Experimental Study on Ground Water Quality Parameters at Various Location in Coimbatore

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Abstract - *Water one of the important natural resource which is colorless solution and chemical formula H_2O. The ground water in India is highly utilized for drinking and agricultural purpose. The quality of the water must be tested before usage. The basic water quality parameters such as pH, hardness, turbidity, total dissolved solids etc. are determined. These parameters are tested extensively with certain accuracy provided in the guidelines given by Bureau of Indian Standards for drinking water specification. After studying the various parameters remedial instructions also been provided if these values exceed the limits given by the guidelines.*

Key Words: **Alkalinity, Chemical characteristics of water, Hardness of water, Physical characteristics of water.**

1. INTRODUCTION

Water a very important substance that is needed for all living things within the Earth while not water it is impossible to live. About 71 % of the Earth's land surface is covered by water and the remaining will be land area that too it has some inhabitable places. Though the entire water present in the Earth is not potable one due to their different geographical locations, physical and chemical characteristics of water. The water which is said to be potable if it has met some certain criteria which is given by the Bureau of Indian Standards (BIS) in form of IS 10500: 2012 Indian Standard Drinking Water Specification (second revision). In India both Ground water and Surface water becomes the source of water supply for drinking, irrigation and other purposes. India receives nearly around 1170 mm rainfall every year. Rainfall is an important factor for replenishing the ground water table. Monsoon rainfall is a huge boon for India since it receives about 4000 billion m³ out of which 3000 billion m³ are gained from June to September month. However just 690 billion m³ of surface water can be used. Though it is a large

amount of rainfall compared to all countries around the globe, due to the lack of water management system and other reasons certain amount of water gets wasted up as surface runoff or get mixed up in oceans.
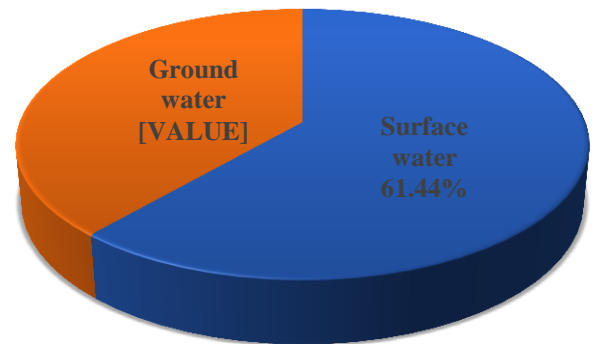

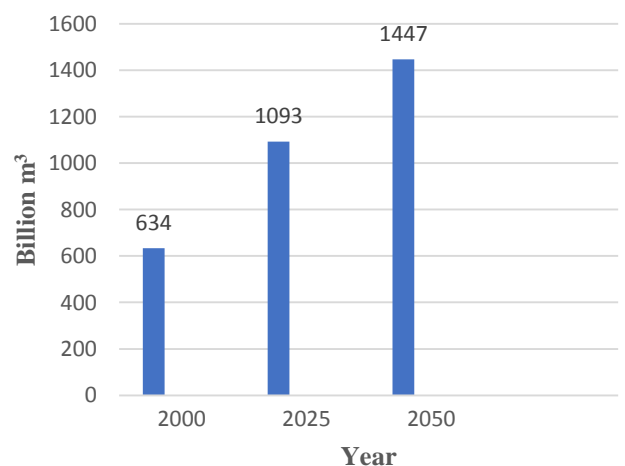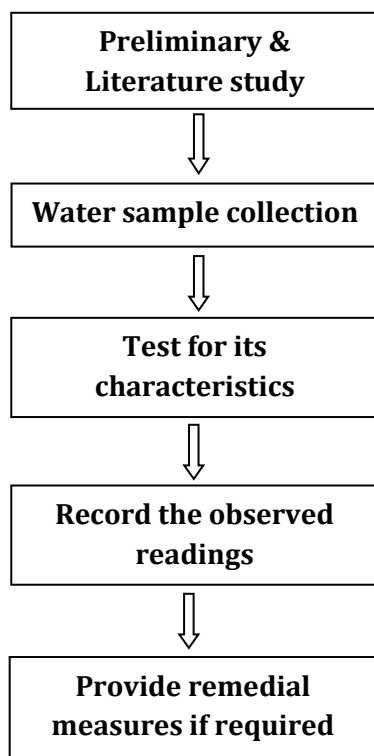**Fig. 1. Annual utilizable water resource in India**

Fig. 2. Future Ground Water demand in India

2. METHODOLOGY

Methodology, a systematic approach combined theoretical and practical method of analysis is to attain the aim and objective of the prescribed work in this journal. Methodology is provided in form of a flow chart in a sequential manner for progression of work in continuous manner.

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┌─────────────────────────┐
│   Preliminary &          │
│   Literature study       │
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┌─────────────────────────┐
│   Water sample collection│
└─────────────────────────┘
            ⇓
┌─────────────────────────┐
│   Test for its           │
│   characteristics        │
└─────────────────────────┘
            ⇓
┌─────────────────────────┐
│   Record the observed    │
│   readings               │
└─────────────────────────┘
            ⇓
┌─────────────────────────┐
│   Provide remedial       │
│   measures if required   │
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3. AIM & OBJECTIVE

1.   To assess the ground water quality parameters at various locations in Coimbatore surrounding areas.

2.   To ensure the physical and chemical parameters of water sample are well within the permissible limits.

3.   To determine the field of application for water based on the physical and chemical parameters of water sample obtained.

4.   To provide remedial measures if the water sample which exceeds the permissible limits given by Bureau of Indian Standards (BIS).

Methodology, a systematic approach combined theoretical and practical method of analysis is to attain the aim and objective of the prescribed work in this journal. Methodology is provided in form of a flow chart in a sequential manner for progression of work in continuous manner.

4. STUDY AREA

Coimbatore second largest city in Tamilnadu known as the Manchester of South India lies at a latitude of 11.0168^o N and longitude of 76.9558^o E. It is 411 meters (1349 feet) above the sea level. It has a geomorphology of an upland plateau region with hill ranges, hillocks and undulating plain. On the west and north direction, it is bounded by the Western Ghats mountain range and Nilgiri Biosphere Reserve respectively. On the southern side Noyyal river forms the boundary. The study areas were of four different parts in Coimbatore district. Four places have been chosen based on the factors such as industrial occupied area, rural area and hilly areas. The details and the reason for choosing the study area are given below.

S.no	Sample Location	Latitude	Latitude
1	Sundarapuram	10.950^o	76.996^o
2	Vellalore	10.9672^o	77.027^o
3	Kondampatti	10.829^o	77.054^o
4	Kadampari	10.251^o	77.002^o

Table I. Details of location of water sample

Sample Location	Reason
Sundarapuram	Small Industries Development Corporation (SIDCO) present in the area
Vellalore	Coimbatore city waste dumping yard located over the area
Kondampatti	Rural region
Kadampari	Hilly region

Table II. Reasons for choosing the location

Method of Analysis

For checking the water which is suitable for drinking and other purposes following physical and chemical characteristics must be determined as per the guidelines given by the Bureau of Indian Standards (BIS) IS 10500: 2012 Indian Standard Drinking Water Specification (second revision).

The physical and chemical characteristics to be tested are mentioned below.

I. Physical Characteristics

- pH Value
- Turbidity and
- Total Dissolved Solids (TDS)

II. Chemical Characteristics

- Ammonia
- Chloride
- Total Hardness
- Calcium
- Magnesium
- Total Alkalinity

Parameters	Method of Analysis
pH (Potential of Hydrogen)	pH meter
Turbidity	Turbidity meter
Total Dissolved Solids (TDS)	Gravimetric method
Ammonia	Titrimetric method
Chloride	Argentometric method
Total Hardness	EDTA Titrimetric method
Calcium	EDTA Titrimetric method
Magnesium	Gravimetric method
Total Alkalinity	Potentiometer method
Conductivity	Conductivity meter

Table III. Methods adopted for water sample analysis

5. EXPERIMENTAL OBSERVATIONS

a. pH value

pH value is the basic physical characteristics of water it must be something around 6.5 to 8.5 without any relaxation. High pH value results in alkalinity and low pH value results basic in nature. pH values are obtained using pH meter.

Sample Number	Average pH value
1	8.2
2	7.7
3	7.5
4	7.3

Table IV. Observed pH values

b. Turbidity

Turbidity is a measure of the colloidal impurities present in the water sample. Turbidity is measured as Nephelometric Turbidity Unit. The turbidity level must be around 1 NTU to 5 NTU.

Sample Number	Turbidity (NTU)
1	0.9
2	0.8
3	1
4	0.8

Table V. Observed Turbidity values

c. Total Dissolved Solids

Total dissolved solids is a combination of organic and inorganic matters in the water. Total Dissolved Solids mainly comprises of calcium, magnesium, potassium, sodium and bicarbonates. The Total Dissolved Solids values must be around 500 mg/l to 2000mg/l

Sample Number	Total Dissolved Solids (mg/l)
1	1115
2	1290
3	840
4	905

Table VI. Observed TDS values

d. Ammonia

Ammonia a pungent smelling gas their permissible limits in the water is 0.5 mg/l. High ammonia content damages internal organ system.

Sample Number	Ammonia (mg/l)
1	0.0055
2	0.0110
3	0.0055
4	0.0056

Table VII. Observed Ammonia value

e. Chloride

Chloride is also known as a disinfectant whose value should not exceeds 250 mg/l. High chlorine content results in respiratory problems.

Sample Number	Chlorine (mg/l)
1	265.87
2	508.70
3	620.38
4	219.79

Table VIII. Observed Chlorine values

f. Total hardness

Total hardness value is the summation of permanent (non-carbonate) and temporary

(carbonate) hardness. These values must not exceed 600mg/l.

Sample Number	Total hardness (mg/l)
1	670
2	757.5
3	875
4	510

Table IX. Observed Total hardness values

g. Calcium

Calcium content in water determines its hardness values indirectly. High intake of calcium content results in constipation, bloating. The calcium content should not exceed above 200 mg/l.

Sample Number	Calcium (mg/l)
1	670
2	757.5
3	875
4	510

Table X. Observed Calcium values

h. Magnesium

High intake of magnesium content results in diarrhea, abdominal cramping. These values must not exceed 100mg/l.

Sample Number	Magnesium (mg/l)
1	401.48
2	453.90
3	514.20
4	305.60

Table XI. Observed Magnesium values

i. Total alkalinity

Higher alkaline water produces scales over the surface and low alkaline water will be more corrosive i.e. acidic in nature. Total Alkalinity level must be within 600 mg/l

Sample Number	Total Alkalinity (mg/l)
1	670
2	757.5
3	875
4	510

Table XI. Observed Total Alkalinity values

7. RESULTS

The following results were obtained from the analysis of water samples at various locations in Coimbatore.

1) The pH values are well within the permissible limits and all samples are alkaline in nature.

2) The Turbidity values are very negligible in this studied area.

3) The Total Dissolved Solids (TDS) values are greater than the acceptable limit but lower than the permissible limit some precautions can be taken to avoid the value goes beyond the permissible limits.

4) The Ammonia content are well within the permissible limit thus they cause no effect on water.

5) The Chloride content in sample number 1, 2 and 3 exceeds the permissible value greatly, therefore remedial measures should be taken to reduce its values beyond the permissible limit.

6) The Total hardness values in sample number 1, 2 and 3 exceeds the permissible value which should be noted and remedial measures must be carried out.

7) The Calcium determination experiment reveals that all the water samples are having high calcium content this shows the hardness quality of the water.

8) The Magnesium content also exceeds the permissible limits.

9) The Alkalinity content is higher this has direct relationship with hardness, calcium and magnesium content.

8. CONCLUSIONS

The following conclusions are taken from the existing study.

1) The water samples collected are mainly alkaline and hard in nature due to the presence of calcium and magnesium salts.

2) As these water samples are ground water are contaminated and their hardness and alkaline levels are higher than the permissible limits, they are unfit for drinking and other domestic purposes.

3) These water samples must undergo some treatment process before making it for usage.

4) The samples which has high calcium and magnesium content can be treated with lime softening and reverse osmosis methods.

5) For high chlorine content Granular Activated Carbon (GAC) filtration can be adopted.

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