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PHYSICOCHEMICAL ANALYSIS OF WATER SAMPLES OF UZHAVOOR GRAMAPANCHAYATH

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Abstract

Water is the most widely used natural resource. In the modern world, due to increase in the developmental activities such as agriculture, construction, deforestation, etc. water being polluted. It is essential to control and prevent the pollution in the drinking water, as it is directly affect human health. The aim of this study was to determine physico-chemical characteristics in water samples collected from varies sites of uzhavoor. Drinking water samples were collected and analysed the physico-chemical parameters like; pH, Dissolved Oxygen ,Conductivity ,Total Hardness, Chloride and sulphate. pH, hardness, iron content were not in the permissible limit. But conductivity, sulphate, chloride and dissolved oxygen were in the permissible limit. Hence it was found that all the water samples were unfit for drinking purposes. The samples were not good for drinking purpose, may be due to the excess use of fertilisers in agricultural land area.

Keywords **:** *: Water, pH, Dissolved oxygen, Hardness, Chloride, Iron, Uzhavoor.*

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Introduction

Water covers 71% of the Earth's surface(Darsan 2002). It is an important energy source of all living organism. On Earth, 96.5% of the planet's crust water is found in seas and oceans, 1.7% in groundwater, 1.7% is locked in mountain glaciers and polar caps, and 0.001% in the air as vapour, clouds(formed of ice and liquid water suspended in air), and precipitation.(Gleick 1993;AGU 1995) Only 2.5% of this water is freshwater, and 98.8% of that water is in ice (excepting ice in clouds) and groundwater. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the Earth's freshwater (0.003%) is contained within biological bodies and manufactured products.(Gleick 1993) A greater quantity of water is found in the earth's interior.(Science news 2015)

Water is one of the most widely used natural resource. Impure water causes about 4 billion cases of diarrhea per year which results in one and half million deaths mostly of children under the age of five .In India ,half a million children die every year due to unsafe drinking water(MDG Report 2008). Every day tons of sea wage and industrial waste are being discharge into our water resources. Water pollution occurs when harmful substances are released into the water in large quantities which cause damage to people, wildlife, or habitat or indirectly into water bodies without proper treatment to remove harmful compounds. Effect is damaging either to individual species and also to the biological communities Drinking water is one of the primary needs of life. So it becomes important to measure the toxicity of drinking water on regular basis to sufficiently support human health risk assessment and to match National as well as International standards that have been set for drinking water

Uzhavoor is a developing village in Kottayam district, in Kerala state. It is famous as the birth place of Dr. K. R. Narayananan, former President of India. Majority of the population are small scale farmers.

Rubber is the major crop cultivated here. Tapiocca, Plantain, vegetables etc are also cultivated in small scale. Domestic wells and ponds are the major source of drinking water facility in this area. St.Stephen's College is the one and only one higher education institution in this area and the Chemistry department of the college has been conducting soil sample analysis of this area with the help and support of Uzhavoor Krishi bhavan and soil testing laboratory Kozha for the last six years which has resulted in giving significant input to the farming community of Uzhavoor.

The objective of the present work is to analyse the physicochemical characteristics of the drinking water samples collected from different areas of Uzhavoor grammapanchayat. Comparative study of water samples collected from different areas of Uzhavoor were analysed to obtain the quality of drinking water.

METHODOLOGY (APHA 1998; Darsan 2002)

Sampling

Sampling of water analysis was done with special care, ensuring that there was no external contamination of water samples. For analysis , Sterilized plastic bottles were used which were sterilised by boiling for 15 minutes and rinsed with distilled water. Effectiveness of sterilization was checked with each run by using sterilization strips inside sampling bottles. During sample collection, some air space was left in the bottle to mix probably before examination.

METHODOLOGY

1. pH VALUE

Parameter	Units	Methods
P^H		Electrometric method
Dissolved oxygen	%	Electrometric method
Conductivity	µs/cm	Electrometric method
Total hardness	ppm	Titration method
Chloride	ppm	Titration method
Iron	ppm	Titration method
Sulphate	Mg/l	Gravimeric method.

pH is defined as the negative logarithm of hydrogen ion concentration or simply the log of the reciprocal of the hydrogen ion concentration. It indicated the degree of acidity or alkalinity of water which was measured by using pH meter. pH meter was switched on, kept at start position and allowed it at least 15 minutes to warm up and turned the switch to on position. Calibrated the meter with standard buffer solutions using 4 and 9.2 buffer after standardizing with pH 7 buffer. The electrodes were washed and wiped with tissue paper. 30-40 ml water sample was taken in a beaker and introduced the electrodes into the water .The operating switch was turned in on position. The pH Values of the sample will be displayed in the meter which can be recorded. The process was repeated till concordant values were reproduced. The water samples were analysed and the values are given in Table.1

2. DISSOLVED OXYGEN

Dissolved oxygen content was measured by using water analyser. Water analyser was switched on and calibrated in air and analysed the water samples . The water samples were analysed and the values are given in table 2.

3. CONDUCTIVITY

Conductivity meter was switched on, checked using 0.01N KCl solution . The electrode was Washed with distilled water and introduced into the water sample taken in a beaker. The range and temperature was set. Care was taken ,the electrode should not touch the beaker. The meter was operated and measured the reading of the given water samples. Evaluation of water samples collected from various areas and values are given in the table 3.

4. TOTAL HARDNESS

Hardness was measured by using titration method. 25 ml of water sample was pipeted out into a conical flask, put a red litmus turned into blue. Two drops of Erichrome Black T indicator was added. Titrated against 0.02N EDTA solution till the colour changed from purplish red to sky blue colour. Evaluation of water samples collected from various areas and values are given in the table 4.

5. CHLORIDE

The Chloride present in the water was measured by volumetric titration method. 50 ml water was pipetted out into a conical flask and chloride content was estimated by using silver nitrate solution using potassium chromate as the indicator. The chloride was precipitated and excess of silver nitrate combined with potassium chromate indicator to form flesh red precipitate of silver chromate. Evaluation of water samples collected from various areas and the values are given in the table 5.

6. IRON

The iron in the water is reduced to ferrous form by adding dilute sulphuric acid . The ferrous iron is oxidised to ferric form by titration with standard potassium permanganate .Using the volume of standard potassium permanganate consumed, the content of iron is estimated by the following procedure: 25 ml of the water samples was pipette out into a conical flask and evaporated to dryness. When completely dried about 1 to 2 ml of concentrated H_2SO_4 was added and again evaporated almost to dryness. The residue was transferred into a 250 ml conical flask using hot water . 40 ml H_2SO_4 and few zinc granules were added. The conical flask was covered with a funnel. It was warmed and allowed to stand for at least half an hour for completion of reduction. The completion of reduction was tested using

ammonium thiocyanate solution taken on a tile against a drop of the solution. There should not be any blood red colour. Then it was filtered into a 250 ml conical flask containing a pinch of carbonate through glass wool. Titrated it against 0.1N KMnO4 .Appearance of permanent pink colour indicated the end point. Evaluation of water samples collected from various areas and the values are given in the table 6.

7 . SULPHATE:

Sulphate can be estimated by gravimetric method. 50 ml of the water sample was pipetted out into a conical flask. 10 ml of dilute HCl and 1 gram solid ammonium chloride were added. Heated to boiling and 10 ml of 10 % barium chloride solution was added drop wise. The boiling was continued for 2 or 3 minutes. The precipitate was allowed to settle and tested for the completion of precipitation by adding Barium Chloride solution and digested for half an hour. Filtered through Whatman No. 42 Filter paper and washed with boiling water till the filtrate run free of chloride. The filter paper along with the precipitate was transfered to a weighed silica crucible and dried it in hot air oven. Ignited over a low flame initially, and heated up to red-hot to get constant weight. From the weight of Barium Sulphate obtained, calculate the sulphate content of the sample was calculated.

RESULT AND DISCUSSION

1. ANALYSIS OF PH VALUE

Table 1 :

samples	Name of the Sample	Source	P^H
Sample 1	Cyriac K A Analil	Well Water	5.97
Sample 2	Luke Thomas, Puthiyakunnel	Well Water	5.22
Sample 3	Joseph P C, Puthiyakunnel	Well Water	5.49
Sample 4	James Manual, Kuzhiplackil	Well Water	5.60
Sample 5	P L Thomas, Puthiyakunnel	Well Water	5.72
Sample 6	Manghanal Kudineer Padhathi	Pond	5.41
Sample 7	Visitation Convent, Near Uzhavoor Church 1	Well Water	5.29
Sample 8	St. Stephen's College, Uzhavoor	Cooler	5.93
Sample 9	Raghu, U K, Kulathinkal	Well Water	5.52
Sample 10	Visitation Convent, Near Uzhavoor Church 2	Well Water	5.61

pH reveals if a solution is acidic or alkaline. pH of water beyond permissible range can affect mucous membrane of cells and cause corrosiveness in water supply system[6]. A PH range of 6 to 9 appears to provide protection for the life of fresh water fish. There are many factors that can affect pH in water, both natural and manmade .

The pH of water samples are measured at the time of collection by using pH meter. pH value is determined for all the water samples collected from selected areas was found to be in the range of 5 to 5.9. The samples are slightly acidic This may be due to the excess use of fertilisers in agricultural land area. All the water samples are not within the limit of BIS/WHO (WHO 2009; WHO 1996) i.e. 6.5 to 8.5

2. ANALYSIS OF DISSOLVED OXYGEN

Table 2

samples	Name of the Sample	Source	Dissolved oxygen (%)
Sample 1	Cyriac K A Analil	Well Water	95.8
Sample 2	Luke Thomas, Puthiyakunnel	Well Water	96.1
Sample 3	Joseph P C, Puthiyakunnel	Well Water	96.3
Sample 4	James Manual, Kuzhiplackil	Well Water	96.4
Sample 5	P L Thomas, Puthiyakunnel	Well Water	96.9
Sample 6	Manghanal Kudineer Padhathi	Pond	97
Sample 7	Visitation Convent, Near Uzhavoor Church 1	Well Water	90.7
Sample 8	St. Stephen's College, Uzhavoor	Cooler	96.6
Sample 9	Raghu, U K, Kulathinkal	Well Water	88.1
Sample 10	Visitation Convent, Near Uzhavoor Church 2	Well Water	96.5

Dissolved oxygen analysis measures the amount of gaseous oxygen dissolved in an aqueous solution. oxygen enter into the water by diffusion from the air, by aeration and as a waste product of photosynthesis. Total dissolved solid gas concentration in water should not exceed 110%.Adequate dissolved oxygen is necessary for good water quality. Dissolved Oxygen value an indicative of pollution in water and depicts an inverse relationship with water temperature. The permissible limit for DO as per BIS/WHO is up to 110% . Drinking water samples collected from various sites showed a values ranges from 88.1 to 97 %. All the samples are in the permissible limit. (WHO 2009; WHO 1996)

3. ANALYSIS OF CONDUCTIVITY

Table 3

samples	Name of the Sample	Source	Conductivity(µs/cm)
Sample 1	Cyriac K A Analil	Well Water	106.4
Sample 2	Luke Thomas, Puthiyakunnel	Well Water	49.01
Sample 3	Joseph P C, Puthiyakunnel	Well Water	86.92
Sample 4	James Manual, Kuzhiplackil	Well Water	65.25
Sample 5	P L Thomas, Puthiyakunnel	Well Water	65.66
Sample 6	Manghanal Kudineer Padhathi	Pond	32.25
Sample 7	Visitation Convent, Near Uzhavoor Church 1	Well Water	72.04
Sample 8	St. Stephen's College, Uzhavoor	Cooler	73.66
Sample 9	Raghu, U K, Kulathinkal	Well Water	49.95
Sample 10	Visitation Convent, Near Uzhavoor Church 2	Well Water	73.5

Conductivity is a measure of the capacity of a solution such as water in a stream to pass an electric current . This is an indication of the concentration of dissolved electrolyte ions in the water. It doesn't identify the specific ions in the water. However significant increases in conductivity may be an indicator that polluting discharges have entered water. Permissible drinking water has a conductivity range up to 300 µs/cm. Conductivity value is in the range of 106.4 to 49 µs/cm Permissible drinking water has conductivity range up to 300 µs/cm. All water samples are within the limit. (WHO 2009; WHO 1996)

4. ANALYSIS TOTAL HARDNESS

Table 4

Samples	Name of the Sample	Source	**Hardness (ppm)**
Sample 1	Cyriac K A Analil	Well Water	30
Sample 2	Luke Thomas, Puthiyakunnel	Well Water	20
Sample 3	Joseph P C, Puthiyakunnel	Well Water	30
Sample 4	James Manual, Kuzhiplackil	Well Water	15
Sample 5	P L Thomas, Puthiyakunnel	Well Water	40
Sample 6	Manghanal Kudineer Padhathi	Pond	30
Sample 7	Visitation Convent, Near Uzhavoor Church(1)	Well Water	65
Sample 8	St. Stephen's College, Uzhavoor	Cooler	30
Sample 9	Raghu, U K, Kulathinkal	Well Water	15
Sample 10	Visitation Convent, Near Uzhavoor Church(2)	Well Water	10

It is defined as the sum of calcium and magnesium concentration. It has no health effects except for imparting taste[7].the world health organization says that there does not appear to be any convincing evidence that water hardness causes adverse health effects in humans. Recommendations have been made for maximum and minimum levels of calcium (40-80 ppm) and magnesium levels (20-30 ppm) in drinking water. Total hardness of water describes the salt content present in it. The range of total hardness in all drinking water samples are in the range of below20 ppm. All water samples are not in the range. The values ranging from 10 to 65 ppm. (WHO 2009; WHO 1996)

5. ANALYSIS OF CHLORIDE

Table 5

samples	Name of the Sample	Source	**Chloride content (ppm)**
Sample 1	Cyriac K A Analil	Well Water	0.6
Sample 2	Luke Thomas, Puthiyakunnel	Well Water	0.6
Sample 3	Joseph P C, Puthiyakunnel	Well Water	0.8
Sample 4	James Manual, Kuzhiplackil	Well Water	0.8
Sample 5	P L Thomas, Puthiyakunnel	Well Water	0.12
Sample 6	Manghanal Kudineer Padhathi	Pond	0.4
Sample 7	Visitation Convent, Near Uzhavoor Church(1)	Well Water	0.6
Sample 8	St. Stephen's College, Uzhavoor	Cooler	0.6
Sample 9	Raghu, U K, Kulathinkal	Well Water	0.5
Sample 10	Visitation Convent, Near Uzhavoor Church(2)	Well Water	0.6

Chlorides are inorganic compound resulting from the combination of the chlorine gas with metal. some common chlorides are sodium chloride and magnesium chloride. Chlorine along as highly toxic, and is often used as a disinfectant. Small amount of chlorides are required for normal cell functions in plant and animal life. Chloride can corrode metals and affect the taste of food products. Permissible limit of chloride is 0 to 3.5 ppm. Chloride content ranginging from 0.12 to 0.8 ppm were detected in the drinking water samples. Permissible limit of chloride is 0 to 3.5 ppm. All the water samples are in the permissible limit. (WHO 2009; WHO 1996)

6. ANALYSIS OF IRON

Table 6

Samples	Name of the Sample	Source	**Iron content (ppm)**
Sample 1	Cyriac K A Analil	Well Water	0.3999
Sample 2	Luke Thomas, Puthiyakunnel	Well Water	1.1999
Sample 3	Joseph P C, Puthiyakunnel	Well Water	0.3999
Sample 4	James Manual, Kuzhiplackil	Well Water	0.3999
Sample 5	P L Thomas, Puthiyakunnel	Well Water	1.1999
Sample 6	Manghanal Kudineer Padhathi	Pond	0.3999
Sample 7	Visitation Convent, Near Uzhavoor Church(1)	Well Water	1.2399
Sample 8	St. Stephen's College, Uzhavoor	Cooler	0.3999
Sample 9	Raghu, U K, Kulathinkal	Well Water	0.3999
Sample 10	Visitation Convent, Near Uzhavoor Church(2)	Well Water	1.1999

It is an essential element in human nutrition. The minimum daily requirement of iron ranged from about 10 to 50 mg/day. Natural water contains variable amount of iron despite its universal distribution and abundance. Iron in the ground water is normally present in the ferrous or bivalent form. The ferrous form can persist in water void of dissolved oxygen and usually originates from ground water. The permissible level of iron in drinking water is less than 0.3ppmIron content present in the water samples are in between 0.3999ppm and 1.299ppm. Iron content present in water samples are not within the limit. (WHO 2009; WHO 1996)

7. ANALYSIS OF SULPHATE

Sulphates which are the forms of sulphur get into water supply when sulphite ores are oxidised. Sulphur containing minerals are found in most of the rocks and soils around the world. As ground water seeps through the earth, some of these compounds are dissolved by water. Rain water that leaches into the ground is also a good source of sulphur. Drinking water that contains high level of sulphate can cause diarrhea(Dezuane 1997). Analysis of water samples shows that sulphate content is absent. The permissible level of limit is as suggested as BIS/WHO i.e. 200 mg/L. (WHO 2009; WHO 1996)

CONCLUSION.

Drinking water samples collected from various areas. Physico-chemical parameters such as pH, hardness, iron content were not in the permissible limit. But conductivity, sulphate, chloride and dissolved oxygen were in the permissible limit.

Hence it was found that all the water samples were unfit for drinking purposes. The samples were not good for drinking purpose, may be due to the excess use of fertilisers in agricultural land area.

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