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Studies on Physico-chemical Parameters of Water Collected from Spa of South, Courtallam, Tamil Nadu

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ABSTRACT

People on the globe are tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Water is the most precious resource on earth. It plays a predominant role in distribution of organisms. Freshwater contains various micro-organisms. This study was designed to assess the quality of falls water in Courtallam falls, Tenkasi district, Tamil Nadu, with respect to the physico-chemical parameters including temperature, pH, Salinity, Turbidity, Ca, Mg, Cl, TH, TA, DO, COD, BOD, Na, K and heavy metals such as Pb, Cr, Ar, Hg, Cd. Hundreds of thousands of tourists visit these falls every year and take baths in these water falls to enjoy the beautiful scenes of nature and to receive medicinal values through their baths. The quality of water through parameters (Physico-chemical) affects the species composition and their abundance. Water samples were collected from the falls and analyzed using standard laboratory methods and procedures.

Key words: Physico-chemical parameters, Freshwater, water quality, Courtallam falls

Courtallam, ‘the Spa of the South’ is situated in the Palani range at an elevation of about 167 meters on the Western Ghats. The temperature that prevails here is moderate and cool. Most of the region of Courtallam receives the rainfall during the month of October to January with the onset of the north east monsoon [1]. Courtallam is a boon to Tirunelveli District, Tamil Nadu. Courtallam is a synonym of water falls. The river Chittar and its tributaries during their course make nine water falls. The falls of Courtallam originate from Pothigai hill. ‘Pothigai’ literally means a place where many things have been concealed. The Spa of the South situated at an altitude of 167 meters on the Western Ghats just beside the Shenkottah gap in the range known as ‘Aariyangavu pass’ [2]. Life on the earth is never possible without water. Water is one of the most essential constituents of the environments. Less than 1% water is present in ponds, lakes, rivers, dams etc., which is used by man for domestic, industrial and agricultural purposes. The term water quality was developed to give an indication of how suitable the water is for human consumption [3] and is widely used in multiple scientific publications related to the necessities of sustainable management [4]. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life [5]. Natural waters contain some types

of impurities whose nature and amount vary with source of water [6]. Water is one of the most important and abundant compounds of the ecosystem. All living organisms on the earth need water for their survival and growth. As of now only earth is the planet having about 70% of water. But due to increased human population, industrialization, use of fertilizers in the agriculture and man-made activity it is highly polluted with different harmful contaminants. Therefore, it is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases [7].

Spa is a place where there is mineral water. In general, it is a place where there is a spring of mineral water having medicinal properties. The Western Ghats Forest which is found in the region of Courtallam possesses botanical wealth rich in medicinal value [8]. The endless scope of ‘Medical tourism’ in Tamil Nadu is largely because of its diverse topography and climate on land and water. In Courtallam a variety of plants, trees and medicinal herbs are found in plenty [9]. Freshwater ecology is a specialized sub category of the overall study of organism and the environment. By studying the plants and animals in a body of water as well as the components of the water itself, a scientist specializing in freshwater ecology can discover vital information about the health and needs of a freshwater system. Freshwater ecosystems depend strongly on physical features such as water quantity and flow, many of the threads to these ecosystems involve activities that affect fundamental physical characteristics. This study reports the physico-chemical analysis of different water samples.

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MATERIALS AND METHODS

The present study was carried out in the Courtallam falls which is located in Tenkasi district in the South Indian State of Tamil Nadu bordering to the Kollam district, Kerala. The following physico-chemical parameters such as, pH (Elico pH meter), Temperature (Thermometer), Salinity [10], Turbidity [11], Alkalinity [12], Dissolved oxygen and Biological Oxygen Demand [13], Total Dissolved Solids [14], Electrical conductivity [12], Chemical Oxygen Demand [6] and Total Hardness [12].

Total harness = EDTA

$$\frac{\text{Solution (ml)} \times \text{ml of sample (mg/l)}}{1000}$$

Sample collection and preparation

The water samples were collected from 5 water falls (Old falls, Main falls, Five falls, Tiger falls and Chittraruvi). The water samples were collected from different locations to evaluate the physico-chemical contamination during rainy, winter and summer season. Samples were collected in polythene bottles (2.0) liter and had been heated for 30-40 minutes using 1.5ml concentrated hydrochloric acid, 2.5ml concentrated nitric acid, 50ml distilled water, 46ml water samples in the sampling site.

Mineral analysis [15]

Mineral water contains a large quantity of dissolved minerals or gases. Minerals such as potassium, iron, phosphorous, sulphur, calcium and magnesium are present in the water sample potassium was represented by yellow precipitate, iron was represented by blue precipitate, phosphorous was represented by greenish yellow precipitate, sulphur was represented by white precipitate, calcium was represented by needle shaped crystals, magnesium was represented by different type of crystals.

Metal analysis

Metals in falls water (heavy metals such as cadmium, arsenic, chromium, lead, mercury) are of high concern because they are toxic to humans and can be extremely harmful if

discharged to the environment. They can also cause problems within treatment processes. Metal content is measured to determine toxicity levels.

RESULTS AND DISCUSSION

The results of this study presented in (Table 1). A total of 12 different physico-chemical parameters were analyzed. The analysis was based on the samples taken from Courtallam water falls. The pH value of all the falls water samples were found to be in the range from pH 7.1-7.7 in pH meter. Temperature value in the falls water samples ranged from 23°C to 28°C. The temperature of different water falls such as Tiger falls, New falls, Chittraruvi, Five falls and Old falls ranged from (23°C-25°C) in running water, (24°C - 26°C) in surface water, (24°C - 28°C) in subsurface water and (25°C - 28°C) in bottom water that had seen in rainy season. The appearance of salinity in the water sample in Tiger falls, Chittraruvi, Old falls is pale orange color and in the New falls and Five falls is turbid yellow color. The analysis of minerals in water samples was carried out using standard procedure and the results expressed in (Table 1). The results showed that the water sample contained Potassium, Iron, Sulphur, Phosphorous, Calcium and Magnesium. The results indicated the presence of Arsenic, Chromium, Lead and Mercury in the water sample.

The analysis shows that the highest mean alkalinity of 93.7mg/l was observed in new falls while the lowest mean alkalinity 43.1mg/l observed in Chittraruvi. Turbidity values ranged from highest in Tiger falls and lowest in Five falls. Total dissolved solid ranged from 259.8 to 304.6 in New falls, Old falls, Tiger falls, Five falls and Chittraruvi. The highest electrical conductivity was observed in Old falls while the lowest mean value in five falls. The highest DO level of 6.6 was obtained in Tiger falls while lowest DO level of 2.3 was observed in Chittraruvi. The highest total hardness was observed in tiger falls and the lowest mean value in new falls. The highest Biological Oxygen Demand of 4.52mg/l was obtained in five falls while lowest Biological Oxygen Demand level of 2.9mg/l was observed in Old falls. The Chemical Oxygen Demand ranged from 10mg/l to 40mg/l. Significant variations were observed for the different parameters in the Courtallam water falls also shows values and limits from World Health Organization (WHO) for water quality parameters.

Table 1 Qualitative analysis of minerals and metals in Courtallam water samples

S. No.	Minerals / metals	S ₁	S ₂	S ₃	S ₄	S ₅
		Tiger falls	New Falls	Chitaruvi	Five falls	Old falls
1.	Potassium	++	++	++	++	++
2.	Iron	+	++	++	++	+
3.	Phosphorous	+	+	+	+	++
4.	Sulphur	++	+	+	++	++
5.	Calcium	+	+	+	+	+
6.	Magnesium	+	+	+	+	+
7.	Arsenic	+	++	++	++	+
8.	Cadmium	-	-	-	-	-
9.	Chromium	-	-	-	-	-
10.	Lead	++	++	++	++	++
11.	Mercury	++	++	++	++	++

(Table 1) Mineral analysis of water samples as potassium, iron, phosphorous, sulphur, calcium and magnesium and metal analysis of water samples as arsenic, cadmium, chromium, lead and mercury. (Fig 1-2), revealed about the presence of various parameters such as pH, temperature,

turbidity, alkalinity, total hardness, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total dissolved solid, electrical conductivity and salinity.

Agriculture is the backbone of our country; study area comes under Eastern Ghats which is one of the hotspot of world.

The rich biodiversity because of nutrients like, minerals, metals and other physic chemical parameters. Among five sampling area, Tiger falls, New falls and old falls covers the major part of agriculture land. Where, the cash crops namely, paddy, banana and black gram being cultivated. Hence, the present findings deals with the qualitative analysis of minerals and metals and quantitative studies on physic chemical parameters.

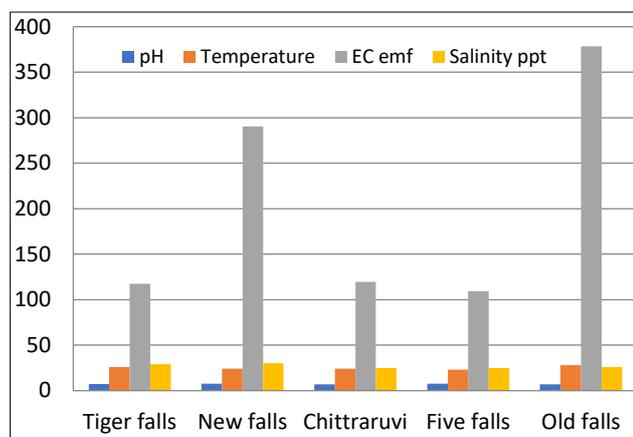


Fig 1 Physical parameters of water samples

Presence of arsenic, lead and mercury were identified because of agri residues of pesticide, fertilizers mixed with water during inflow of waterfalls (Table 1) absence of cadmium and chromium showed a positive result after the steps taken by the pollution control board and district authority of state government from 2010 onwards.

People on globe are under tremendous threat due to undesired changes in the physical, chemical and biological characteristics of air, water and soil. Due to increased human population, industrialization, use of fertilizers and man-made activity water is highly polluted with different harmful contaminants. Natural water contaminates due to weathering of rocks and leaching of soils, mining processing etc. It is necessary that the quality of drinking water should be checked at regular time interval, because due to use of contaminated drinking water, human population suffers from varied of water borne diseases. The availability of good quality water is an indispensable feature for preventing diseases and improving quality of life. It is necessary to know details about different physico-chemical parameters such as color temperature, acidity, hardness, Ph, sulphate, chloride, DO, BOD, COD, alkalinity used for testing of water quality. Heavy metals such as Pb, Cr, Fe, Hg etc. are of special concern because they produce water or chronic poisoning in aquatic animals. Some water analysis reports with physico-chemical parameters have been given for the exploring parameter study. Guidelines of different physico-chemical parameters also have been given for comparing the value of real water sample [16]. Narmada river is considered to be the holy river of the state Madhya Pradesh. A study was considered for the development of water quality index using eight parameters pH, Temperature, Total Dissolved Solid (TDS), turbidity, Nitrate-Nitrogen, Phosphate, Biological Oxygen Demand (BOD), Dissolved Oxygen (DO) measured at different sites (S₁-S₆) along the river Narmada. Three methods (Weighted Arithmetic Water Quality Index, National Sanitation Foundation Water Quality Index and Canadian Council of Ministers of the Environment Water Quality Index) were used for the calculation of water quality index. This was observed that the water quality was found to be excellent to good in the season summer and winter and poor to unsuitable for human consumption in the season monsoon along the river Narmada.

The inflow of water current confirms the high value of Electrical conductivity (EC) of water and it was recorded in (Fig 1). Similarly, the rate of Salinity was observed below 35-38ppt which was less than the seawater. Similarly, deposition of silt increases the content of Alkalinity, COD, DO, turbidity and TDS and this was expressed in (Fig 2). Hence, the water is highly useful for agriculture purposes.

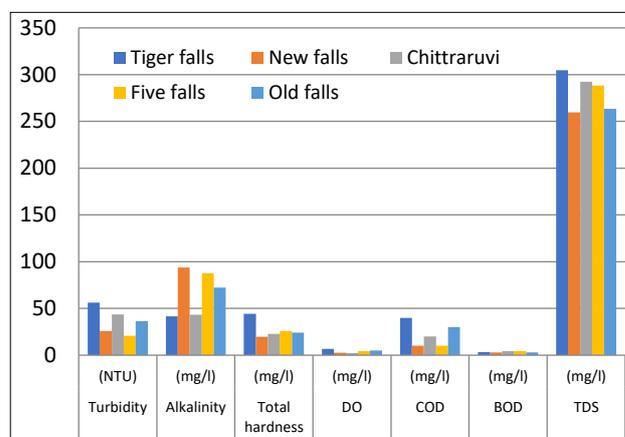


Fig 2 Chemical parameters of water samples

The fall in the quality of water in monsoon season was due to poor sanitation, turbulent, soil erosion and high anthropogenic activities [17]. Monthly changes in physical and chemical parameters such as water temperature, turbidity, pH, Total Dissolved Solids, Dissolved Oxygen, free carbon-di-oxide and total hardness, chlorides, alkalinity, phosphate and nitrates were analyzed for a period of 1 year from 1st January 2007 to 31st December 2007. All parameters were within the permissible limits. The results indicate that the tank is non-polluted and can be used for domestic, irrigation and fisheries [18]. The characteristics of the water decides whether the available water is suitable for consumption of living organisms. Therefore, the measurement of heavy metals concentration and physico-chemical parameters decides the quality of the water resources which significantly contributes to the social quality of the people living in the particular area. In this regard and attempt is made to measure the quality of the water available in Asigde Tsimbla Woreda in Northwestern Tigray, Ethiopia. There are 25 drinking water samples were collected for the analysis. In order to understand the quality of drinking water in Asigde Tsimbla Woreda, National and international standards was utilized for analyzing the various physico-chemical parameters and heavy metals concentrations. The heavy metal concentration was found to be Cd (44%), Co (76%), Cr (40%), Fe (76%), Ni (44%), Cu (16%), Pb (64%) and Zn (100%) which were higher than WHO limit for drinking purposes. The results show that water exhibit the poor in quality, then it needs the physico-chemical treatment during drinking purposes [19]. A total of 10 ground water samples were collected from in and around Tirunelveli during the year 2010 were analyzed for their physico-chemical characteristics. The physico-chemical parameter such as pH, conductivity, Total Dissolved Solids (TDS), calcium, magnesium, sodium, potassium, chloride, sulphate, nitrate, Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) were analyzed. The results were compared with the World Health Organization (WHO 2003) standard values. The quality of ground water samples were discussed with respect to these parameters and thus an attempt was made to ascertain the quality of ground water is fit or not for drinking and other purposes [20]. The drinking water quality was investigated in

suspected parts of Perak state, Malaysia, to ensure the continuous supply of clean and safe drinking water for public health protection. In this regard, a detailed physical and chemical analysis of drinking water samples was carried out in different residential and commercial areas of the state. A number of parameters such as pH, Turbidity, conductivity, Total Suspended Solids (TSS), Total Dissolved Solids (TDS), and heavy metals such as Cu, Zn, Mg, Fe, Cd, Pb, Cr, As, Hg and Sn were analyzed for each water sample collected during winter and summer periods. The obtained values of each parameters were compared with the standard values set by the World Health Organization (WHO) and local standards such as National Drinking Water Quality Standard (NDWQS). The value of each parameter were found to be within the safe limits set by the WHO and NDWQS. Overall, the water from all the locations was found to be safe as drinking water. However, it is also important to investigate other potential water contaminants

such as chemicals and microbial and radiological materials for a longer period of time, including human body fluids, in order to assess the overall water quality of Perak State [21].

CONCLUSION

Courtallam the spa of south is special in so many aspects. It highlights the uniqueness of the water falls which possess medicinal value. The present findings conclude to the availability of minerals, metals and physical parameters such as pH, temperature, turbidity, alkalinity, total hardness, Do, COD, BOD, TDS, EC and salinity.

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