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A study on variation in Total Dissolved Solids (TDS) of Groundwater of Arni Town, District-Yavatmal (MS) India.

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Abstract- Water is life. Groundwater is considered as purest and majorly available source of water. It is used to fulfill 50% urban and 80% ruler water demand in India besides irrigation. Total Dissolved Solids, also known as TDS, are inorganic compounds that are found in water such as salts, heavy metals and some traces of organic compounds that are dissolve in water. Total dissolved solids (TDS) are a measure of the combined total of organic and inorganic substances contained in a liquid. This includes anything present in water other than the pure H_20 molecules. These solids are primarily minerals, salts, and organic matter that can be a general indicator of water quality. Arni is a town (Taluka) with (Administrative Division) & Tahsil in Yavatmal district of Maharashtra State in India. As groundwater is prominently used to fulfill domestic demands hence quality of groundwater must be checked time to time in order to supply safe drinking water. In this paper, one attempt has been made to study of variation in total dissolved solids of water of Arni Town, District-Yavatmal (MS) India over a period of 1 year. TDS range of groundwater in Arni city is found to be acceptable and fair.

Keyword- water, total dissolved solids, groundwater, variation in total dissolved solids of water of Arni Town, District-Yavatmal (MS) India.

Introduction-

Water is colourless, odourless and transparent substance. Water is the important, precious and indispensable natural resources of the earth, covering approximately three-forth of the earth surface. Water is life. Water is an essential element of human being. Approximately 60-65% of human body is composed of water (1). A man can survive for 20 days without food but cannot survive even for 20 hours without water. The earth has a reserve of 75% water of which 97% is of saline water and only 3% is fresh water. Out of the 3%, a little over 2% is tied up in ice caps and glaciers and along atmospheric and soil moisture, is not accessible and only 0.003% is readily available to us in the form of groundwater and surface water. Surface water is mostly polluted so it becomes unfit for use. Groundwater has excellent natural quality, usually free from pathogens, color and turbidity and can be consume directly without treatment. It does not require large storage, treatment and distribution system, can be frequently developed incrementally at point near water demand. Generally, groundwater is mostly chemically and microbiologically non-polluted so it is safe for drinking and cooking in addition to agriculture or industrial use. Groundwater is used to irrigate around two fifth of India's total agricultural land. Groundwater is considered as purest and majorly available source of water. It is used to fulfill 50% urban and 80% ruler water demand in India besides irrigation (2).

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Total Dissolved Solids, also known as TDS, are inorganic compounds that are found in water such as salts, heavy metals and some traces of organic compounds that are dissolve in water. Excluding the organic matters that are sometimes naturally present in water and the environment, some of these compounds or substances can be essential in life. But, it can be harmful when taken more than the desired amount needed by the body. The total dissolved solids present in water are one of the leading causes of turbidity and sediments in drinking water. When left unfiltered, total dissolved solids can be the cause of various diseases. Total dissolved solids (TDS) are a measure of the combined total of organic and inorganic substances contained in a liquid. This includes anything present in water other than the pure H_20 molecules. These solids are primarily minerals, salts, and organic matter that can be a general indicator of water quality.

Arni is a town (Taluka) with (Administrative Division) & Tahsil in Yavatmal district of Maharashtra State in India. It is situated on the banks of the Arunavati River. It Connected with National Highway-361. Nearest Railway Station is a Dhamangaon which is located 90 km approximately & Nearest Airport is a Dr. Babasaheb Ambedkar International Airport, Nagpur is around 187 km from Arni. Location of Arni in Maharashtra, India Coordinates: 20°07′40″N 77°55′39″E. In Arni town, main source of drinking water is groundwater. As groundwater is prominently used to fulfill domestic demands hence quality of groundwater must be checked time to time in order to supply safe drinking water (3).

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Fig. - Yavatmal distric map

In this paper, one attempt has been made to study of variation in total dissolved solids of water of Arni Town, District-Yavatmal (MS) India over a period of 1 year.

Methodology – Water samples were collected from different location of Arni town during investigation period of March 2019 to February 2020. Sample is collected in polyethylene bottle. Within 1 hour, its temperature, pH, total hardness is measured. For measurement of hardness of the sample, used Tds meter whose details are as follows:

Brand	: HM
Model Number	: AP-1
Type	: Digital
Range	: 0-5000 ppm
Temperature Range	: -5+50 degree C degree C
Accuracy	: +-2%
Battery Life	: 1000
Power Features	
Power Requirement	: 3v

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Dimensions
Width : 3 cm
Height : 15 cm
Weight : 0.1 kg
Manufacturer : HM DIGITAL PVT LTD SOUTH KOREA

Importer : HM DIGITAL INDIA PVT LTD DELHI

Source-www.Flipkart.com

For the study purpose, we had selected six different groundwater sources of Arni. Water samples are collected every week (four in a month) and Tds is measured with the help of digital Tds meter. Following table shows details of the water sample source:

Sr. No.	Sample	Area of sample	Groundwater source	Depth
1.	Sample 1	Madhav Nagar	Borewell	125 ft
2.	Sample 2	Old Tahsil Area	Borewell	100 ft
3.	Sample 3	Datta Nagar	Borewell	125 ft
4.	Sample 4	Mathura Nagar	Borewell	110 ft
5.	Sample 5	Sambhaji Nagar	Borewell	150 ft
6.	Sample 6	Swami Samarth Nagar	Borewell	200 ft

Sample 1 Sr. No.	Month	Week	Total TDS (in ppm)
1	March 2019	I	565
2		II	554
3		III	550
4		IV	542
5	April 2019	I	595

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6		II	548
7		III	568
8		IV	570
9	May 2019	I	555
10		II	574
11		III	594
12		IV	620
13	June 2019	I	634
14		II	605
15		III	657
16		IV	642
17	July 2019	I	580
18		II	650
19		III	635
20		IV	675
21	August 2019	I	650
22		II	590
23		III	625
24		IV	605
25	September 2019	I	535
26		II	543
27		III	551
28		IV	540
29	October 2019	I	528
30		II	553
31		III	505
32		IV	535
33	November 2019	I	528
34		II	516
35		III	550

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36		IV	497
37	December 2019	I	548
38		II	483
39		III	495
40		IV	480
41	January 2020	I	460
42		II	402
43		III	408
44		IV	435
45	February 2020	I	416
46		II	464
47		III	420
48		IV	407

Sample 2 Sr. No.	**Month**	**Week**	**Total TDS (in ppm)**
1	March 2019	I	833
2		II	830
3		III	838
4		IV	825
5	April 2019	I	840
6		II	855
7		III	890
8		IV	830
9	May 2019	I	790
10		II	850
11		III	824

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12		IV	830
13	June 2019	I	750
14		II	689
15		III	720
16		IV	750
17	July 2019	I	795
18		II	803
19		III	824
20		IV	843
21	August 2019	I	860
22		II	799
23		III	850
24		IV	867
25	September 2019	I	830
26		II	840
27		III	831
28		IV	835
29	October 2019	I	750
30		II	655
31		III	700
32		IV	630
33	November 2019	I	651
34		II	648
35		III	710
36		IV	670
37	December 2019	I	601
38		II	635
39		III	603
40		IV	600
41	January	I	602

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42	2020	II	600
43		III	590
44		IV	598
45	February 2020	I	605
46		II	600
47		III	598
48		IV	600

Sample 3 Sr. No.	**Month**	**Week**	**Total TDS (in ppm)**
1	March 2019	I	681
2		II	650
3		III	623
4		IV	640
5	April 2019	I	609
6		II	670
7		III	658
8		IV	632
9	May 2019	I	690
10		II	670
11		III	661
12		IV	640
13	June 2019	I	620
14		II	627
15		III	590
16		IV	628
17	July 2019	I	580
18		II	600

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19		III	587
20		IV	540
21	August 2019	I	576
22		II	580
23		III	550
24		IV	530
25	September 2019	I	526
26		II	529
27		III	520
28		IV	500
29	October 2019	I	495
30		II	450
31		III	470
32		IV	440
33	November 2019	I	510
34		II	490
35		III	526
36		IV	484
37	December 2019	I	467
38		II	451
39		III	490
40		IV	504
41	January 2020	I	450
42		II	470
43		III	480
44		IV	425
45	February 2020	I	444
46		II	457
47		III	450
48		IV	431

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Sample 4 Sr. No.	Month	Week	Total TDS (in ppm)
1	March 2019	I	503
2		II	502
3		III	510
4		IV	507
5	April 2019	I	500
6		II	520
7		III	536
8		IV	540
9	May 2019	I	580
10		II	594
11		III	554
12		IV	530
13	June 2019	I	520
14		II	498
15		III	505
16		IV	480
17	July 2019	I	536
18		II	507
19		III	560
20		IV	497
21	August 2019	I	484
22		II	479
23		III	462
24		IV	457
25	September	I	502

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26	2019	II	543
27		III	570
28		IV	556
29	October 2019	I	535
30		II	525
31		III	547
32		IV	516
33	November 2019	I	504
34		II	546
35		III	537
36		IV	553
37	December 2019	I	525
38		II	500
39		III	518
40		IV	507
41	January 2020	I	500
42		II	498
43		III	476
44		IV	465
45	February 2020	I	453
46		II	446
47		III	430
48		IV	436

Sample 5 Sr. No.	**Month**	**Week**	**Total TDS (in ppm)**
1	March 2019	I	484
2		II	506

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3		III	534
4		IV	498
5	April 2019	I	546
6		II	531
7		III	580
8		IV	549
9	May 2019	I	520
10		II	555
11		III	580
12		IV	594
13	June 2019	I	603
14		II	598
15		III	616
16		IV	605
17	July 2019	I	664
18		II	670
19		III	649
20		IV	637
21	August 2019	I	624
22		II	657
23		III	692
24		IV	702
25	September 2019	I	664
26		II	647
27		III	600
28		IV	620
29	October 2019	I	634
30		II	664
31		III	619
32		IV	581

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33	November 2019	I	558
34		II	541
35		III	536
36		IV	520
37	December 2019	I	538
38		II	517
39		III	643
40		IV	512
41	January 2020	I	481
42		II	375
43		III	490
44		IV	355
45	February 2020	I	361
46		II	313
47		III	345
48		IV	325

Sample 6 Sr. No.	**Month**	**Week**	**Total TDS (in ppm)**
1	March 2019	I	363
2		II	403
3		III	371
4		IV	400
5	April 2019	I	416
6		II	405
7		III	380
8		IV	402
9	May 2019	I	394

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10		II	360
11		III	390
12		IV	346
13	June 2019	I	406
14		II	393
15		III	434
16		IV	406
17	July 2019	I	394
18		II	349
19		III	384
20		IV	396
21	August 2019	I	410
22		II	436
23		III	378
24		IV	384
25	September 2019	I	419
26		II	379
27		III	354
28		IV	369
29	October 2019	I	399
30		II	362
31		III	380
32		IV	390
33	November 2019	I	409
34		II	401
35		III	378
36		IV	390
37	December 2019	I	353
38		II	364
39		III	327

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40		IV	320
41	January 2020	I	349
42		II	377
43		III	396
44		IV	366
45	February 2020	I	356
46		II	304
47		III	340
48		IV	303

According to World Health Organization (WHO) and Bureau of Indian Standard some parameter are as follows:

Sr. No.	**Water quality parameter**	**Bureau of Indian Standard (IS-10500:1994)**	**WHO International Standard (1983)**
1.	pH	6.5-8.5	7.0-8.5
2.	Total Dissolved solids (ppm)	500-2000	500
3.	Total hardness (ppm)	300-600	100

TDS- The mineral constituents dissolved in water constitute total dissolved solids. The concentration of dissolved solids in natural water is usually <500 ppm while water with more than 500 ppm is undesirable for drinking and industrial use. It is reported that TDS value of 500 ppm is desirable limit and 2000 ppm is the maximum permissible limit and that water containing more than 500 ppm of TDS causes gastrointestinal irrigation (4). High value of TDS influences taste, hardness and corrosive property of water (5, 6). Drinking water should contain sufficient minerals to keep you healthy and should not contain excess minerals that become overloaded in the body. In this article, we will provide details about the acceptable minimum and maximum TDS (Total dissolved solids) Limits for drinking water.

Following table summarize portability of TDS amount of water:

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TDS Level (ppm)	Palatability of Water
Less than 300	Excellent
300-500	Good
600-900	Fair
900-1200	Poor
Above 1200-2000	Unacceptable

Variation in hardness and minimum, maximum hardness of sample are summarized in the following table:

Sr. No.	Sample	Maximum TDS (in ppm)	Minimum TDS (in ppm)	TDS Range (in ppm)	Variation in TDS (Max.-Min.)	Average TDS variation
1.	Sample 1	675	402	675-402	273	
2.	Sample 2	**890**	590	890-590	300	
3.	Sample 3	690	425	690-425	265	**239 ppm**
4.	Sample 4	594	430	594-430	164	
5.	Sample 5	702	313	702-313	389	
6.	Sample 6	346	**303**	346-303	43	

Conclusion- From the variation of hardness table it is observed that the minimum TDS of groundwater Arni city is 303 ppm and maximum is 890 ppm. Out of six samples, five samples have TDS more than 500 ppm and below 1000. These samples have acceptable value according to Bureau of Indian Standard (IS-10500:1994) which has range 500-2000 ppm. One sample has value below 500 ppm which has acceptable value according to WHO International Standard (1983). The average TDS of groundwater variation in Arni city throughout period of a year is found to be 239 ppm. TDS range of groundwater in Arni city is found to be acceptable and fair.

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