263-280. http://dx.doi.org/10.1007/s10584-007-9389-2

11. Mimikou, M.A., Baltas, E., Varanou, E. and Pantazis, K. (2010) Regional Impacts of Climate Change on Water Resources Quantity and Quality Indicators. Journal of Hydrology, 234, 95-109. http://dx.doi.org/10.1016/S0022-1694(00)00244-4

12. Carriere, A., Barbeau, B. and Cantin, J.F. (2007) Vulnerability of Drinking Water Treatment Plants to Low Water Levels in the St. Lawrence River. Journal of Water Resources Planning and Management, 133, 33-38. http://dx.doi.org/10.1061/(ASCE)0733-9496(2007)133:1(33)

13. Delpla, I., Jung, A.-V., Baures, E., Clement, M. and Thomas, O. (2009) Impacts of Climate Change on Surface Water Quality in Relation to Drinking Water Production. Environment International, 35, 1225-1233.

14. Environment Canada (2001) Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada. National Water Research Institute, Burlington, NWRI Sceintific Assessment Report Series No. 1, 72 p.

15. Schuster, C.J., Ellis, A.G., Robertson, W.J., Charron, D.F., Aramini, J.J., Marshall, B.J. and Medeiros, D.T. (2005) Infectious Disease Outbreaks Related to Drinking Water in Canada, 1974-2001. Revue Canadienne de Santé Publique, 96, 254-258.

16. Murdoch, P.S., Baron, J.S. and Miller, T.L. (2000) Potential Effects of Climate Change on Surface-Water Quality in North America. Journal of the American Water Resources Association, 36, 347-366. http://dx.doi.org/10.1111/j.1752-1688.2000.tb04273.x

17. Schindler, D.W. (2001) The Cumulative Effects of Climate Warming and Other Human Stresses on Canadian Freshwaters in the New Millennium. Canadian Journal of Fisheries and Aquatic Sciences, 58, 18-29. http://dx.doi.org/10.1139/f00-179

18. Thorne, O. and Fenner, R.A. (2011) The Impact of Climate Change on Reservoir Water Quality and Water Treatment Plant Operations: A UK Case Study. Water and Environment Journal, 25, 74-87. http://dx.doi.org/10.1111/j.1747-6593.2009.00194.x