

The Temperature effect on Total Dissolved Solid (TDS) levels in various Water bodies

¹ Dr.Ch.Snehalatha Reddy, ² Dr.Narendar Kethireddy, ³ Dr.B.Mahipal Reddy, ⁴Naveen Moola

¹Associate Professor, Department of Physics, Government Degree College Wardhannapet, Kakatiya University, India.

²Assistant Professor, Department of Physics, Government Degree College Huzurabad, Satavahana University, India.

³Assistant Professor, Department of Chemistry, Government Degree College Huzurabad, Satavahana University, India.

⁴Assistant Professor, Department of Physics, Government Degree College Chanchalguda, Osmania University, India.

Email - ¹snehareddy1978@gmail.com, ²kethireddynaren@gmail.com, ³mahipalreddyboda@gmail.com,
⁴navinmoola@gmail.com

Abstract: The overall quality of Ground and surface water is important, primarily because it determines the suitability of water for drinking, irrigation, and domestic purposes. This study conducted in Huzurabad locality, Telangana state, India, involved the collection and examination of various water samples, including tap water, municipal water, mineral water, lake water, open well, and bore well water, with the aim of reducing water hardness and total dissolved solids (TDS). We studied how water quality could be enhanced by boiling water. The results suggest that heating is more successful at lower temperatures than extended boils, as none of the boiling tests fell below the initial value. Reducing these substances will reduce water hardness and enhance the flavor of tap water. These results will enable locals consume more tap water rather than bottled water with equal taste and health advantages at a lower price, as well as a reduction in plastic waste.

Key Words: Total Dissolved Solids (TDS), Water Hardness, Thermocouple, digital TDS meter.

1. INTRODUCTION:

Total dissolved solids (TDS) is a measure of the dissolved combined content of all inorganic and organic substances present in a liquid in Molecular, ionized, or micro-granular (colloidal sol) suspended form. TDS concentrations are often reported in parts per million (ppm). TDS present in water is one of the most important factors influencing the flavor of water. The most common chemical constituents are calcium, phosphates, nitrates, sodium, potassium, and chloride, which are found in nutrient runoff, general storm water runoff and runoff from snowy climates where road de-icing salts are applied. The amount of TDS is also supplies essential ions including sodium, potassium, magnesium and calcium [1-3]. Substances and ions including nitrate, lead, arsenic, and copper can pollute water supplies, which can result in a number of health issues linked to heavy metal toxicity and ingestion [4,5]. More exotic and harmful elements of TDS are pesticides arising from surface runoff. However, water with high TDS readings typically indicates human activity contamination, including nitrate-based fertilizer overuse, uncontrolled animal grazing and wildlife impacts, soil and agricultural runoff from irrigation, and environmentally harmful farming practices like slash and burn agriculture etc [6]. TDS readings will also be higher in water that comes from natural springs and streams that have high levels of organic salts in minerals and rocks and groundwater that comes from wells that contain high levels of salt [7]. Furthermore, most people do not tolerate or prefer water with high hardness or chlorine additives [8], as the taste changes tremendously and becomes unpreferably. Even so, TDS levels are not accounted for in mandatory water regulations, because the essential removal of harmful toxins and heavy metals is what matters the most in water safety. Some companies indicate risks in certain ions and alkali metals, showing how water hardness is mostly disregarded and is not as well treated as commercial water bottling companies [9,10]. The effect of temperature on water makes it significant. Higher temperatures typically result in faster chemical reactions. Higher temperature of water, especially groundwater, has a greater electrical conductivity because it may dissolve more minerals from the nearby rock [11]. In this work we have been reported variation of TDS values of various water bodies including surface water bodies underground water bodies and mineral water taken from local water plants and also included packed water bottles with

variation of temperature in India particularly in Telangana region at Huzurabad Municipal locality. The results of this study will provide options for residents and water treatment plants to find ways to maintain the general taste of the water. we find it is a better method to reduce TDS and treat water hardness. water standards can be updated by including TDS values as a mandatory measurement in day to day.

2. LITERATURE REVIEW:

Temperature effect on TDS of surface water bodies located in Nigeria have been reported by Emmanuel O. Thomas [12]. Wang.B.B.investigated how water quality could be improved by utilizing water boiling, activated carbon and sodium bicarbonate additives, as well as electrolysis methods. The results show that heating is effective at lower temperatures rather than long boils [13]. Shoukat et al also studied the Effects of Temperature on Total dissolved Solid in water in and around Sindh provinces in Pakistan[14]. Due to the importance of TDS values of water various researchers developed models to estimate TDS levels in water bodies across the world, recently Banadkooki, F. B et al.,[15] proposed a new model to estimate the TDS levels of ground water. Nall. Et al., discusses a study that deals three options for using high-total dissolved solids (TDS) local sewage treatment effluent. These options are designed to provide a non-potable resource [16]. Kaur, P studies reveals TDS of effluent water from industries[17]. Various researchers studied the TDS of different water bodies like domestic water, tropical river water and drinking water different geographical parts of India [18-20]. Dewangan. et al., reported that as water temperature increases, the solubility of certain substances can change, which can impact the TDS measurement. For example, some salts become less soluble at higher temperatures, which can result in a decrease in TDS. However, other substances may become more soluble, which could increase the TDS measurement. It is important to take into account the effect of temperature when measuring TDS in water to ensure accurate results [21]. Mueller J. S et al., reported effects of temperature of total dissolved solids and total suspended solids on survival and development rate of larval Arkansas River Shiner and this data suggest it may be associated with lower survival rates [22]. Thomas, E. O. in 2021 studied the measurement and analysis of temperature gradients along a river profile as well as its effects on the properties of the river provide an insight to the quantitative estimates of rates of interaction through the use of statistics and a possible inferred direction of groundwater movement through sediments across the surface-water and groundwater interface [23]. Naturally, mineral water has no smell or taste. A change in the TDS level changes the texture and taste making the water unfit for consumption. we should measure the TDS level of drinking water to know the Taste [high TDS level can make the water salty and/or bitter]. Health Concerns [water with high TDS level will not have a drastic impact on your health but the high level of lead or copper can make you fall sick]. Drinking water generally has a TDS below 500 ppm.

3. OBJECTIVES:

Water samples were gathered from eight distinct water bodies located within the chosen area to analyze and compare the TDS levels of the water before and after heating in order to determine whether heating contaminates or purifies the water from various water bodies. This work is proposed to find out the alternative method to reduce TDS values of different water bodies from the selected region and also knows the effect of temperature on different water bodies in different climate conditions and suggest optimal temperature at which TDS values are suitable for drinking water.

4. RESEARCH METHODOLOGY:

To carry out this study water samples five litres each were collected from various water bodies which includes mineral water plants, packed water bottles, surface and ground water bodies through field visits in and around huzurabad municipal area of karimnagar district in Telangana state. water samples were taken before each experimental set and measured for TDS at different temperatures, and all equipment were cleaned thoroughly with distilled water and dried before and after each measurement. Equipment includes a 50 L, 5L containers, 1 L beakers for water, a graduated cylinder, a stir rod, a measuring spoon, tweezers, a scale, purified water, and a standard TDS meter, heater, thermos couple thermometer with digital display, stop clock were used, operated by measuring the total amount of solids in the water. The instrument is also calibrated prior to testing. All results were recorded and compiled for tabulation and analysis.

5. RESULTS AND DISCUSSION:

This study TDS values of water as a function of temperature was carried out on various water bodies at particular chosen place gave mixed results, those are for water bodies having low TDS values like rain water, bottled water and mineral water etc. almost independent on temperature this may be the chemical composition of low TDS water, further purification is very longer and may not possible for further purification. the water bodies whose TDS are less than

250ppm the TDS values slight decreases as increasing temperature and some water bodies whose TDS values are more than 300ppm it is noticed that the TDS values slight increasing as temperature increases this may be due to evaporation of pure water which result remaining water posses with slight more values .

Table 5.1: TDS values of Rainwater at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	17	17	17
2	35	17	17	17
3	45	17	17	17
4	55	17	16	16.5
5	65	16	17	16.5
6	75	16	16	16
7	85	16	16	16
8	95	16	16	16

Table 5.2: TDS values of Bottled water at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	38	38	38
2	35	38	39	38.5
3	45	38	38	38
4	55	37	37	37
5	65	38	39	38.5
6	75	39	39	39
7	85	37	39	38
8	95	38	37	37.5

Table 5.3: TDS values of Muncipal water at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	243	243	243
2	35	243	245	244
3	45	244	246	245
4	55	242	244	243
5	65	246	244	245
6	75	243	241	242
7	85	240	240	240
8	95	240	238	239

Table 5.4: TDS values of Mineral water at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	63	63	63
2	35	63	64	63.5
3	45	64	64	64

4	55	63	63	63
5	65	64	64	64
6	75	63	63	63
7	85	67	63	65
8	95	65	69	67

Table 5.5: TDS values of Borewell water at different Temperatures

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	308	310	309
2	35	310	308	309
3	45	310	312	311
4	55	310	312	311
5	65	312	314	313
6	75	314	312	313
7	85	316	316	316
8	95	316	314	315

Table5.6: TDS values of Pond water at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	297	297	297
2	35	297	303	300
3	45	300	303	301.5
4	55	302	302	302
5	65	304	304	304
6	75	304	306	305
7	85	306	308	307
8	95	307	309	306

Table 5.7: TDS values of Hand pump water can at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	325	327	326
2	35	326	328	327
3	45	327	333	330
4	55	329	331	330
5	65	330	333	331.5

6	75	331.5	333	332.25
7	85	332.25	332.25	332.25
8	95	332.25	332.25	332.25

Table 5.8: TDS values of Open well water can at different Temperatures.

Sl.No	Temperature	TDS values on Heating	TDS values on Cooling	Average
1	25	586	587	586.5
2	35	586.5	587.5	587
3	45	587	589	588
4	55	589	591	590
5	65	590	588	589
6	75	589	596	592.5
7	85	596	598	597
8	95	597	599	598

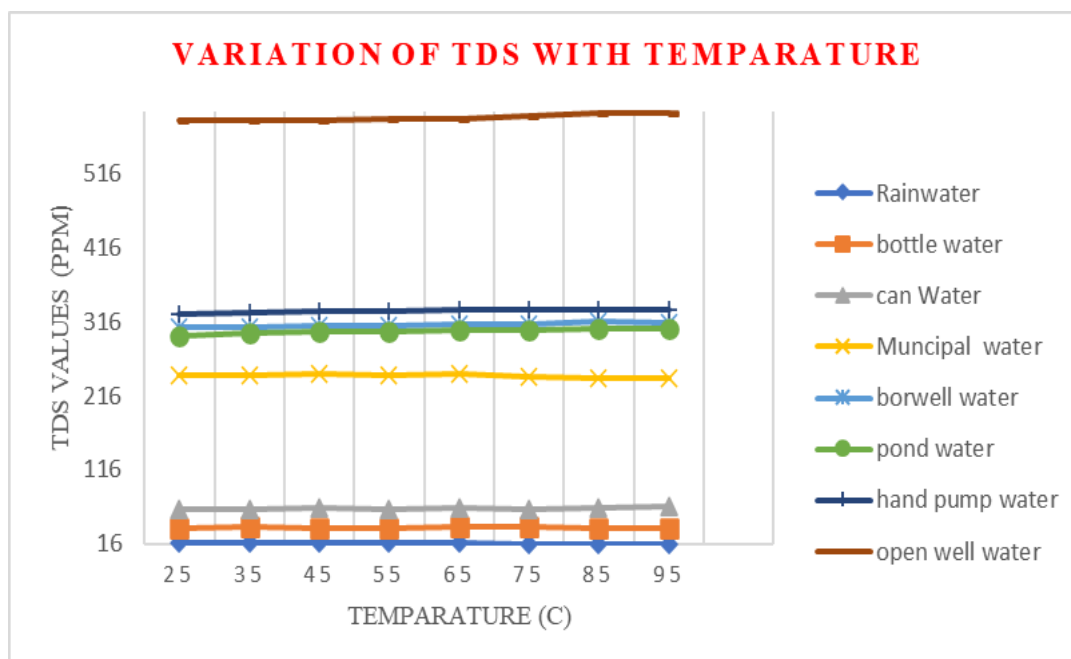
Table 5.9: TDS values on Heating and Cooling of all Water bodies.

Sl. No	Water Sample	TDS values on Heating	TDS values on Cooling
1.	Municipal water	243	239
2.	Hand pump water	325	332.25
3.	Bore well water	308	315
4.	Mineral water (Can)	63	67
5.	Rain water	17	16.5
6.	Pond water	297	306
7.	Bottled water (Bisleri, Kinley)	38	37.5
8.	Open well water	586	598

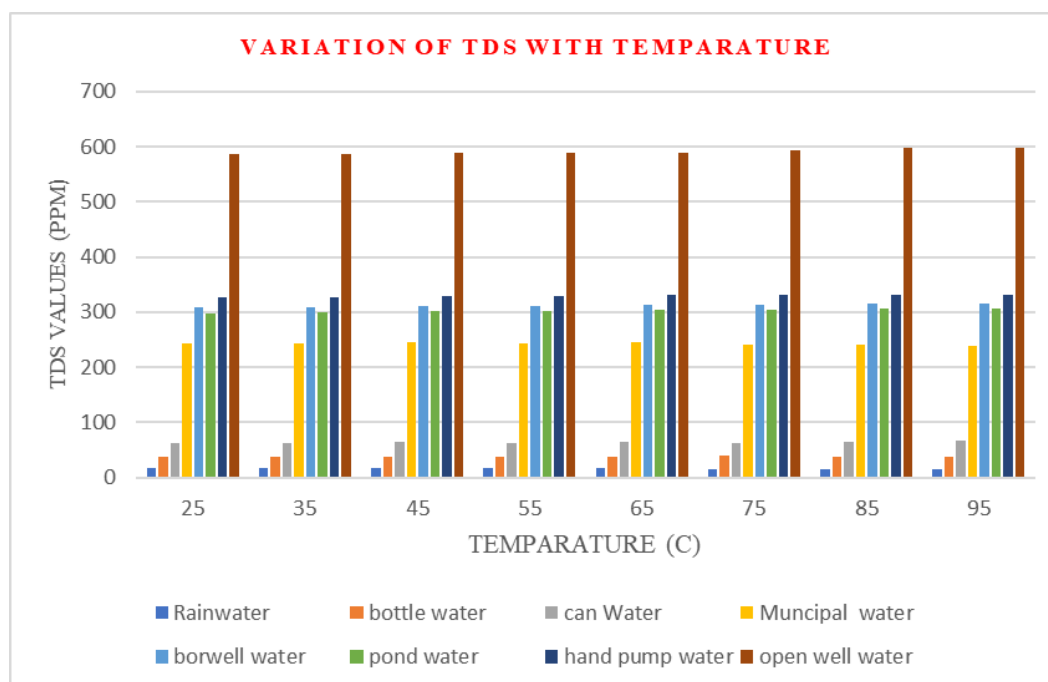
Table 5.10: TDS values of all water bodies at different Temperatures.

Tempa rature	Rain Water	Bottle water	Can Water	Mun- cipal water	Bore well water	Pond water	Hand pump water	Well water
25	17	38	63	243	309	297	326	586.5
35	17	38.5	63.5	244	309	300	327	587
45	17	38	64	245	311	301.5	330	588
55	16.5	37	63	243	311	302	330	590
65	16.5	38.5	64	245	313	304	331.5	589
75	16	39	63	242	313	305	332.25	592.5
85	16	38	65	240	316	307	332.25	597
95	16	37.5	67	239	315	306	332.25	598

Graph 5.11: Graph showing the TDS values of all Water bodies at different Temperatures.



Graph 5.12: Graph showing the TDS values of all Water bodies at different Temperatures.



6. CONCLUSION :

It is observed that effect of heating on water bodies shows slight effect on the TDS levels of the water. It is also found that there is almost no effect of temperature on TDS levels of mineral-water and rain water. The effect of temperature is considerable in case of open well water and hand pump water. This study suggests that it is the cheapest way for rural habitations to reduce TDS levels of water.

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