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Hydro Check Investigation of the Safety of Local Drinking Water

Sources in Putheri, Kanyakumari District.

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Abstract

The present study is focused on the determination of physico-chemical parameters such as Appearance,Colour, pHvalue,Odour,Turbidity,Total dissolved Solids, Calcium Free residual chlorine,Iron,MagnesiumSulphate,TotalAlkalinity, Lead, TotalArsenic, Fluoride, Biochemical oxygen demand,Chemical oxygen demand, Dissolved Oxygen, Temperature, Electrical conductivity, Potassium, E.coli, and Coilform study of various water samples collected from different sampling points (Water from Bore-wells, Corporationwater, Damwater) in Putheri village of Kayakumari District, Tamilnadu, India were analysed using methods prescribed by the **American Public Health Association (APHA)**. The obtained values were compared with permissible limits recommended by the **World Health Organization (WHO)** and the **Bureau of Indian Standards (BIS)**. The results obtained indicate that this water can be used for agricultural purposes, cattle washing, human bathing, etc and after proper purification the water can be used for the drinking purposes.

Key words: Bore-wells; Corporation water; Damwater; Physico-chemical characteristics; quality analysis.

Introduction

The quality of water (determined by the physical, chemical and biological compositions) is now the major concern in the countries of the world; the decision of WHO's 29th Session (May 1976) emphasizes that of experts in all water delivered to the consumer should meet the high requirements of modern hygiene and should be free from pathogenic micro-organisms and toxic substances [1]. Due to historical, geographical, religious, political, and socio cultural reasons, India has a unique place in the world, however pollution-causing activities have caused severe changes in aquatic environments over the last few decades[2].The quality of potable water depends on the water sources like river, pond, well, lake,*etc*.; and the drinking water could be polluted with pathogens, toxic metals, chemical compounds (such as pesticides and herbicides) (3) and other agricultural and industrial wastes[4].The pollution of drinking water is responsible for large number of mortalities and morbidities due to water borne diseases like typhoid, cholera, diarrhea, dysentery, hepatitis, as well as many protozoan and helminthes infections. Exposure to chemicals in(5-6) drinking water may lead to a range of chronic diseases (*e.g.*,cancerous and cardiovascular diseases),adverse reproductive outcomes and effects on children's health (*e.g.*, neuro development), among other health effects [7].Therefore, the quality and nature of water require proper assessment before use which can be done by suitable physical and chemical analyses.Physico-chemical characteristics of water have been analyzed by several researchers considering water samples from different water resources of the world [8-13]. Putheri village is a small village located about 6-7 km north of Nagercoil in Kanyakumari district, Tamil Nadu. It is part of the Rajakkamangalam Block and lies at an elevation of around 26 meters above sea level. The area is

known for its natural ponds, temples, and scenic surroundings, though in recent years some of its greenery has been affected by urban growth.

Location& Connectivity: Putheri is well connected to Nagercoil town by road and lies close to schools, shops, and bus stops, making it easily accessible for residents and visitors.

Natural Features: The village is famous for Putheri Kulam (lake) along with other water bodies like Kadukulam and Ala Mootu Kulam. These ponds serve as habitats for migratory birds and are important for the ecological balance of the region.

Cultural& Historical Importance: The 500-year-old Yogeeswarar Temple is a significant religious site in Putheri. Local legend connects the temple with a yogi who attained samadhi here, and the name "Putheri" itself is believed to have originated from the word puttru.

C**ommunity & Lifestyle**: Being close to Nagercoil, Putheri has a semi- urban lifestyle. People rely on agriculture, small businesses, and daily commuting to the town for employment and services.

Challenges: Once rich in farmland and water resources, Putheri now faces issues like encroachment of ponds, reduction of green cover, and poor maintenance of natural resources, which has led to environmental concerns.

Figure 1: Site map of Putheri village in the Kanyakumari district of Tamil Nadu.

In the present study, in order to understand the quality of water for drinking and other purpose in the above village, we have selected the above mentioned (and available) three water sources by getting samples from them at different places and analyzed physico-chemically. The results obtained are reported and discussed here in.

Experimental Methods:

Sample Collection

Water samples were collected in glass bottles having well fitted stoppers. For the physico- chemical analyses, the bottles should have a water holding capacity of about 1 litre; and, for the bacteriological examinations, bottles with smaller holding capacity is sufficient. The bottles were thoroughly cleaned, and filled thrice with water and emptied before collecting the sample. After collecting the sample the stopper in the bottle was well secured and the bottles containing samples of water were labeled stating the source, date and time of collection. Bore-well, Corporation water, Dam water available in the Putheri village were the water sources considered for the present study.

Physico-chemical Analysis

The physico-chemical parameters such as colour (the true colour of water from which the turbidity has been removed),odour (a quality factor affecting acceptability of drinking water), pH value (the measure of acidity, H^+ ion concentration, at 25 ^oC), total hardness (the measure of calcium and magnesium presence), turbidity (thereduction of transparency), total dissolved solids (TDS) content (the measure of particulate solids presence at 105 ^oC), dissolved oxygen content (the measure of oxygen presence), chemical oxygen demand (COD), biochemical oxygen demand (BOD),flouride

content (the measure of fluoride presence), chloride content (the measure of chloride presence), magnesium content (the measure of magnesium presence), residual free chlorine content (the measure of residual free chlorine), sulphate content (the measure of sulphate presence), total alkalinity (the quantitative capacity to react with a strong acid to a designated pH), iron content (the measure of iron presence), cadmium content (the measure of cadmium presence), mercury content (the measure of mercury presence), arsenic content (the measure of arsenic presence), chromium content (the measure of chromium presence) and lead content (the measure of lead presence) were determined for all the three water samples considered in the present study by applying the available
standard techniques [11-13].

Methods followed before purification (as such)

Appearance:Physical,Colour:IS3025Part–4, pHValue:IS3025Part–11,Odour:IS3025Part–5,Turbidity:IS3025Part–10,TotaldissolvedSolids:IS3025Part–16Calcium:IS3025Part–40,Freeresidualchlorine:IS3025Part–26,Iron:IS3025Part–53Magnesium:IS3025Part–46,Sulphate:IS3025Part–24,TotalAlkalinity:IS3025Part–23Lead:IS3025Part–47TotalArsenic:IS3025Part–37,Fluoride:IS3025Part–60,Biochemical oxygen 60Biochemicaloxygendemand:IS3025Part–44,Chemicaloxygendeman,d:IS3025Part–58,Dissolvedoxygen:IS3025Part–38,Temperature:IS3025Part–9Electricalconductivity: IS3025Part–14,Potassium:IS3025Part–45,E.coli:IS15185,Coilform:IS15185

After purification(Methods followed):

We have followed the natural Purification methods:

Solar Disinfection(SODIS). Bio sand filters,Ceramic Filters, Plant based coagulants, Natural setting sedimentation, **Bio-sand filter:** This method is effective for removing pathogens and some chemicals from water.(i) Layered Filtration (ii) Biological Processes (iii) Physical processes. Low cost,Easy maintenance and Effective. Next using Moringa oleifera seed water is purified

RESULTS OBTAINED:(Before Purification and After Purification)

The following results were obtained through **the physico-chemical analysis Before purification** of three samples obtained from three different sources.

RESULTS:

The following results were obtained through **the physico- chemical analysis Before purification** of three samples obtained from three different sources.

Table-I

Parameters tested/analyzed with the instrument/method used and the results obtained along with the maximum acceptance limit prescribed.

SI. NO.	Parameters (Units)	Results Obtained for			Max. Acceptance limits of IS: 10500:2012
		Sample I(BW)	Sample II(CW)	Sample III(DW)	
1	Appearance	Clear	Clear	Clear	Clear, no any sediments
2	Colour (Hazen)	5.0	1.0	5.0	5.0
3	Odour	Agreeable	Agreeable	Agreeable	Agreeable
4	pHvalue	7.04	6.72	6.99	6.5–8.5
5	Turbidity (NTU)	0.7	0.5	0.9	1

6	Total dissolved Solids (mg/L)	968	383	612	500
7	Calcium (mg/L)	92.4	40.2	65.3	75
8	Free residual chlorine (mg/L)	0.1	0.1	0.1	0.2
9	Iron (mg/L)	0.146	0.1	0.12	0.3
10	Magnesium(mg/L)	26.5	16.3	19.6	30
11	Sulphate (mg/L)	60.2	22.1	46.8	200
12	Total lkalinity(mg/L)	246	86.4	198	200
13	Fluoride (mg/L)	0.246	0.1	0.182	1.0
14	Lead (mg/L)	0.01	0.01	0.01	0.01
15	TotalArsenic(mg/L)	0.005	0.005	0.005	0.01
16	BiochemicalOxygen Demand (mg/L)	2.0	2.0	2.0	--
17	Chemical Oxygen Demand(mg/L)	4.0	4.0	4.0	--
18	DissolvedOxygen (mg/L)	6.3	6.7	6.2	--
19	Temperature	28.2	27.9	27.1	--
20	ElectricalConductivity	1489	589	941	--
21	Potassium(mg/L)	22.5	10.4	16.2	--
22	Escherichia coli (MPN/100ML)	Absent	Absent	Absent	Absent
23	Total Coliform (MPN /100ML)	Absent	Absent	Absent	Absent

Table-II

The following results were obtained through **the physico-chemical analysis <u>After purification</u>** of three samples obtained from three different sources:

SI. NO	**Parameters (Units)**	**ResultsObtainedfor**			**Max. Acceptance limits of IS: 10500:2012**
		Sample I(BW)	**Sample II(CW)**	**Sample III(DW)**	
1	Appearance	Clear	Clear	Clear	Clear, no any sediments
2	Colour(Hazen)	1.0	1.0	1.0	5.0
3	Odour	Agreeable	Agreeable	Agreeable	Agreeable
4	pHvalue	6.94	6.63	6.81	6.5–8.5
5	Turbidity(NTU)	0.5	0.5	0.5	1
6	Total dissolved Solids (mg/L)	546	169	312	500
7	Calcium(mg/L)	54.5	8.46	31.2	75
8	Free residual chlorine (mg/L)	0.1	0.1	0.1	0.2
9	Iron(mg/L)	0.1	0.1	0.1	0.3
10	Magnesium(mg/L)	19.2	1.2	8.46	30

11	Sulphate(mg/L)	19.6	4.21	14.5	200
12	Total Alkalinity (mg/L)	154	18.0	89	200
13	Fluoride(mg/L)	0.1	0.1	0.1	1.0
14	Lead(mg/L)	0.01	0.01	0.01	0.01
15	Total Arsenic (mg/L)	0.005	0.005	0.005	0.01
16	Biochemical Oxygen Demand (mg/L)	2.0	2.0	2.0	--
17	Chemical Oxygen Demand (mg/L)	4.0	4.0	4.0	--
18	Dissolved Oxygen (mg/L)	6.6	6.9	6.6	--
19	Temperature	27.7	27.3	27.5	--
20	Electrical Conductivity	840	169	480	--
21	Potassium(mg/L)	9.42	1.0	2.46	--
22	Escherichia coli (MPN/100ML)	Absent	Absent	Absent	Absent
23	Total Coliform (MPN /100ML)	Absent	Absent	Absent	Absent

Discussion

The study analysed three water samples — Bore Well (Sample I), Corporation Water (Sample II), and Dam Water (Sample III) — before and after purification to evaluate their physical and chemical characteristics.

Before Purification:

Sample I (Bore Well): Showed the highest hardness, TDS, alkalinity, calcium, and magnesium, indicating very hard water. It was clear and colourless but required treatment for safe long-term use.

Sample II (Corporation Water): Had the lowest TDS, hardness, and alkalinity. It was soft, pleasant in taste, and met desirable standards for drinking.

Sample III (Dam Water): Had moderate hardness and TDS, with a balanced mineral composition. It was better than Bore Well water but not as soft as Corporation water.

After Purification:

Sample I (BoreWell): Retained high mineral content and TDS, though pH was near neutral. Still safe for use, but contained more dissolved salts.

Sample II (CorporationWater): Exhibited the lowest TDS and conductivity, confirming it as the softest and best-quality water among the samples. All parameters were within permissible limits.

Sample III (DamWater):Showed intermediate hardness and balanced alkalinity with no fluoride risk. It was safe for consumption and had a desirable mineral balance.

CONCLUSION:

Among the three samples, Corporation Water (Sample II) is the best quality water source, both before and after purification, meeting all drinking water standards and showing the most favourable physicochemical properties.

Dam Water (Sample III) is moderate in quality, acceptable for general use after purification.Bore Well Water (Sample I), although clear, remains hard and mineral-rich, requiring softening or further treatment for long-term household or drinking purposes.Overall, purification improved the quality of all samples, ensuring that they fall within safe and acceptable limits for consumption.

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