CHAPTER – IV

RESULTS AND DISCUSSION

CONTENTS

4.1 PHYSICOCHEMICAL PARAMETERS OF ANKLESHWAR TALUKA

Ground water analysis of water samples collected from 15 stations of ANKLESHWAR TALUKA of BHARUCH DISTRICT such as SARTHAN, TELVA, PILUDRA, UMARWADA, JETALI, PIPROD, AVADAR, PARDI MOKHA, SANGPOR, KOSAMADI, PANOLI, KHAROD, MOTALI, ANDALA AND UTIYADARA.

All parameters are measure in terms of pH, Fluoride, Nitrate, Hardness, Akalinity, Phosphate, Ca^{2+}, Mg^{2+}, Sulphate ion, COD, BOD. TDS and Total dissolved oxygen etc. All parameters are measured in winter, summer and monsoon seasons.

Table 4.1: Physicochemical Parameter of Ground Water from Ankleshwar Taluka of Bharuch District, Gujarat (Winter)

Physicochemical parameters															
Sr. No.	**Station Name**	**TDS mg/ L**	**pH**	**Total Hardness mg/L**	**Ca^{2+} mg/ L**	**Mg^{2+} mg/ L**	**Cl^{1-} mg/ L**	**SO_4^{2-} mg/ L**	**NO_3^- mg/L**	**F^{1-} mg/ ssL**	**ALKALINITY mg/L**	**TURBIDITY NTU**	**COD mg/ L**	**BOD mg/ L**	**DO mg/L**
1	SARTHAN	486	6.91	378	38	33	75	40	15.80	0.1	422	3.4	15	8	0.58
2	TELVA	504	6.99	380	36	32	80	41	15.36	0.4	410	3.8	16	7	0.89
3	PILUDRA	448	7.03	360	35	33	88	45	10.22	0.3	316	2.8	13	8	0.85
4	UMARWADA	594	7.00	365	34	32	108	38	13.14	0.6	368	2.9	12	6	0.86
5	JETALI	744	6.82	390	38	31	85	36	16.20	0.5	365	3.8	11	9	0.75
6	PIPROD	628	6.85	385	39	31	110	34	16.18	0.2	420	2.5	14	8	0.90
7	AVADAR	510	6.92	375	37	32	95	45	19.10	0.3	432	2.4	13	8	10.2
9	SANGPOR	535	7.01	380	38	31	80	52	18.21	0.3	318	3.9	15	7	0.75

10	KOSAMADI	485	6.83	375	35	46	72	35	15.82	0.2	314	3.3	11	6	0.73
11	PANOLI	636	7.60	257	60	23	98	40	8.52	0.2	310	3.8	14	2	0.32
12	KHAROD	742	7.70	265	39	54	120	38	8.11	1.2	435	2.6	15	3	0.75
13	MOTALI	545	7.10	300	38	32	88	42	10.12	0.3	321	3.8	15	4	0.65
14	ANDALA	515	7.42	302	38	38	38	35	12.12	0.4	290	1.4	10	7	0.89
15	UTIYADARA	580	7.10	280	41	40	95	42	17.35	1.1	293	2.6	11	4	0.60

Table 4.2: Physicochemical Parameter of Ground Water from Ankleshwar Taluka of Bharuch District, Gujarat (Summer)

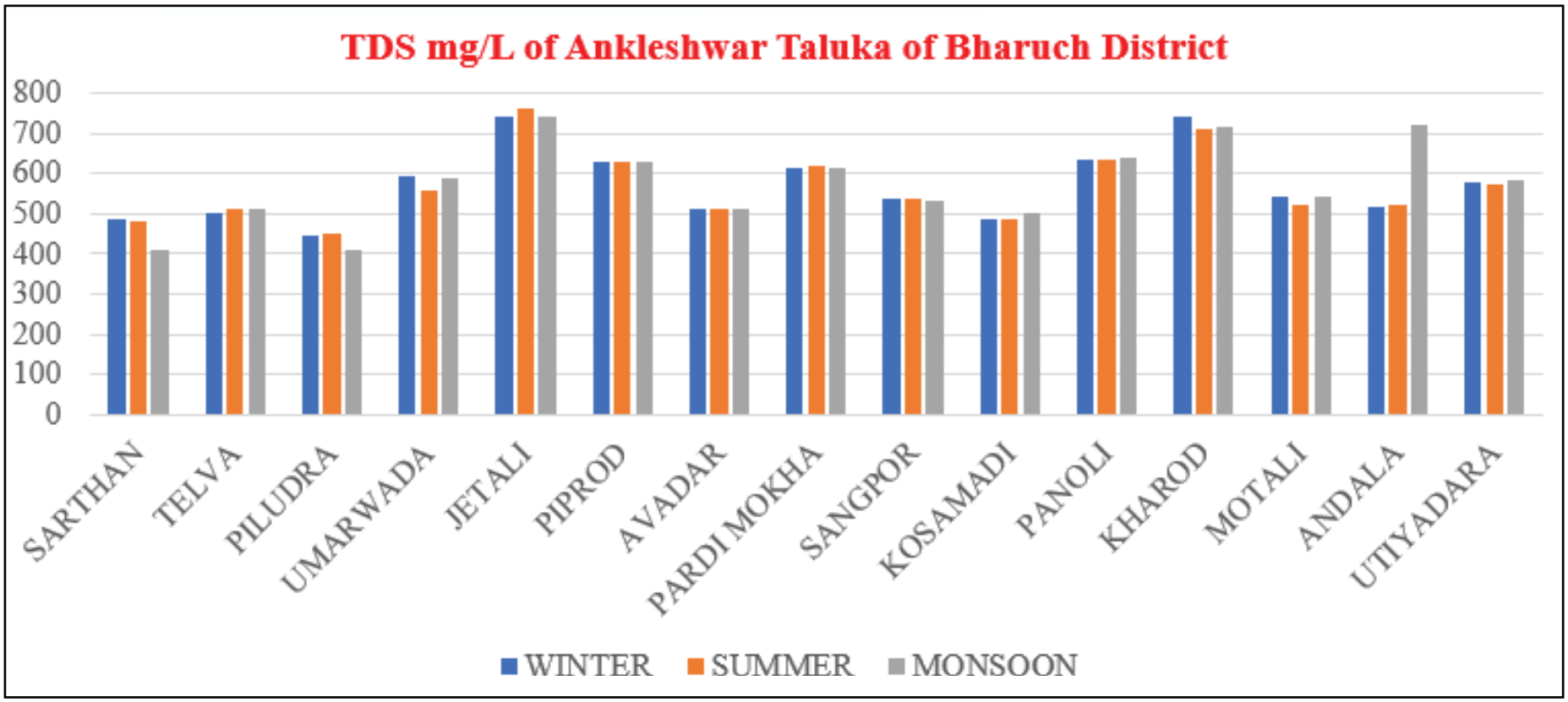
Physicochemical parameters															
Sr. No.	**Station Name**	**TDSmg /L**	**pH**	**Total Hardness mg/L**	**Ca^{2+} mg/L**	**Mg^{2+} mg/L**	**Cl^{1-} mg/L**	**SO_4^{2-} mg/L**	**NO_3^{1-} mg/L**	**F^{1-} mg/L**	**ALKALINITY mg/L**	**TURBIDITY NTU**	**COD mg/L**	**BOD mg/L**	**DO mg/L**
1	SARTHAN	481	6.82	380	39	32	71	42	14.80	0.2	430	3.5	14	9	0.60
2	TELVA	510	6.72	385	38	34	81	42	13.36	0.3	410	3.8	19	8	0.81
3	PILUDRA	452	7.12	365	30	30	82	46	12.22	0.4	320	2.7	14	7	0.82
4	UMARWADA	560	7.10	360	29	35	105	39	13.15	0.7	370	2.6	13	5	0.84
5	JETALI	760	6.56	392	40	30	86	38	16.22	0.6	360	3.9	12	8	0.73
6	PIPROD	630	6.90	380	41	30	112	39	16.19	0.3	422	2.4	14	7	8.2
7	AVADAR	512	7.15	360	42	35	96	46	19.10	0.4	430	2.3	12	7	0.92
9	SANGPOR	540	6.35	372	35	35	82	50	19.21	0.4	314	3.7	18	8	0.73

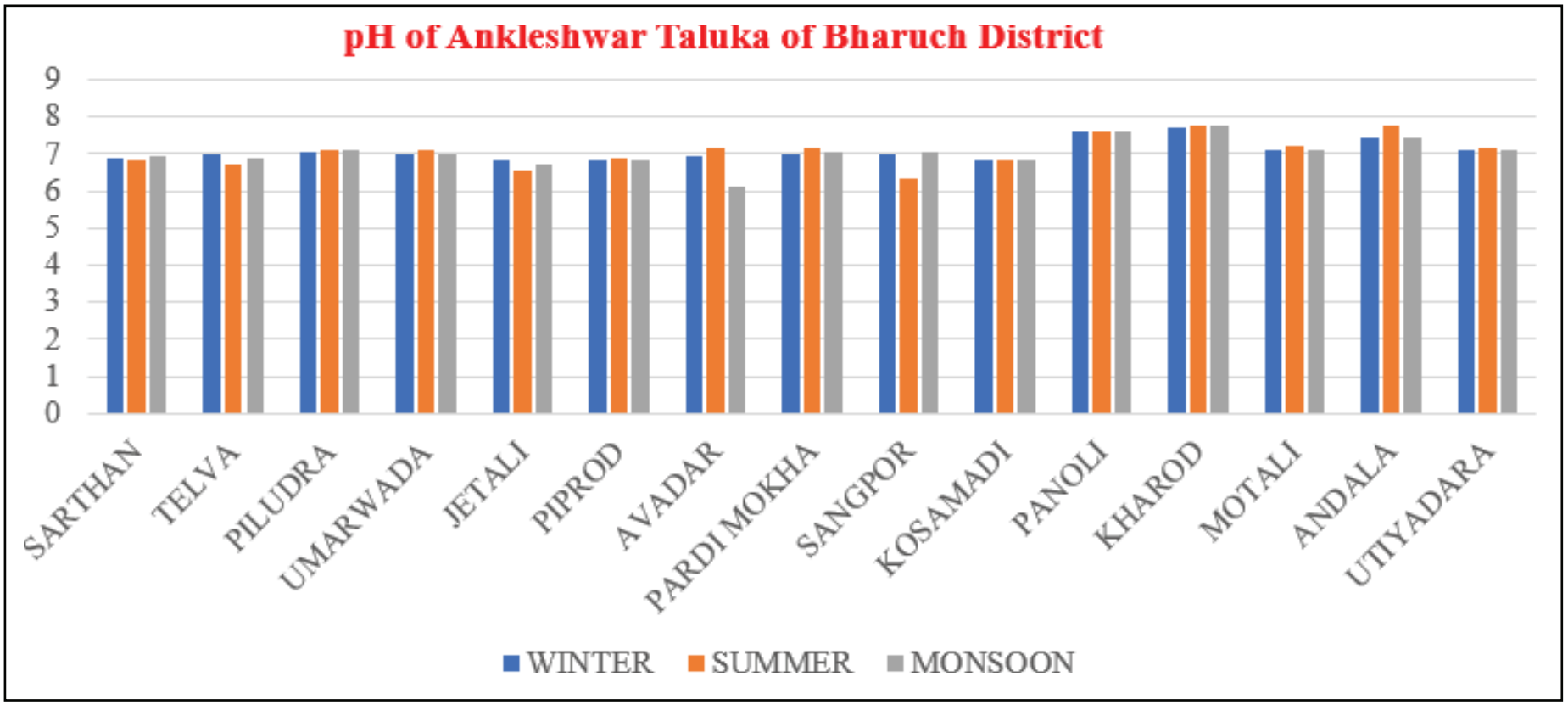
10	KOSAMADI	487	6.81	378	36	48	75	36	15.81	0.3	315	3.2	10	8	0.74
11	PANOLI	635	7.61	258	62	25	95	42	8.50	0.1	312	3.6	12	3	0.38
12	KHAROD	712	7.75	268	37	58	122	39	8.10	1.1	433	2.7	14	4	0.70
13	MOTALI	520	7.20	310	36	32	82	41	10.14	0.5	329	3.8	17	4	0.60
14	ANDALA	520	7.78	319	37	53	40	34	12.10	0.2	298	1.2	11	5	0.84
15	UTIYADARA	575	7.14	290	40	42	92	40	17.30	1.2	294	2.7	12	3	0.62

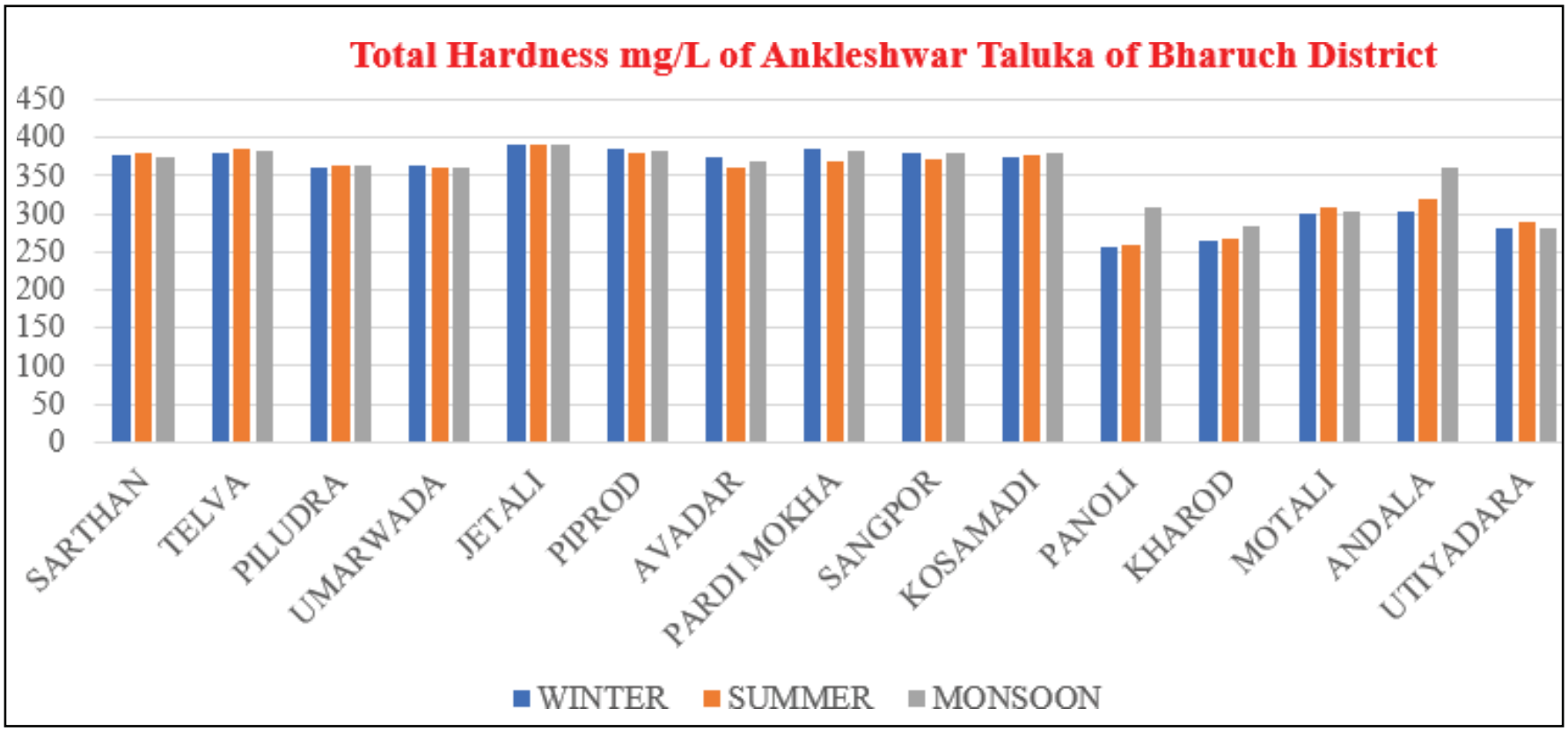
Table 4.3: Physicochemical Parameter of Ground Water from Ankleshwar Taluka of Bharuch District, Gujarat (Monsoon)

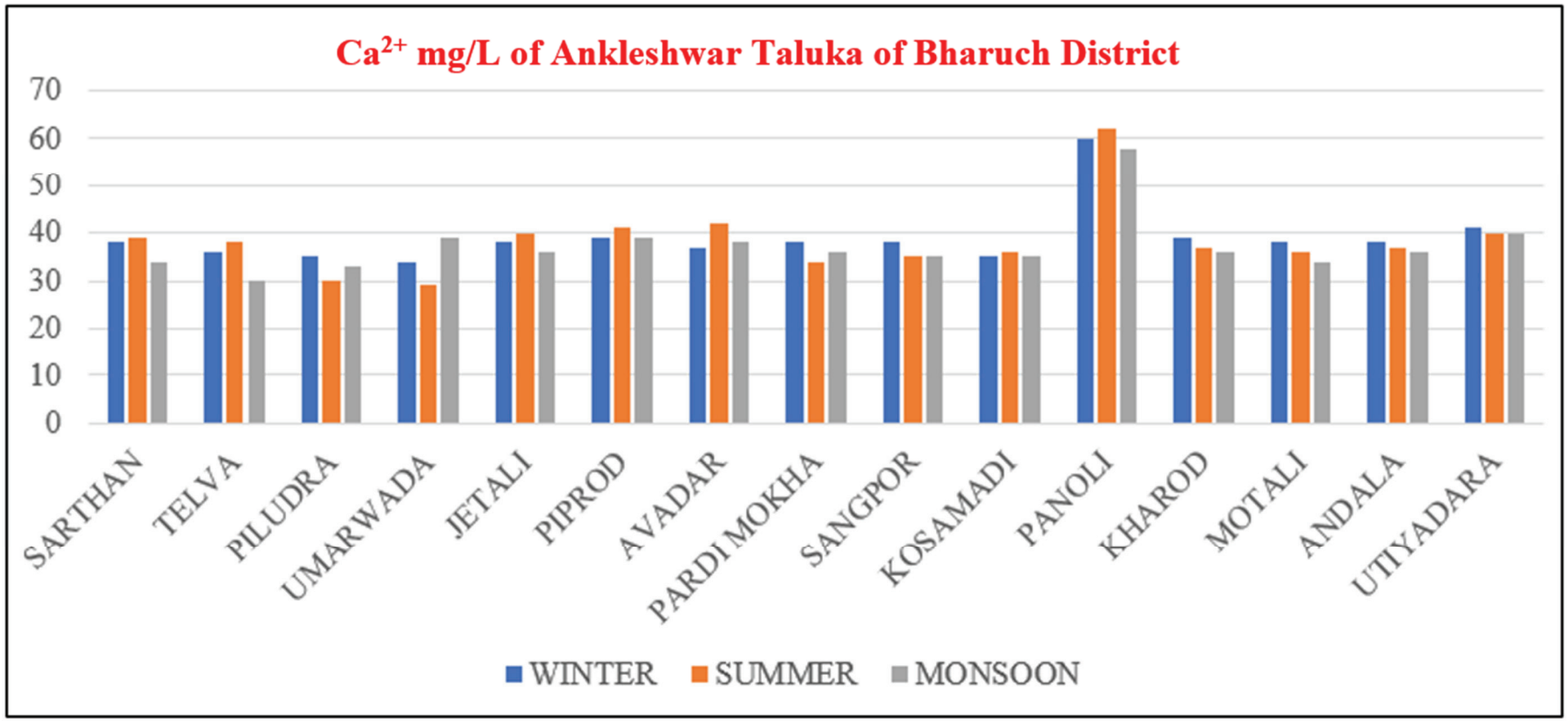
Physicochemical parameters															
Sr. No.	**Station Name**	**TDS mg/L**	**pH**	**Total Hardness mg/L**	**Ca^{2+} mg/L**	**Mg^{2+} mg/L**	**Cl^{1-} mg/L**	**SO_4^{2-} mg/L**	**NO_3^{1-} mg/L**	**F^{1-} mg/L**	**ALKALINITY mg/L**	**TURBIDITY NTU**	**COD mg/L**	**BOD mg/L**	**DO mg/L**
1	SARTHAN	408	6.92	375	34	31	74	42	15.82	0.1	420	3.6	12	9	0.60
2	TELVA	510	6.90	382	30	29	54	40	15.20	0.3	418	3.6	15	8	0.85
3	PILUDRA	410	7.10	364	33	30	84	42	10.20	0.4	318	2.8	12	6	0.82
4	UMARWADA	590	7.02	360	39	30	102	36	13.12	0.7	370	2.7	15	7	0.82
5	JETALI	742	6.75	392	36	32	86	38	14.21	0.6	360	3.8	12	6	0.70
6	PIPROD	630	6.82	382	39	30	80	36	16.14	0.3	425	2.5	13	8	8.9
7	AVADAR	512	6.10	370	38	34	99	48	19.12	0.5	430	2.5	13	8	0.90
8	PARDI	612	7.08	382	36	36	78	48	20.20	0.2	320	3.9	16	6	0.85

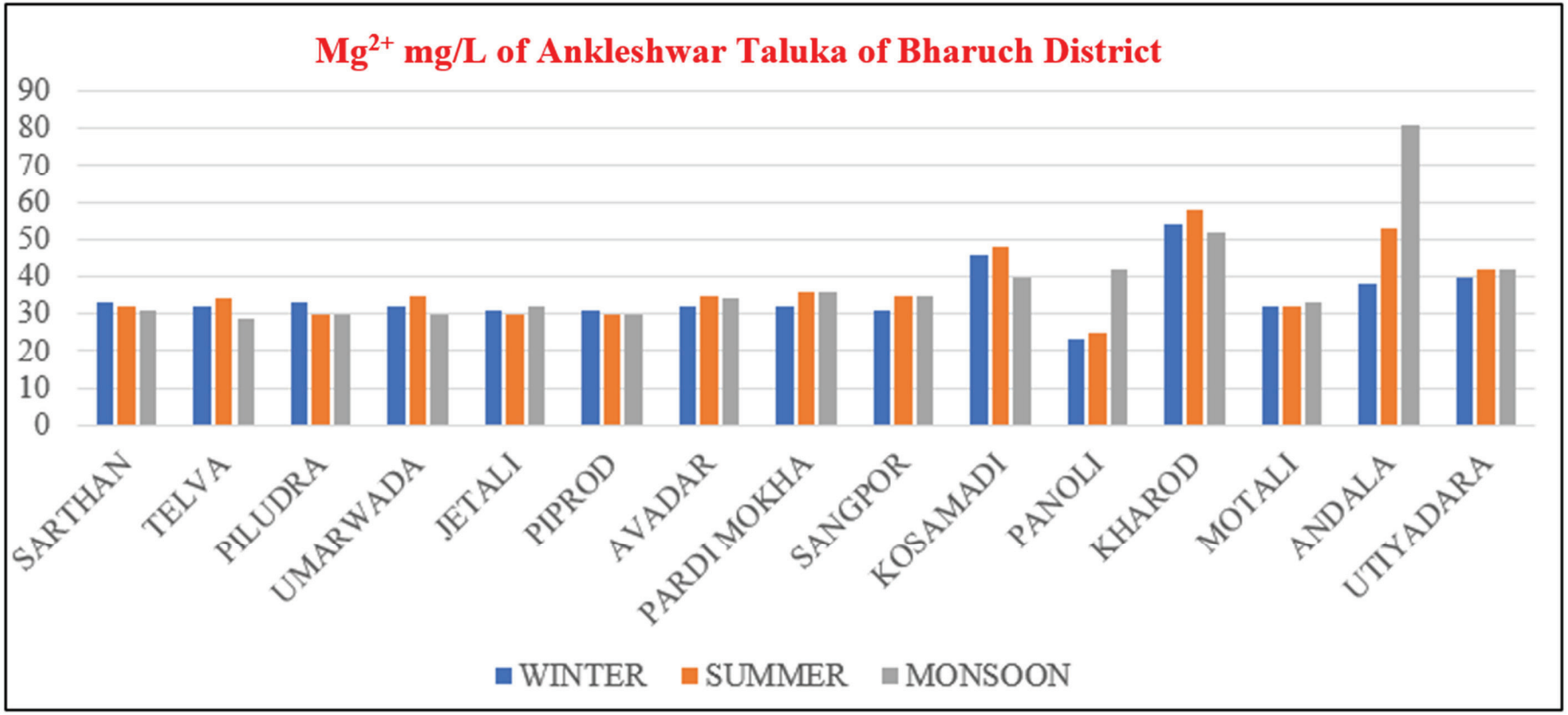
9	SANGPOR	530	7.04	381	35	35	82	53	18.20	0.4	319	3.6	19	6	0.74
10	KOSAMADI	500	6.84	380	35	40	75	37	15.81	0.3	320	3.4	10	5	0.70
11	PANOLI	640	7.62	310	58	42	85	45	8.52	0.6	332	3.7	13	3	0.30
12	KHAROD	715	7.75	283	36	52	109	36	8.12	0.8	395	3.2	14	2	0.71
13	MOTALI	542	7.12	302	34	33	85	40	10.10	0.5	325	3.4	18	6	0.62
14	ANDALA	720	7.44	360	36	81	55	34	12.12	0.6	295	1.6	11	6	0.82
15	UTIYADARA	582	7.12	281	40	42	90	40	17.30	1.2	290	2.2	09	5	0.62

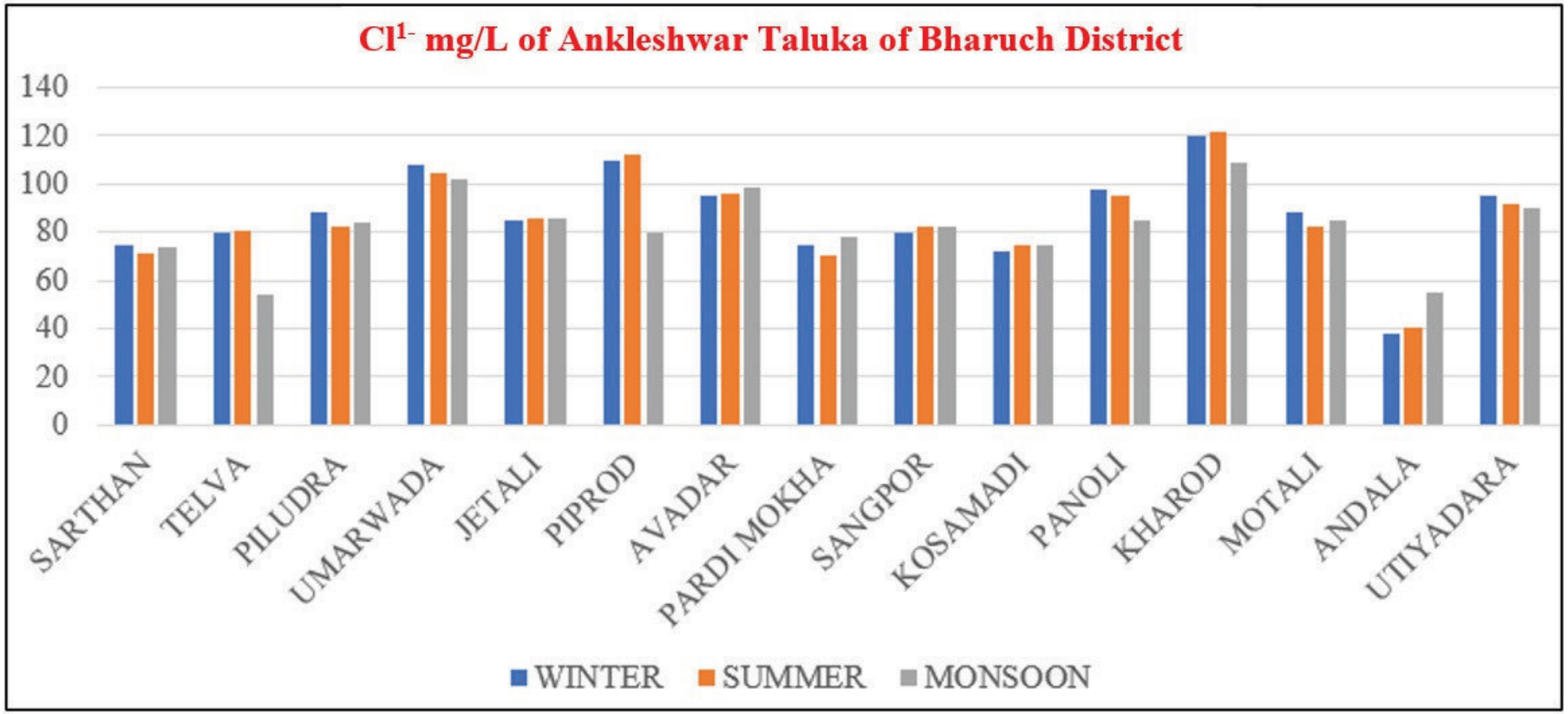

TDS mg/L of Ankleshwar Taluka of Bharuch District
800
700
600
500
400
300
200
100
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

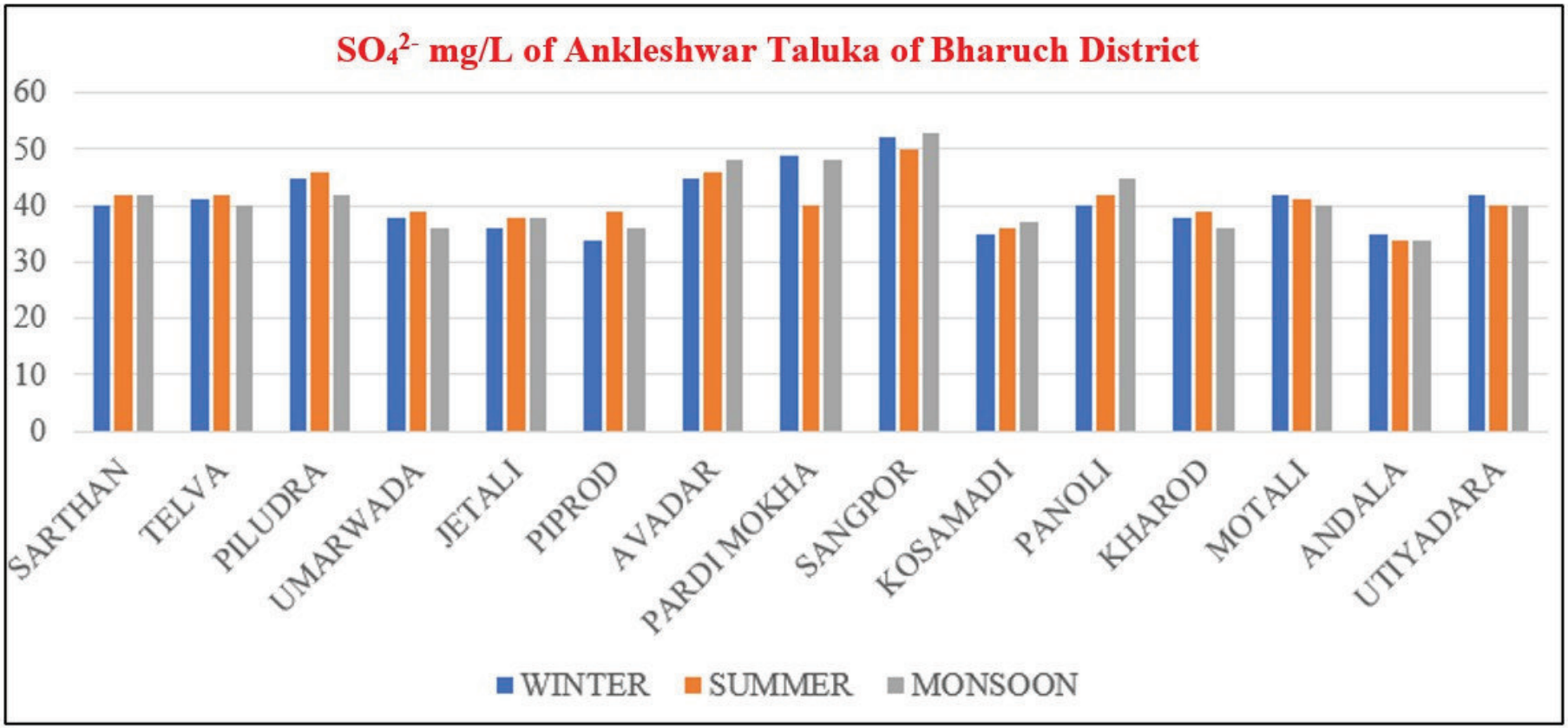

pH of Ankleshwar Taluka of Bharuch District
9
8
7
6
5
4
3
2
1
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

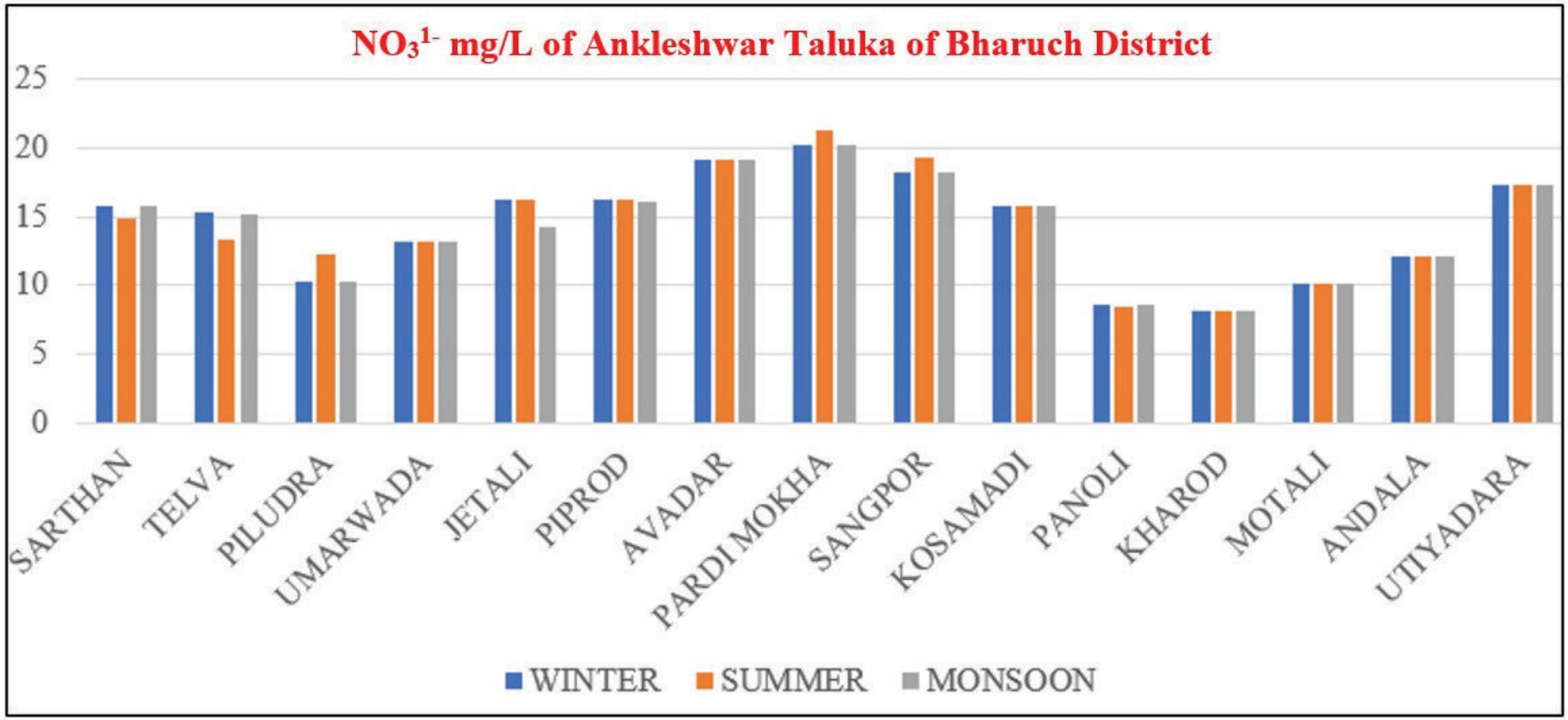

Total Hardness mg/L of Ankleshwar Taluka of Bharuch District
450
400
350
300
250
200
150
100
50
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

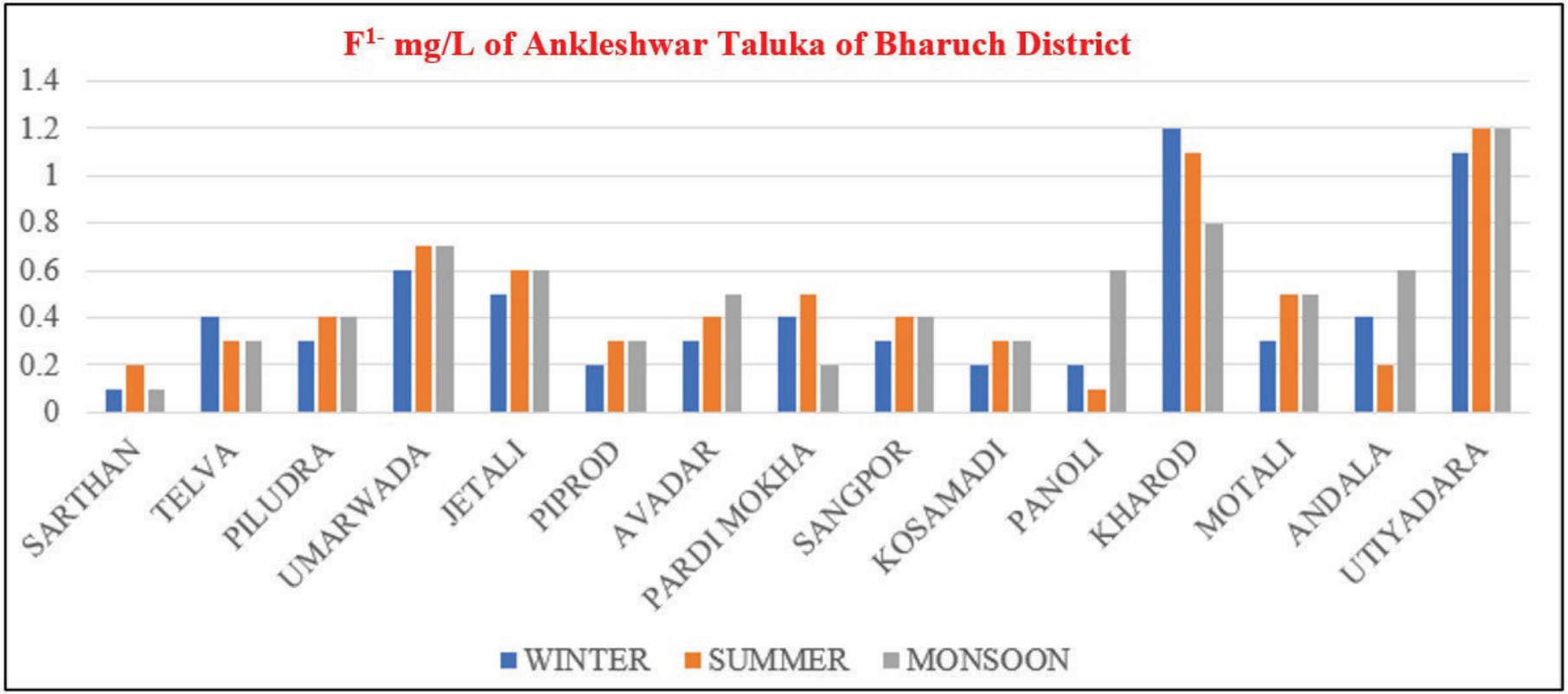

Ca2+ mg/L of Ankleshwar Taluka of Bharuch District
70
60
50
40
30
20
10
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

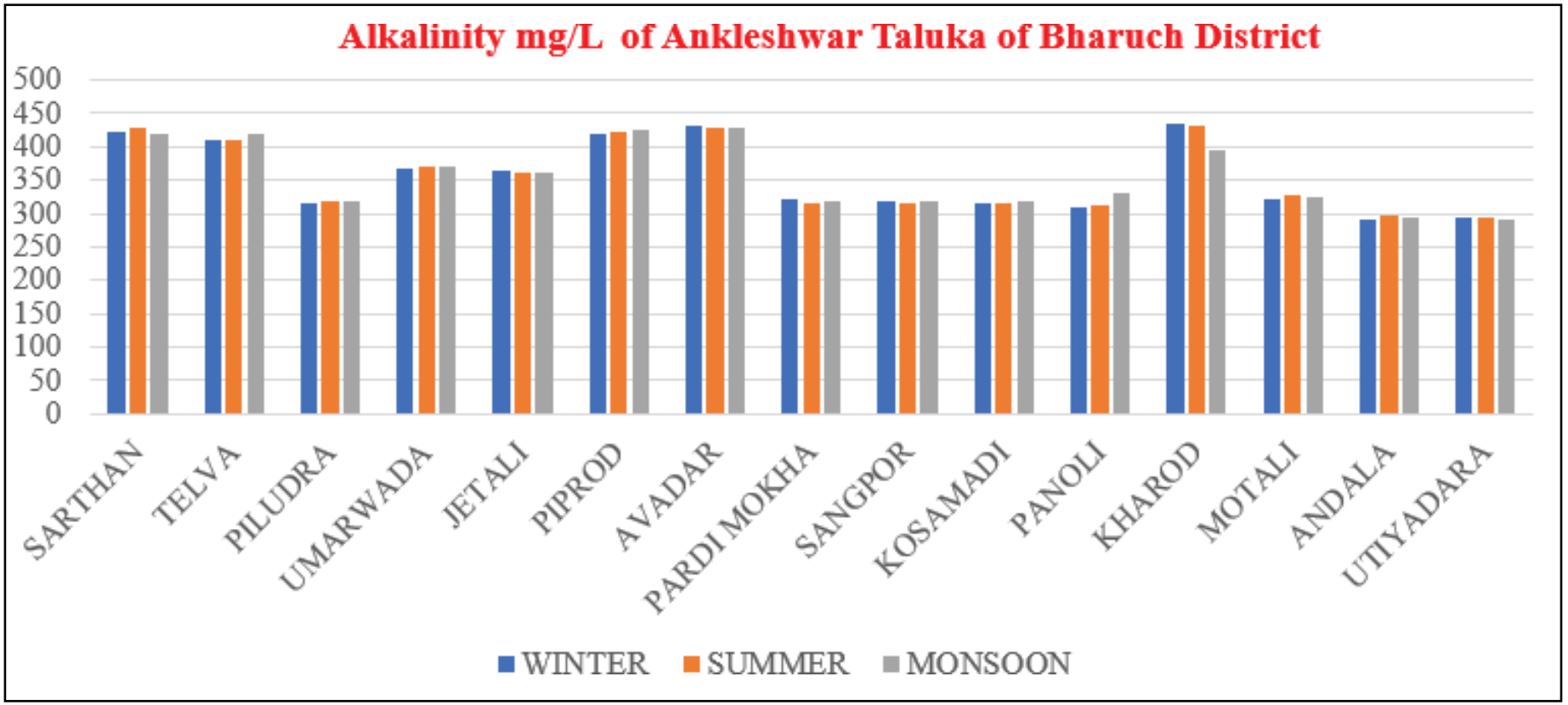

Mg2+ mg/L of Ankleshwar Taluka of Bharuch District
90
80
70
60
50
40
30
20
10
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

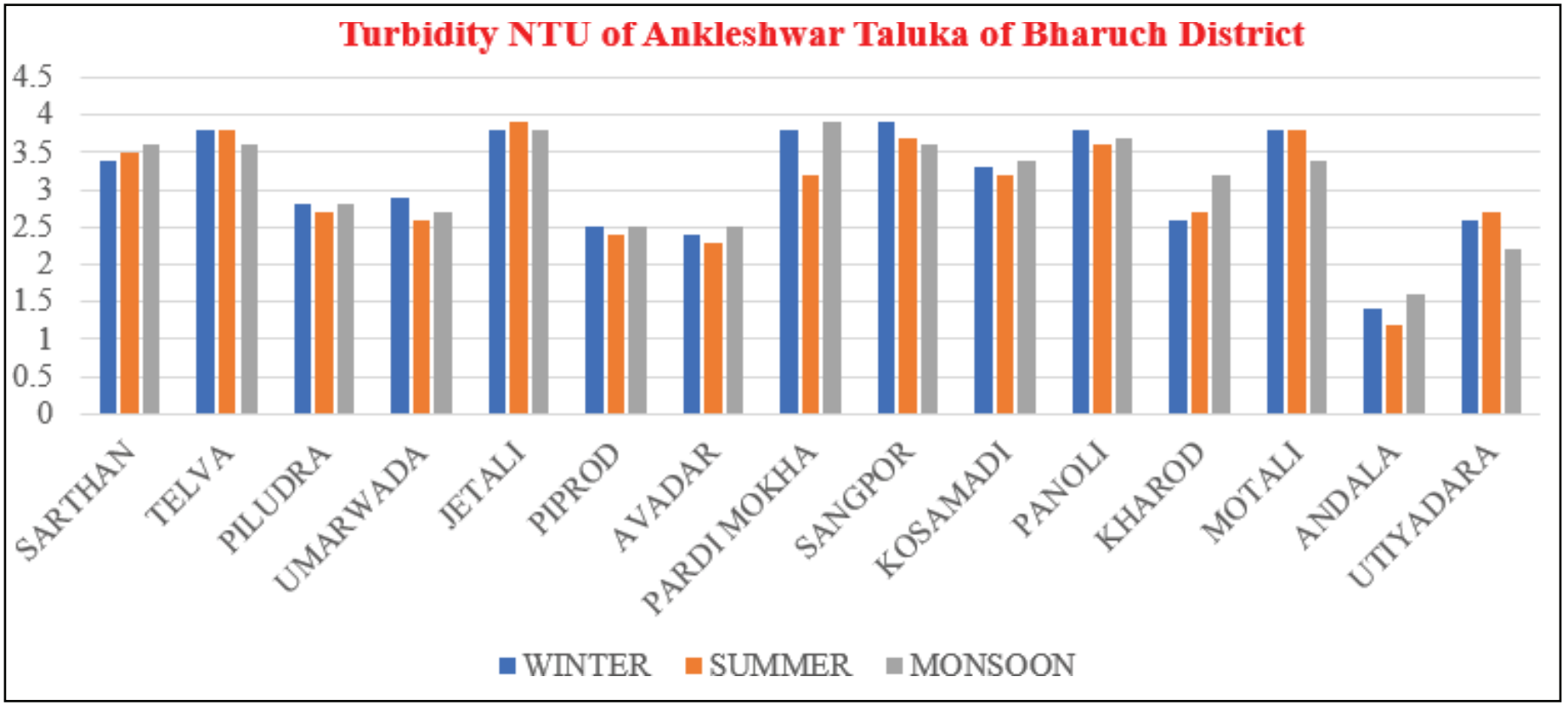

Cl1- mg/L of Ankleshwar Taluka of Bharuch District
140
120
100
80
60
40
20
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

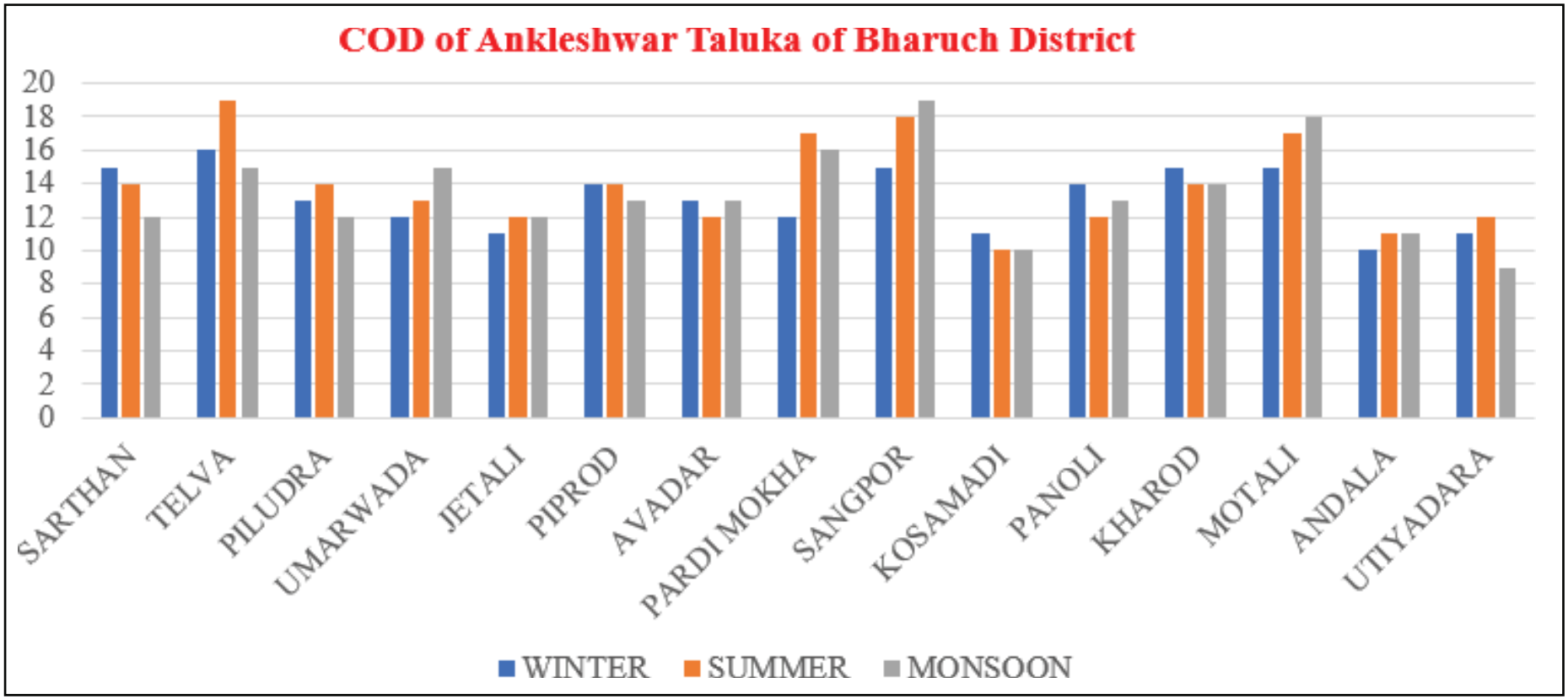

SO4 2- mg/L of Ankleshwar Taluka of Bharuch District
60
50
40
30
20
10
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

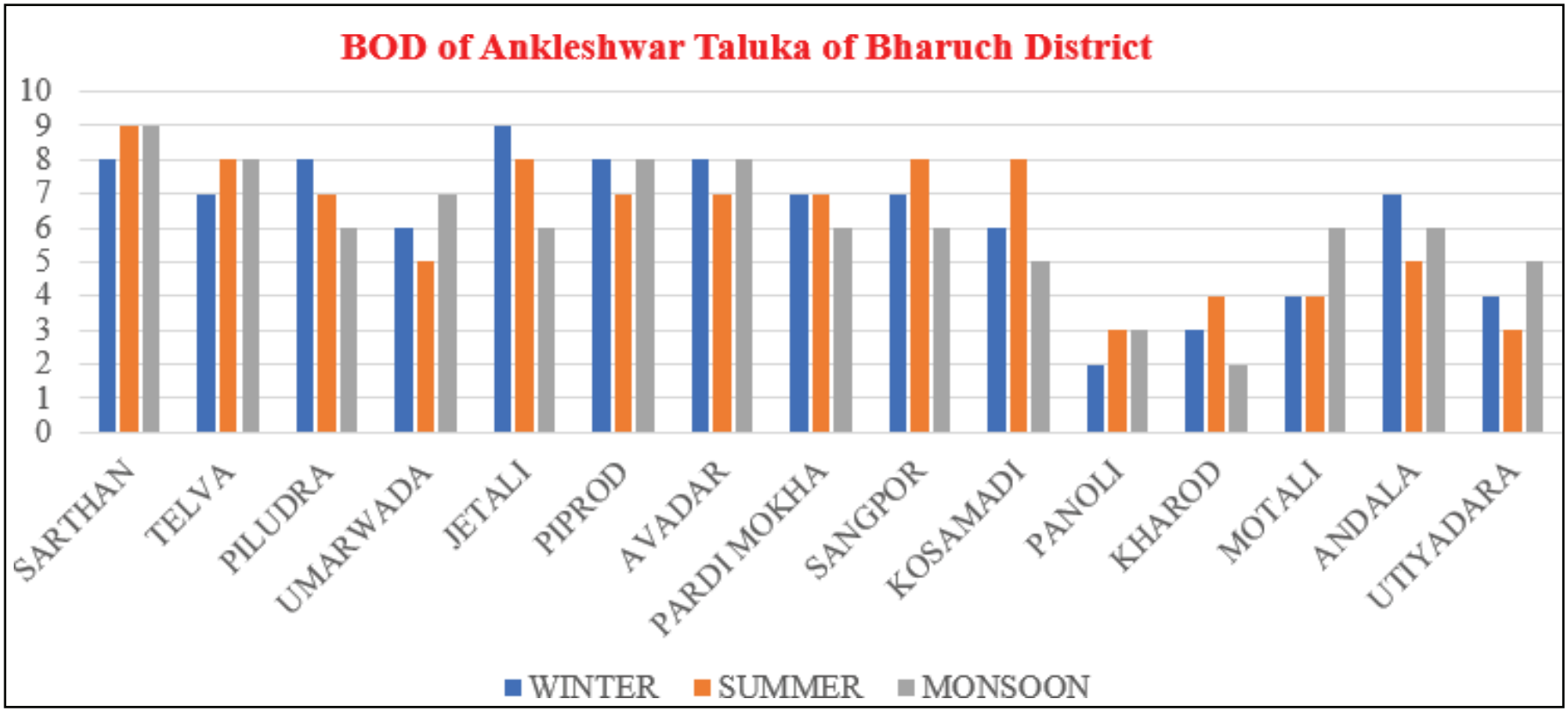

NO_3^{1-} mg/L of Ankleshwar Taluka of Bharuch District
25
20
15
10
5
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

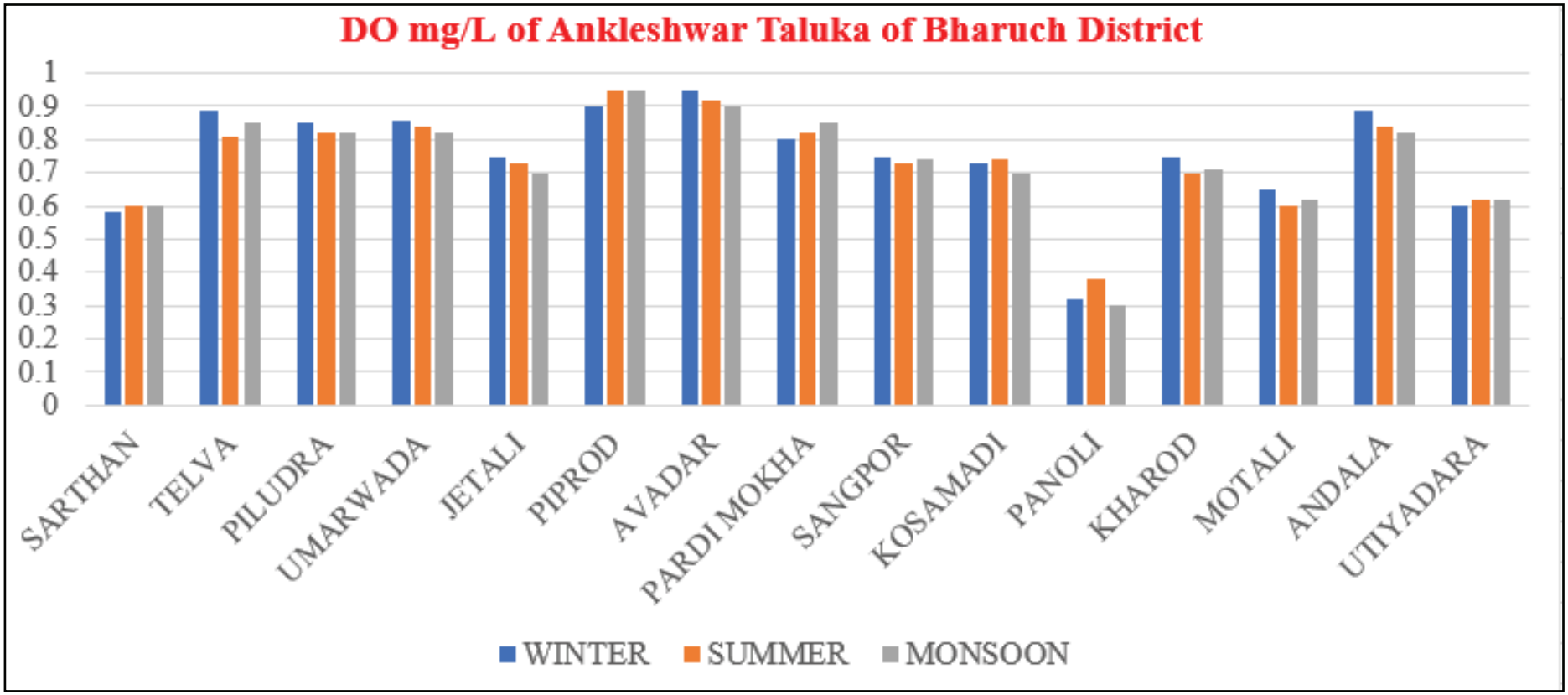

F1- mg/L of Ankleshwar Taluka of Bharuch District
1.4
1.2
1
0.8
0.6
0.4
0.2
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON


Alkalinity mg/L of Ankleshwar Taluka of Bharuch District
500
450
400
350
300
250
200
150
100
50
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON


Turbidity NTU of Ankleshwar Taluka of Bharuch District
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON


COD of Ankleshwar Taluka of Bharuch District
20
18
16
14
12
10
8
6
4
2
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON


BOD of Ankleshwar Taluka of Bharuch District
10
9
8
7
6
5
4
3
2
1
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON


DO mg/L of Ankleshwar Taluka of Bharuch District
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
SARTHAN
TELVA
PILUDRA
UMARWADA
JETALI
PIPROD
AVADAR
PARDI MOKHA
SANGPOR
KOSAMADI
PANOLI
KHAROD
MOTALI
ANDALA
UTIYADARA
WINTER
SUMMER
MONSOON

4.2 RESULTS AND DISCUSSION OF PHYSICOCHEMICAL PARAMETERS FOR ANKLESHWAR TALUKA

Ground water samples were collected from fifteen different stations of Ankleshwar Taluka of Bharuch district, Gujarat. Data obtained were discussed for its minimum and maximum values in comparison of standard physicochemical parameters.

TDS

Salts, all nonvolatile materials and inorganic impurities are called Total Dissolved Solid. Upper limit of TDS is 1000 mg/L specified by World Health Organization in 1993. Higher level of total dissolved solid may cause kidney disease, calcium deposition, stone formation, etc. TDS include inorganic salts as well as small quantity of organics which are dissolved in water. So, TDS depicts a qualitative picture of dissolved solids not indicating the nature of ions and their relationship. TDS will affect odour and taste of the water. In some cases, dissolved solid contains very low amount of metals like arsenic and lead, which make water toxic and affects adversely the development and growth of children, Higher Values of TDS, also produce negative impact on vegetation and aquatic life, because at higher TDS, oxygen level decreases, which is essential for aquatic life. Variation of TDS values also change the pH of water making it misfit for survival of various species. Higher value of TDS also alters the quality of soils required for growth of plants and soil erosion also increases. Wildlife is adversely affected by higher value of TDS, because when wildlife use polluted water for long time, it can cause death also. Therefore, regular evaluation of TDS levels is the utmost-need to sustain clean environment. Present study shows that TDS comes at 400 to 800 mg/L value. Season wise lowest and highest values of the parameter are given below:

Higher value was found for **JETALI** station and Lower value was found for **PILUDRA** station during winter season.

Higher value was found for **JETALI** station and Lower value was found for **PILUDRA** station during summer season.

Higher value was found for **JETALI** station and Lower value was found for **SARTHAN** station during monsoon season.

pH

pH indicates the acidity and alkalinity of water. Acidic pH range is 0-7 and basic pH range is 7-14. Acceptable pH of water is 6.5-8.5 according to World Health Organization. Higher or lower Values of pH have negative impact on the lives of plants and human beings. Alkaline water causes irritation in eyes, skin and problems related to digestive system. Higher values of pH may cause dehydration due to reduction in absorption capacity of water by the human body. More alkaline water can also cause formation of stones in kidney due to building-up of calcium salts in urinary tract.

Also, acidic water (lover pH) can cause skin irritation, tooth decay and stomach uncomfort. Such water can also produce corrosion of metal pipes and fixtures, which will create water pollution of heavy metals, like copper, lead, etc. This will increase the risk of bladder cancer. Higher or lower values of pH of drinking water may disrupt the general functioning of various biological processes in human being. Higher pH or alkaline water is detrimental to plants growth due to the requirement of specific pH range for different vegetations. If pH value is much higher, then it will decrease the concentration of nutrients like Ca, Mg and Fe. The leaves of plants become yellow at higher pH value and growth is hampered and therefore plants may die. Water having lower pH will make the solid acidic and so important nutrients like Ca, Mg, K, etc will leach to make plants weak, thereby causing various plant diseases.

Life of flora and fauna is sensitive to the pH of water. A certain range of pH is essential for various organisms to survive. Deviation from the permissible range will affect their health adversely. Low pH of water can dissolve CaCO3, which is taken up by various aquatic organisms to form skeleton and shells. Acidic water will cause deformation, retarded growth and sometimes death of the species, like coral, snail and clams.

The solubility of various heavy metals is affected by the changes in pH values of water which becomes toxic for organisms of aquatic systems. Acidic water increases the toxicity of aluminium. It adversely affect the fish gills by reducing their ability of breathing. The pH of water also affects the amount of dissolved oxygen which is very much essential for aquatic life. The quantity of dissolved oxygen is reduced in water of low pH, which is harmful for fish and other species to take to breathe. This will cause death of fishes in water bodies. The pH value also affects the reproduction of aquatic organisms, Larvae cannot survive at low pH of water, eggs fish and in result, the decrease

in populations is observed. Therefore, to sustain life, the pH should be maintained in the desired acceptable standard limits, so, it is necessary to test the pH of drinking water frequently for its safe utilization.

Higher values were found for **KHAROD** station and Lower values were found for **JETALI** station during winter season.

Higher values were found for **ANDALA** station and Lower values were found for **SANGPOR** station during summer season.

Higher values were found for **KHAROD** station and Lower values were found for **AVADAR** station during monsoon season.

Total Hardness (TH)

Water contains anions, cations, minerals such as salts magnesium and calcium. All these ions are responsible for the hardness of water. Acceptable value of total hardness for potable water is 300 mgL-1 according to WHO. Total hardness means total concentration of calcium and magnesium ions in mg L-1 (CaO3 equivalent). In ground water, it is found due to effluents from chemical and mining industries and also due to use of fertilizers in agriculture fields. Though higher values of TH is good for human health because it reduces the risk of cardiovascular diseases, cancer, etc but higher value may cause the problem of kidney stones also, Irritation and dryness of skin is another adverse effect of TH, Bones are strengthened by calcium but higher levels of TH may cause gastrointestinal problems due to its laxative functioning, result into diarrhea. Higher value of TH for water also impact on the development of plants. This is due to the fact that at higher TH, the soil became more alkaline and hence the nutrients will not be available to plants. However, citrus fruits plants grow more at higher TH. Animal behaviour and reproduction is also affected by higher levels of TH. Amphibians and few fishes need definite value of TH for their reproduction and development.

TH has significant effect on the species of aquatic life, which uses CaCO3 for their skeletal or shell formation. Low value of TH led to deformation and decrease their survival rates, whereas high value of TH may deposit minerals on their gills and other parts of the body. This well reduce the uptake of oxygen and so the survival is adversely affected. TH parameter is crucial for plants, human wellbeing and wildlife. Higher value of TH is sometimes advantageous but these are also disadvantageous in other ways. So, it is necessary to monitor TH of drinking water continuously

Higher value was found for **JETALI** station and Lower value was found for **KHAROD** station during winter season.

Higher value was found for **JETALI** station and Lower value was found for **PANOLI** station during summer season.

Higher value was found for **JETALI** station and Lower value was found for **UTIYADARA** station during monsoon season.

Calcium content

Calcium is required to strengthen our bones but excess level of calcium may cause kidney stone and other problems. Desirable limit for calcium is 75 to 200 mgL-1 in accordance with WHO. Calcium is very important and essential for our body. It can prevent the absorption of heavy metals in our body and enhance the bone mass. It also reduces the risk of some kinds of cancers. The value of hardness of water is directly associated with calcium content. Growth and development of teeth and bones are dependent on the calcium content of water we use for drinking. Calcium plays a vital role to regulate nerve and muscle functioning, blood clot, enzyme and hormone production, etc. Bone density is also affected by calcium in drinking water. If diet with low calcium is taken, chances of osteoporosis increases. The permissible content of calcium in drinking water is beneficial from protective point of view against heart problems due to its role in reducing blood pressure and improving the lipid distribution. Calcium is also required for healthy teeth, mainly in developing child having age 8 years. It prevents decaying of tooth. Depending upon the age, gender and constitution of human body, the optimum level of calcium is varied. Calcium is fruitful for the health as well as survival of various organisms. The exoskeletons and Shells formation largely depend upon the calcium. The proper quantity of calcium in water gives structural integrity to these organisms and therefore, deformation in skeletal structures is halted. Plants growth and development is also affected by calcium. The cell walls of the plants are protected by desired level of calcium in water, promoting the development of roots and increasing the absorption of nutrients. To sustain bones and teeth in animals also, calcium is very significant.

The proper concentration of calcium in drinking water enhance the growth and development of aquatic life, plants and wildlife. Lower Calcium Content enhances the probabilities of bone abnormalities. Looking to its important role, the concentration of calcium is necessary to determine in drinking water, such that a healthy environment is

maintained and a balance among various nutrients is sustained.

Higher value was found for **PANOLI** station and Lower value was found for **UMARWADA** station during winter season.

Higher value was found for **PANOLI** station and Lower value was found for **UMARWADA** station during Season summer season.

Higher value was found for **PANOLI** station and Lower value was found for **TELVA** station during monsoon season.

Mg^{2+} content

To keep the digestion better in the body, Magnesium is the one of the important mineral but its values above the desirable value may led to irritation in gastrointestinal tract. Desirable value is 50 to 100 mgL-1 according to WHO. Magnesium content in drinking water is advantageous for health point of view, but at higher concentrations, it causes some health problems also. It is essentially required for proper functioning of cardio-vascular systems. It also causes laxative Impact when present in higher concentration. Hardness of water sample reflects the magnesium content of water and it is with calcium also, but magnesium content is always less than calcium content in drinking water. It is an important element in chlorophyll and flora growth is governed by its content.

Various physiological processes are governed by the magnesium. Its desired amount in drinking water makes our bones healthy but lover content of magnesium may cause osteoporosis also. Heart functions are properly maintained by magnesium content. Therefore, lower content of magnesium increases the risk of heart strokes, high blood pressure and various diseases related to cardiac systems. The lower content of magnesium can make our muscle weak and cramps, spasms and tremors can also occur. Magnesium is helpful to regulate insulin sensitively and amount of sugar in blood and therefore lower magnesium content car cause type 2 diabetes. The risk of rectal and colon cancer is also reduced by somewhat higher magnesium content in drinking water. The growth and survival of various organisms like fish, algae, invertebrates, etc depends on the magnesium content. Good scales and bones are the result of magnesium along with cell's ionic balance regulation and enzymatic functions in cells. Lower magnesium content increases likelihood of diseases and produce harmful effect on growth, development and reproduction.

Plants also essentially require magnesium for their growth and development. Magnesium is essential for synthesis of chlorophyll, which is main pigment in photosynthesis. Lower magnesium content in water and soil affect the growth and yield in adverse manner. Lower value makes the plants more susceptible to pests and other diseases. Thus, it is essential and significant to maintain the magnesium content in water to sustain the balance of other nutrients to keep our environment healthy.

Higher value was found for **KHAROD** station and Lower value was found for **PANOLI** station during winter season.

Higher value was found for **ANDALA** station and Lower value was found for **PANOLI** station during summer season.

Higher value was found for **ANDALA** station and Lower value was found for **TELVA** station during monsoon season.

Chloride content

Most of water body possess chloride and more than 50% chloride is present in the common salt. Higher level of chloride may cause seance towards heart, kidney and laxative effect diseases. Desirable value is up to 250 mgL-1 according to WHO. Natural sources of water contain chloride and if taken in low quantity, it is non toxic for human beings. However, its adverse effects on health, plants, aquatic and wildlife at higher concentration has also been seen. Higher chloride content in drinking water gives a salty taste, so it will not be palatable. Therefore, to keep our body Just hydrated, its use has been limited. Higher chloride content produce dehydration in summer.

Those who have high blood pressure or any heart problems, they are at low sodium diet and if chloride content in drinking water is higher then such people are at high risk, as we know, chloride is very soluble in water, and highly stable, not degrading in water, so it will accumulate in water bodies. The internal salt level of fishes and various animals are affected by higher chloride content in water. Higher chloride content produces problems in the process to regulate salt balance in fishes and other aquatic animals. The higher chloride content may cause dehydration and in some cases, death also occur. High chloride content bring changes in aquatic plants and algae, and therefore, whole ecosystem is disturbed, High chloride content in Wetland has also impacted various kinds of plants which have cascading effects on the environment. If chloride content in water used for irrigation is high, then growth of crops and other plants is adversely affected. The uptake of nutrient

and water by plants is affected by high content of chloride in water: This leads to wilting and plants remain underdeveloped.

The higher chloride content also affects the microorganisms which support the growth of plants. So, it is necessary to monitor chloride concentration in drinking water such that suitable methods can be used to control the high content of chloride, if any.

Higher value was found for **KHAROD** station and Lower value was found for **ANDALA** station during winter season.

Higher value was found for **KHAROD** station and Lower value was found for **ANDALA** station during summer season.

Higher value was found for **KHAROD** station and Lower value was found for **TELVA** station during monsoon season.

SO_4^{2-} content

As compared to chloride, the sulphate has very slight outcome on the test of water. Higher level of sulphate in comparison to desirable limit may cause intestinal disorder and diarrhea. Desirable value is from 200 to 400 mgL-1 according to WHO. Sulphate is an important nutrient and has significant role to form protein and other compounds in our body. Its antioxidant property help protects against some chronic diseases. Higher sulphate content leads to gastrointestinal distress, like diarrhea and dehydration. Sulphate increases water solubility of metals by forming various harmful compounds which are detrimental to human health. The higher sulphate content in drinking water have varied effects on plants, vegetable and animal life, depending upon the amount and time period to which it is exposed. Invertebrates and fishes are affected by its toxic effects, resulting in to reduced population and disruption of environment. Uptake of nutrients by plants is also adversely affected by higher content of sulphate in water, which causes reduction in development and productivity of plants, Higher sulphate content produce a cascading impact on the whole eco-system because plant is the basis of various food webs. Higher sulphate content can change the pH as well as the soil chemistry, this will affect the capacity of animals to use nutrients. Some kinds of wildlife development and reproduction is also affected by higher content of sulphate, Higher concentration of sulphate results in to decrease in oxygen content, which is detrimental to the survival of aquatic organisms because they require Oxygen to survive.

So, it is significant to monitor the sulphate content in water for adopting a right strategy to reduce its high concentration.

Higher value was found for **SANGPOR** station and Lower value was found for **PIPROD** station during winter season.

Higher value was found for **SANGPOR** station and Lower value was found for **ANDALA** station during summer season.

Higher value was found for **SANGPOR** station and Lower value was found for **ANDALA** station during monsoon season.

NO_3^- content

Nitrate is available in combined form such as nitrogen, which is one of the important components for the plant growth. If nitrate containing water is used for preparation of food, it will cause diarrhea in child and adult as well as blue baby syndrome. Desirable value is up to 45 mgL-1 according to WHO. Nitrate content in water source has good and bad impacts on human beings. High content of nitrate in drinking water leads to serious problem in pregnant women and infants. It is known that higher concentration of nitrate causes methemoglobinemia (blue baby syndrome).

It is also knows as a natural antimicrobial agent which protect us against bacterial infections. Nitrate can be changed to nitric oxide in the body which improve the blood flow and decrease the blood pressure, thus reducing the risk of cardiovascular and heart problems. It is a neurotransmitter helping the signal process in neurons. It also has antioxidant properly as well as anti-inflammatory nature. Nitrate is essential for plant growth and that's why it is used in fertilizers for agriculture proposes. Aquatic life is also negativity affected by high content of nitrate, because it results in to a phenomenon known as eutrophication, which produce fast growth of algae and other plants leading to reduction in oxygen levels in water, thereby fish and various species can die. The aquatic food web is also affected by high content of nitrate. Consequently, whole ecosystem is affected. This will cause proliferation of some kinds of bacteria, interfering to advantageous bacteria, therefore, total balance of environment is disrupted So, to sustain life of human beings as well as plant kingdom, nitrate content is necessarily monitored and maintained at the permissible limit. No relaxation is given by WHO for recommended value of Nitrate concentration in water.

Higher value was found for **PARDI MOKHA** station and Lower value was found for **KHAROD** station during winter season.

Higher value was found for **PARDI MOKHA** station and Lower value was found for **KHAROD** station during summer season.

Higher value was found for **PARDI MOKHA** station and Lower value was found for **KHAROD** station during monsoon season.

Fluoride content

Number of minerals are soluble in water because they form salt with the fluoride. Fluorosis, porous bone disease is caused by the excess limit of the fluoride ion. Desirable value is 0.6 to 1. mgL^{-1} according to WHO. As compared to surface water, Fluoride is found more in ground water. Dental health is associated with the fluoride content in water, but when it is present in permissible limits only, otherwise higher values of fluoride content in drinking water can cause tooth-decay as well as serious disease known as skeletal fluorosis. Fluoride gives strength to enamel of the tooth so that tooth become ristant to acid from bacteria in mouth. The early sign like white spots on teeth is prevented by fluoride content in water. Higher content of fluoride can cause dental fluorosis. Due to higher content of fluoride and long-term use of such drinking water, the serious problems like lead skeletal fluorosis occur, in which stiffness, joint pain, ligament and bones are damaged. It also causes thyroid problem, infertility and cognitive ability is adversely affected. High content of fluoride become toxic for aquatic life, like amphibian and fishes. The various functions of enzymes and biological processes are disrupted by the intervention of fluoride, in aquatic fauna also. Wildlife is also adversely affected by higher content of fluoride in drinking water. The growth and health of agricultural corps are negatively affected, when irrigated with high fluoride content water, because, fluoride interferes uptaking of nutrients and water by plants which lead to wilting. So, it is necessary to monitor water sources regularly for fluoride content such that defluoridation techniques may be applied to high fluoride content water.

Higher value was found for **KHAROD** station and Lower value was found for **SARTHAN** station during winter season.

Higher value was found for **UTIYADARA** station and Lower value was found for **PANOLI** station during summer season.

Higher value was found for **UTIYADARA** station and Lower value was found for **SARTHAN** station during monsoon season.

Alkalinity

Water is alkaline because of presence of carbonates, bicarbonates and hydroxides. It is nothing but ability of water to neutralize acidity. Desirable value is up to 600 mgL^{-1} according to WHO. Alkalinity of waters is mainly due to dissolved carbonates, bicarbonates and hydroxides - Alkalinity of water is different from pH, though it is the capacity of water to neutralize acidity. The permissible range of alkalinity for water irrigation is 0-100 mg L^{-1} $CaCO_3$. The value between 30 and 60 mg L^{-1} are optimum for most of the plants. High alkalinity affects the plant nutrition. High alkalinity significantly affects the growing medium fertility.

Water of moderate alkalinity is advantageous because it became an important source of Calcium and Magnesium. Two billion tonnes of various alkaline residue are produced every year globally, this residue comes from alumina refining, and Coal based power plants. Such water is stored in landfills which is hazardous to health and environment. Borates, phosphates and silicates also contribute to alkalinity of water. Alkalinity is significant when the suitability of water for irrigation and mixing of pesticides is done. Alkalinity also affect soil quality and change the pH. The health impacts of alkalinity are important: alkalinity plays virtual trole for aquatic ecosystems, affecting the health of rivers, lakes, and ocean. It acts as natural buffer; Moderate alkalinity of drinking water is beneficial for health which improve digestion and reduce the acid reflux. It also increases hydration. Proper alkalinity of wate is good for irrigation which gives stability to soil and increase availability of nutrients. Therefore, alkalinity of water is important to sustain health and life. Therefore, monitoring alkalinity levels in drinking water will be a pro-active step for overall wellbeing.

Higher value was found for **KHAROD** station and Lower value was found for **ANDALA** station during winter season.

Higher value was found for **KHAROD** station and Lower value was found for **UTIYADARA** station during summer season.

Higher value was found for **AVADAR** station and Lower value was found for **UTIYADARA** station during monsoon season.

Turbidity

Desirable value is 10 NTU for drinking water according to WHO. Turbidity decreases the clarity of water samples. Turbidity is due to suspended matter which absorb or scatter light Water's called turbid if the suspended particles are harmful for health, Suspended materials reduce the light penetration, mainly inorganic suspended matter. It is different from total suspended solids (TSS). Turbidity implies light scattering properties of water samples It is "haziness" and this is due to fine particles which scatters light at about 90° to the direction from. Which light enters the sample. Turbidity should not be confused with colour or vice-versa. It is measured by a Turbidity Meter and expressed in Nephelometric Turbidity Units (NTU). Purified water should have turbidity <1 NTU. Higher Turbidity produce negative impact on aquatic life. It clogs fish gills, hinder the visibility and decreases light penetration affecting adversely the aquatic plants. High turbidity also reduces fish resistance to various diseases. It affects the developments of larva and eggs. Higher turbidity also increases temperature of water and decrease the amount of dissolved oxygen because of enhanced heat absorption by water: Decrease in light penetration decrease the dissolved oxygen, content, thereby reducing the photosynthesis of aquatic plants. Hence aquatic life and human health, both are affected by high turbidity water. So, it is necessary to monitor turbidity of drinking water regularly.

Higher value was found for **SANGPOR** station and Lower value was found for **ANDALA** station during winter season.

Higher value was found for **JETALI** station and Lower value was found for **ANDALA** station during summer season.

Higher value was found for **PARDI** station and Lower value was found for **ANDALA** station during monsoon season.

Chemical Oxygen Demand (COD)

It is one of the significant properties of drinking water. It is the amount of oxygen needed for oxidation of chemical compounds present in water. It is a significant parameter for quality of water. Higher values of COD reflect the pollution of water present due to organics and inorganic compounds. Higher COD values of water samples decreases the concentration of dissolved oxygen in water, which is detrimental for aquatic life. Eutrophication is also caused by higher COD, which resulted in to reduced level of dissolved oxygen. Therefore, fishes and various aquatic organisms are at risk for their

survival. The changes in weather pattern and temperature or climate change also affect the value of COD because these climatic changes result in to change in the concentration of pollutants in water. Therefore, to known the level of water pollution, it is necessary to determine COD, such that appropriate technique is to be used for removing pollution due to organic and inorganic compounds in water. Majority of ground water having dissolve oxygen level of 4.2 to 6.0 mgL^{-1}. Desirable limit is 3 mgL^{-1} according to WHO. Water with saturated oxygen levels gives very pleasant test. Water with less dissolve oxygen value than desirable limit is fetal for aquatic animals.

Higher value was found for **TELVA** station and Lower value was found for **ANDALA** station during winter season.

Higher value was found for **TELVA** station and Lower value was found for **KOSAMADI** station during summer season.

Higher value was found for **SANGPOR** station and Lower value was found for **UTIYADARA** station during monsoon season.

Biological Oxygen Demand (BOD)

It is the quantity of oxygen required by microorganisms for decomposition of organic matter present in water. Like, COD, BOD is also an important parameter to assess the water pollutions, Higher BOD means more polluted water because higher value of BOD indicates the presence of more quantity of organic matter in water. This will decrease the concentration of dissolved oxygen, putting aquatic life at risk, Higher BOD value also produce eutrophication due to which, increase in the growth of algae and other aquatic plants has been observed. Again, this will also decrease the dissolved oxygen levels in water.

Higher BOD Value of drinking water is harmful for health of human beings. When the untreated sewage and human waste is mixed in waterbodies, the BOD of water increases. Pollution due to higher BOD may leads to diseases like dysentery and Cholera also. So, it is significant to monitor BOD value of water samples to sustain aquatic ecosystem and health of people.

High BOD level indicates less dissolved oxygen. Plant kingdom to survive in the water are due to nitrate and phosphate salts present in the water. World Health Organization recommended the water having dissolve oxygen value 30 mgL^{-1}.

Higher value was found for **JETALI** station and Lower value was found for **PANOLI** station during winter season.

Higher value was found for **SARTHAN** station and Lower value was found for **UTIYADARA** station during summer season.

Higher value was found for **SARTHAN** station and Lower value was found for **KHAROD** station during monsoon season.

Dissolved Oxygen (DO)

Dissolved oxygen in water is the utmost requirement to sustain the life of aquatic environment, wildlife and human beings. It is very Important parameter because respiration and metabolism of aquatic organisms largely depends on this dissolved oxygen, Oxygen is needed for aquatic organisms like crustacean, fish and others to derive energy from their food to sustain their metabolism Hypoxia (oxygen deficiency) is caused to aquatic organism if dissolved oxygen level is low enough, and also anoxia (lack of oxygen) cause death of these organisms. At higher temperature, the amount of oxygen decreases in water resulting in to the conditions of hypoxia or anoxia. Biodiversity is also adversely affected by low levels of oxygen in water, because same species are more sensitive towards lower amount of oxygen than other species. Also, some species can survive even in low oxygen content whereas others cannot.

Human health is also affected by dissolved oxygen in water. The low amount of oxygen indicates pollution due to nutrients where growth of bad algae increases and they produce toxic substances, which are harmful to human health. In coastal areas, the concentration of oxygen is naturally at low levels, there needs the oxygen masks or other breathing equipment's for proper functioning of lungs. Therefore, it is very necessary to monitor the amount of dissolved oxygen in water for its quality requirement to sustain aquatic systems, plants and wildlife.

Higher value was found for **AVADAR** station and Lower value was found for **SARTHAN** station during winter season.

Higher value was found for **PIPROD** station and Lower value was found for **SARTHAN** station during summer season.

Higher value was found for **PIPROD** station and Lower value was found for **PANOLI** station during monsoon season.

Physicochemical parameters of Bharuch Taluka

Ground water analysis of water samples collected from 15 stations of BHARUCH TALUKA of BHARUCH DISTRICT such as ADOL, AMDADA, AMLESHWAR, BAMBUSAR, BHUVA, CHOLAD, DABHALI, GHODI, HALDAR, KARELA, KELOD, OSARA, SAMLOD, SEGVA AND SHAHPURA.

All parameters were measured in terms of pH, Fluoride, Nitrate, Hardness, Alkalinity, Phosphate, Ca^{2+}, Mg^{2+}, Sulphate ion, COD, BOD. TDS and Total dissolved oxygen, etc. All parameters were measured in winter, summer and monsoon season.

Table 4.4: Physicochemical Parameter of Ground Water from Bharuch Taluka of Bharuch District, Gujarat (Winter)

Physicochemical parameters															
Sr. No.	**Station Name**	**TDS mg/L**	**pH**	**Total Hardness mg/L**	**Ca^{2+} mg/L**	**Mg^{2+} mg/L**	**Cl^{1-} mg/L**	**SO_4^{2-} mg/L**	**NO_3^{1-} mg/L**	**F^{1-} mg/L**	**ALKALINITY mg/L**	**TURBIDITY NTU**	**COD mg/L**	**BOD mg/L**	**DO mg/L**
1	ADOL	628	6.85	385	38	31	80	52	16.18	0.2	422	3.5	12	7	0.62
2	AMDADA	510	6.92	375	35	46	72	35	19.10	0.3	430	3.8	15	6	0.80
3	AMLESHWAR	615	7.02	385	60	23	98	40	20.22	0.4	322	2.6	11	2	0.80
4	BAMBUSAR	535	7.01	380	39	54	120	38	18.21	0.3	318	2.6	14	3	0.84
5	BHUVA	486	6.91	378	38	32	88	42	15.80	0.1	422	3.7	15	8	0.78
6	CHOLAD	504	6.99	380	38	38	38	35	15.36	0.4	410	2.4	17	8	0.91
7	DABHALI	448	7.03	360	38	33	75	40	10.22	0.3	316	2.3	10	9	0.95
8	GHODI	594	7.00	365	36	32	80	41	8.11	1.2	435	3.6	15	8	0.82
9	HALDAR	545	7.10	300	35	33	88	45	10.12	0.3	321	3.7	16	7	0.75

10	KARELA	515	7.42	302	34	32	108	38	12.12	0.4	290	3.6	13	8	0.72
11	KELOD	580	7.10	280	38	31	85	36	17.35	1.1	293	3.7	12	6	0.32
12	OSARA	742	7.70	265	36	33	110	34	13.14	0.6	368	2.6	11	10	0.75
13	SAMLOD	744	6.82	390	39	31	108	35	16.20	0.5	365	3.8	14	8	0.63
14	SEGVA	485	6.81	375	41	40	95	42	15.82	0.2	314	1.5	13	7	0.81
15	SHAHPURA	636	7.60	257	38	32	75	49	8.52	0.2	310	2.8	13	5	0.60

Table 4.5 Physicochemical Parameter of Ground Water from Bharuch Taluka of Bharuch District, Gujarat (Summer)

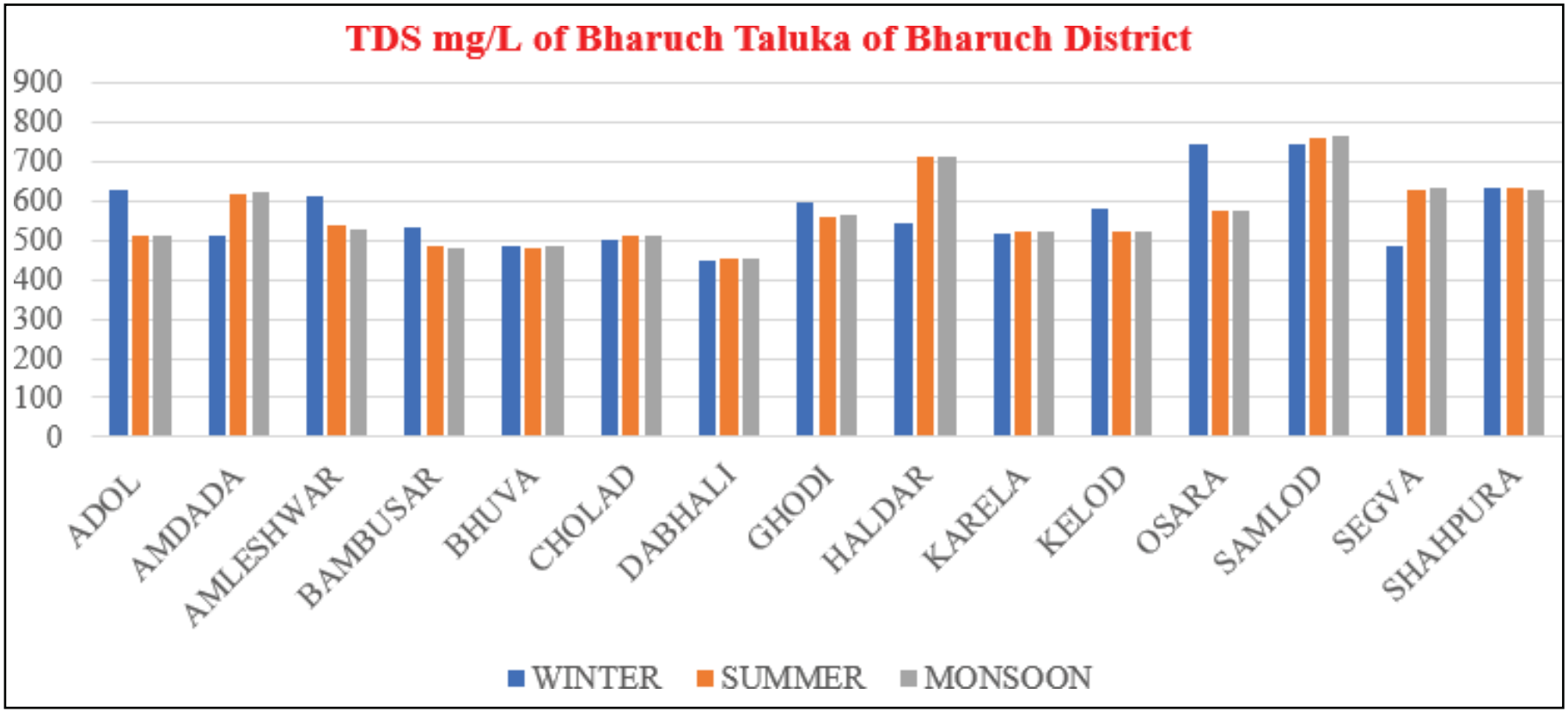
Physicochemical parameters															
Sr. No.	**Station Name**	**TDS mg/L**	**pH**	**Total Hardness mg/L**	**Ca^{2+} mg/L**	**Mg^{2+} mg/L**	**Cl^{1-} mg/L**	**SO_4^{2-} mg/L**	**NO_3^{1-} mg/L**	**F^{1-} mg/L**	**ALKALINITY mg/L**	**TURBIDITY NTU**	**COD mg/L**	**BOD mg/L**	**DO mg/L**
1	ADOL	512	6.85	360	42	35	96	42	11.25	0.1	315	3.6	17	8	0.74
2	AMDADA	620	6.72	370	34	36	70	39	8.50	1.1	312	2.7	18	8	0.38
3	AMLESHWAR	540	7.12	258	35	35	122	41	8.10	0.5	433	3.8	10	3	0.70
4	BAMBUSAR	487	7.75	268	36	48	82	34	10.14	0.2	329	1.2	12	4	0.60
5	BHUVA	481	7.20	310	62	32	40	40	12.10	1.2	292	2.7	14	4	0.84
6	CHOLAD	510	7.40	319	37	34	92	39	17.30	0.3	294	2.4	17	5	0.62
7	DABHALI	452	7.14	290	39	30	81	46	19.10	0.4	430	2.3	11	2	0.92
8	GHODI	560	7.15	360	38	35	82	40	21.24	0.5	315	3.2	12	7	0.82

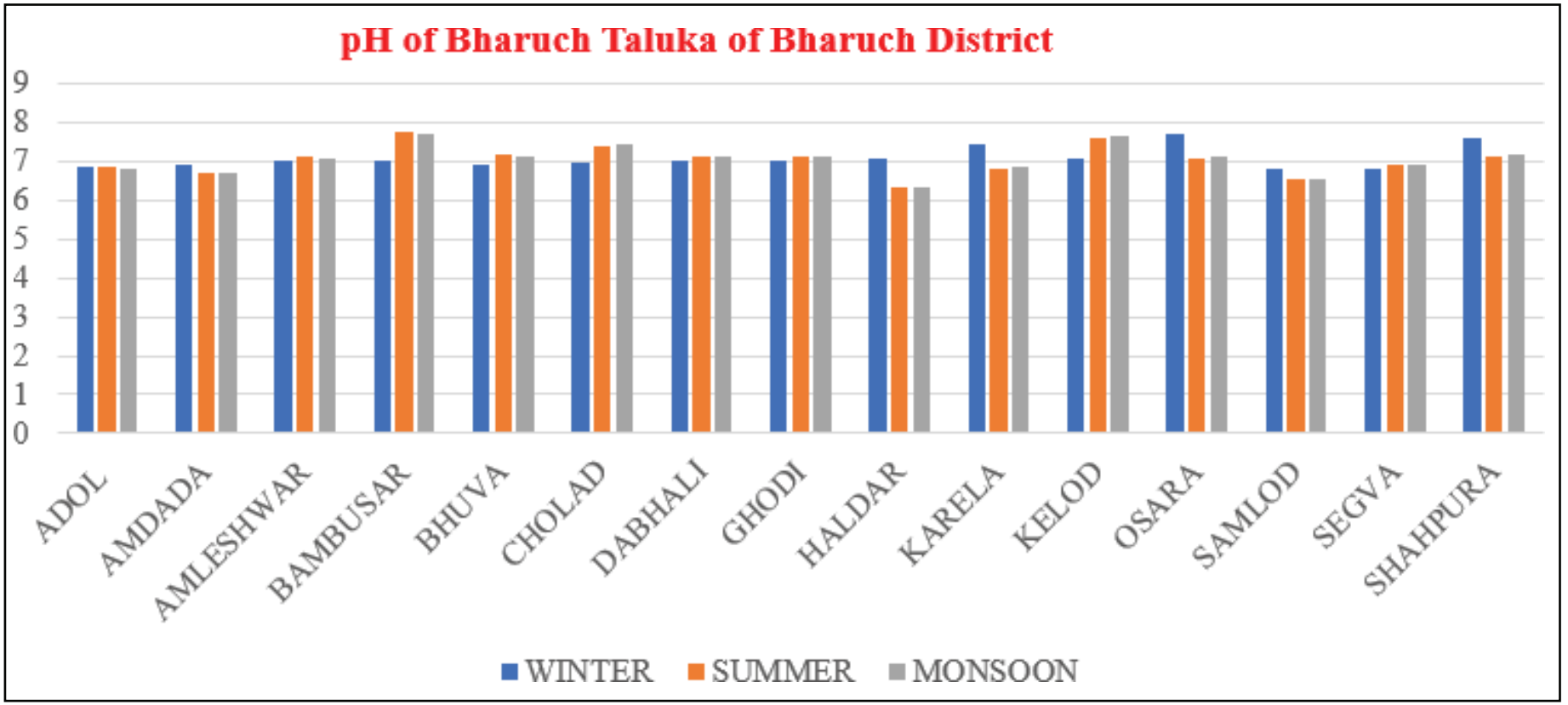
9	HALDAR	712	6.35	392	36	30	105	50	19.21	0.4	314	3.7	14	9	0.73
10	KARELA	520	6.81	380	37	32	86	36	15.81	0.3	430	3.2	16	8	0.62
11	KELOD	520	7.61	372	40	83	112	42	14.80	0.2	410	3.5	14	7	0.81
12	OSARA	575	7.10	378	41	42	82	42	13.36	0.3	320	3.8	13	5	0.82
13	SAMLOD	760	6.56	380	29	30	75	46	12.22	0.4	370	2.7	12	8	0.84
14	SEGVA	630	6.90	385	30	25	95	39	13.15	0.7	360	2.6	14	7	0.73
15	SHAHPURA	635	7.15	382	40	58	71	38	16.22	0.6	365	3.9	12	8	0.84

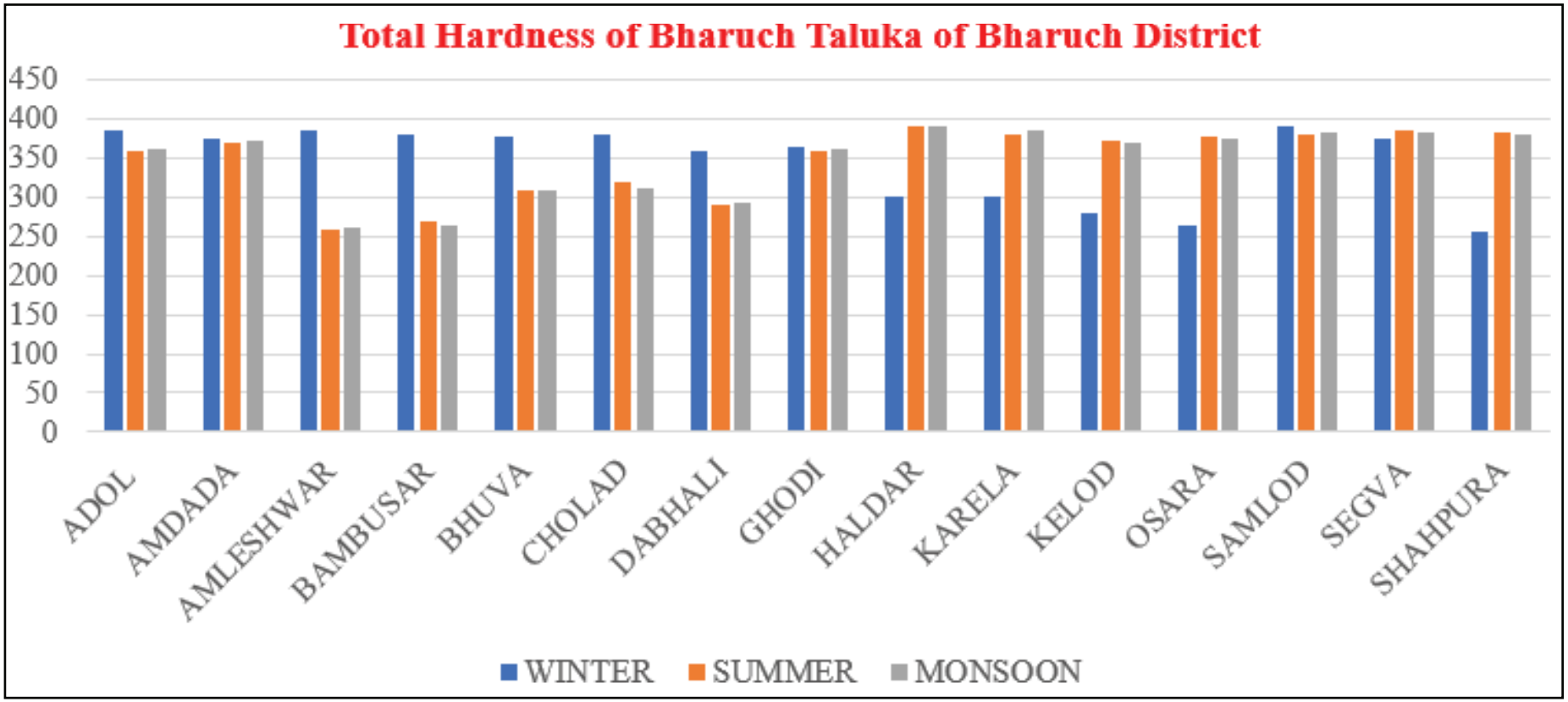
Table 4.6: Physicochemical Parameter of Ground Water from Bharuch Taluka of Bharuch District, Gujarat (Monsoon)

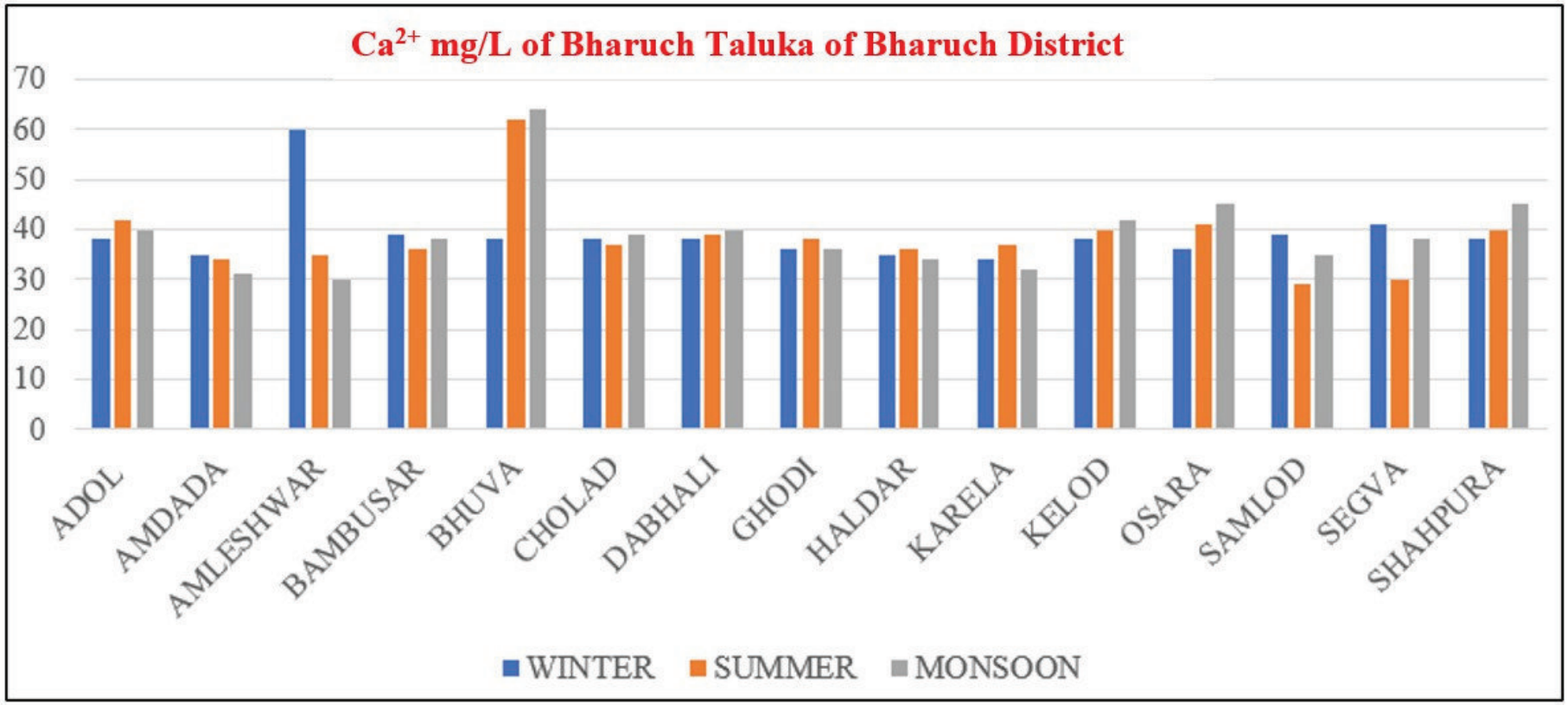
Physicochemical parameters															
Sr. No.	**Station Name**	**TDS mg/L**	**pH**	**Total Hardness mg/L**	**Ca^{2+} mg/L**	**Mg^{2+} mg/L**	**Cl^{1-} mg/L**	**SO_4^{2-} mg/L**	**NO_3^{1-} mg/L**	**F^{1-} mg/L**	**ALKALINITY mg/L**	**TURBIDITY NTU**	**COD mg/L**	**BOD mg/L**	**DO mg/L**
1	ADOL	514	6.80	362	40	34	94	44	11.20	0.2	316	3.7	18	8	0.72
2	AMDADA	625	6.70	372	31	30	72	30	8.52	1.2	314	2.8	19	7	0.30
3	AMLESHWAR	530	7.10	260	30	36	120	42	8.12	0.4	432	3.6	12	4	0.72
4	BAMBUSAR	480	7.70	264	38	40	83	35	10.13	0.3	328	1.3	14	3	0.61
5	BHUVA	486	7.15	309	64	31	42	45	12.12	1.3	291	2.8	13	2	0.82
6	CHOLAD	512	7.45	312	39	36	91	38	17.32	0.4	292	2.5	15	6	0.60
7	DABHALI	455	7.13	292	40	35	80	45	19.12	0.5	432	2.4	12	4	0.91
8	GHODI	565	7.14	362	36	36	85	42	21.20	0.4	316	3.4	13	6	0.86

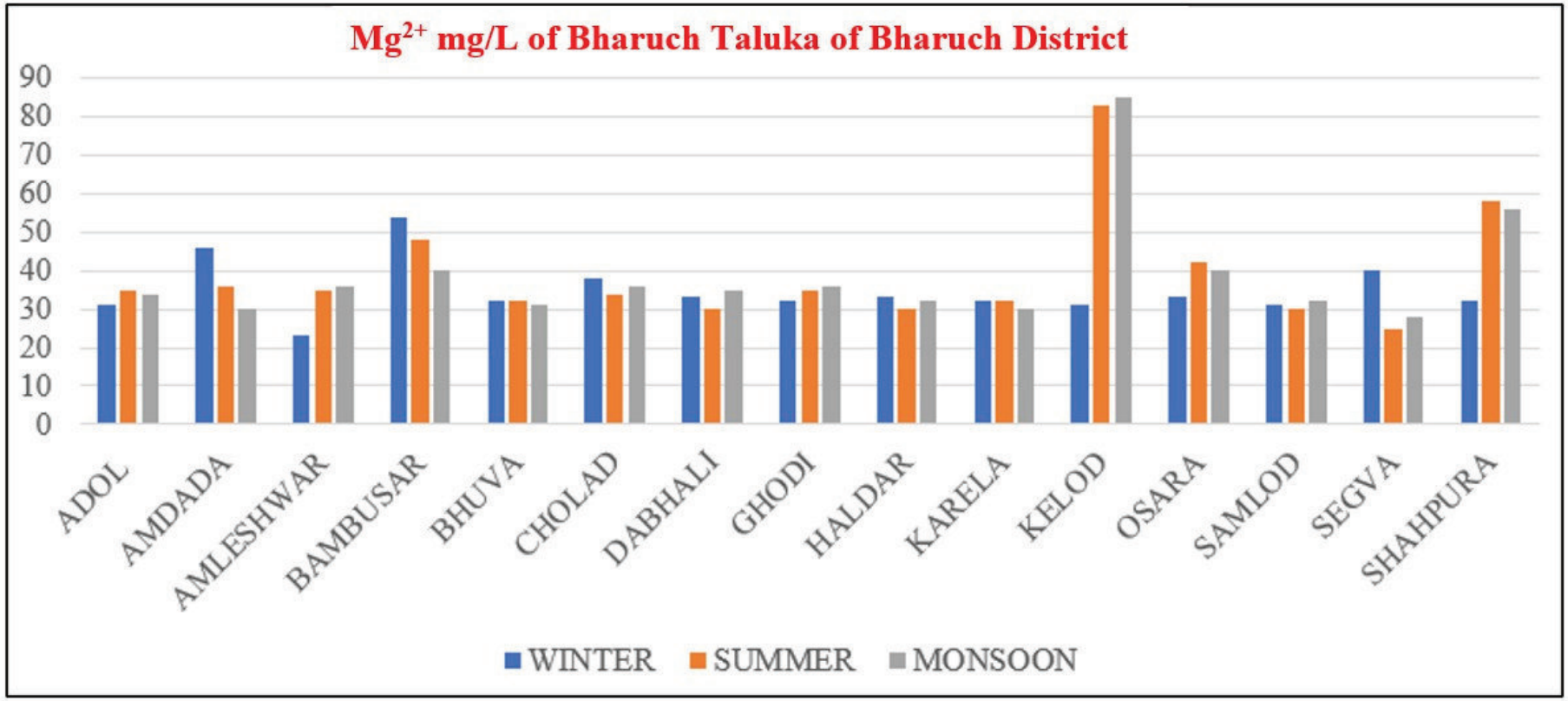
9	HALDAR	714	6.36	390	34	32	106	49	19.20	0.5	315	3.9	14	9	0.72
10	KARELA	522	6.85	385	32	30	87	38	15.80	0.4	434	3.4	18	8	0.65
11	KELOD	521	7.65	370	42	85	114	43	14.82	0.3	412	3.6	15	6	0.85
12	OSARA	576	7.15	374	45	40	83	43	13.35	0.4	322	3.5	13	4	0.84
13	SAMLOD	764	6.54	383	35	32	78	44	12.20	0.5	360	2.8	14	8	0.83
14	SEGVA	633	6.92	382	38	28	99	38	13.14	0.6	365	2.7	10	6	0.75
15	SHAHPURA	630	7.20	380	45	56	72	32	16.20	0.5	363	3.2	13	7	0.86

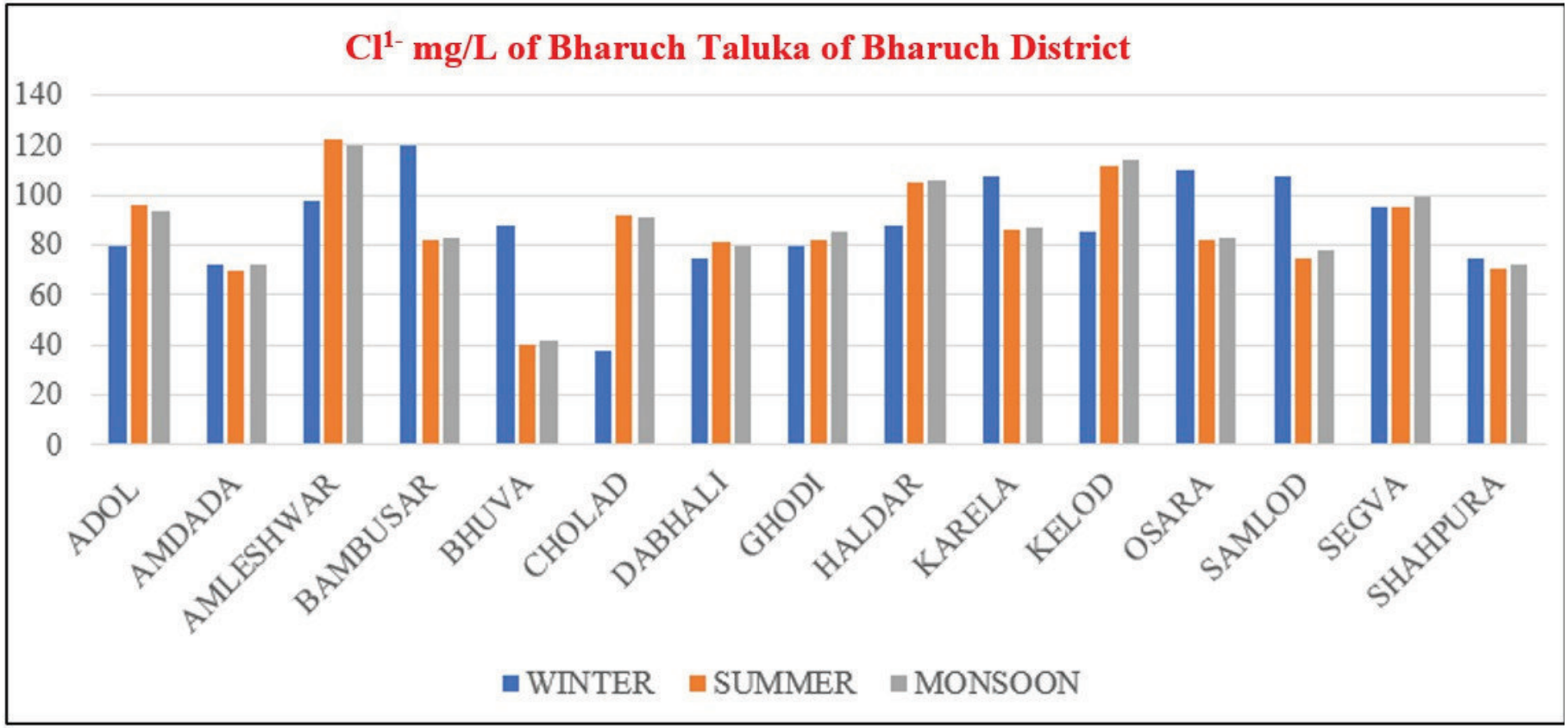

TDS mg/L of Bharuch Taluka of Bharuch District
900
800
700
600
500
400
300
200
100
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

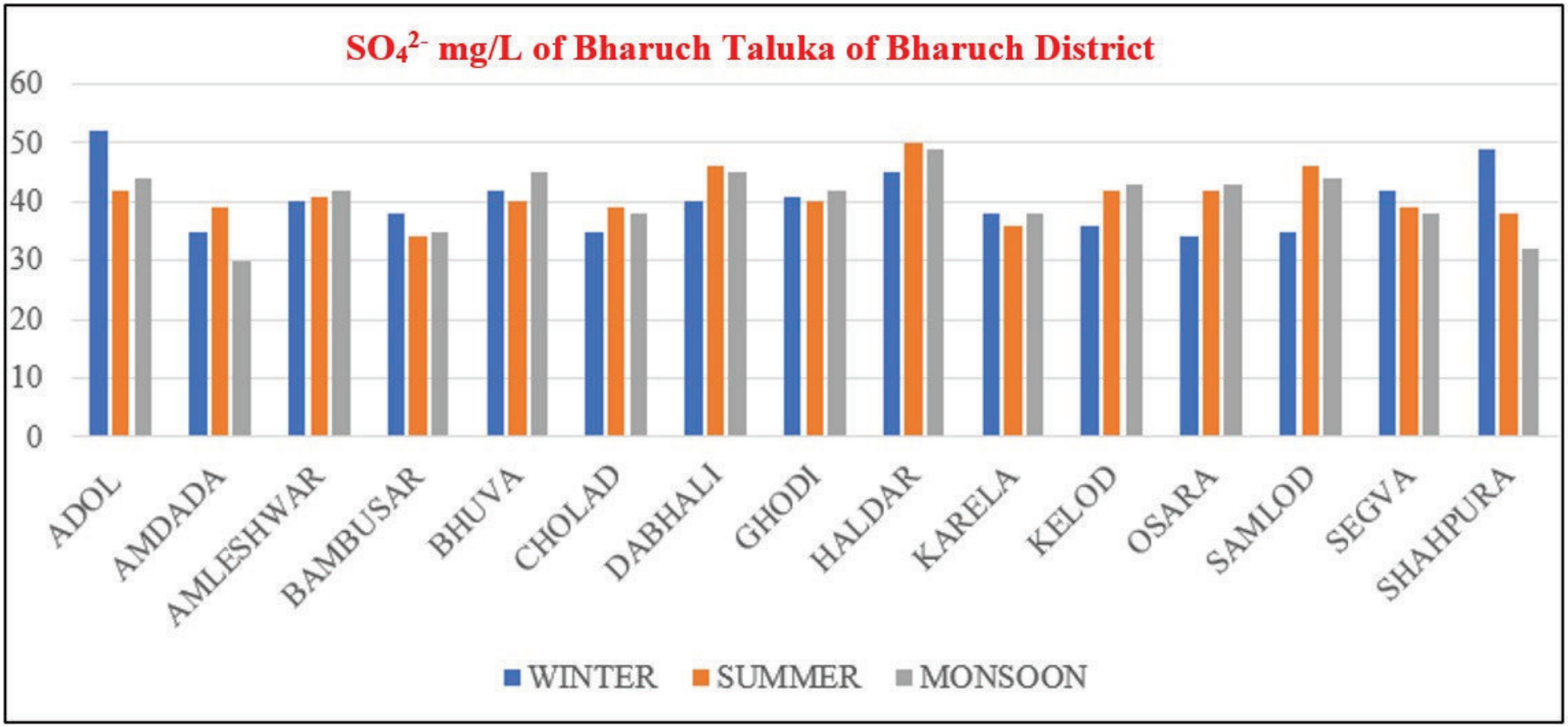

pH of Bharuch Taluka of Bharuch District
9
8
7
6
5
4
3
2
1
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

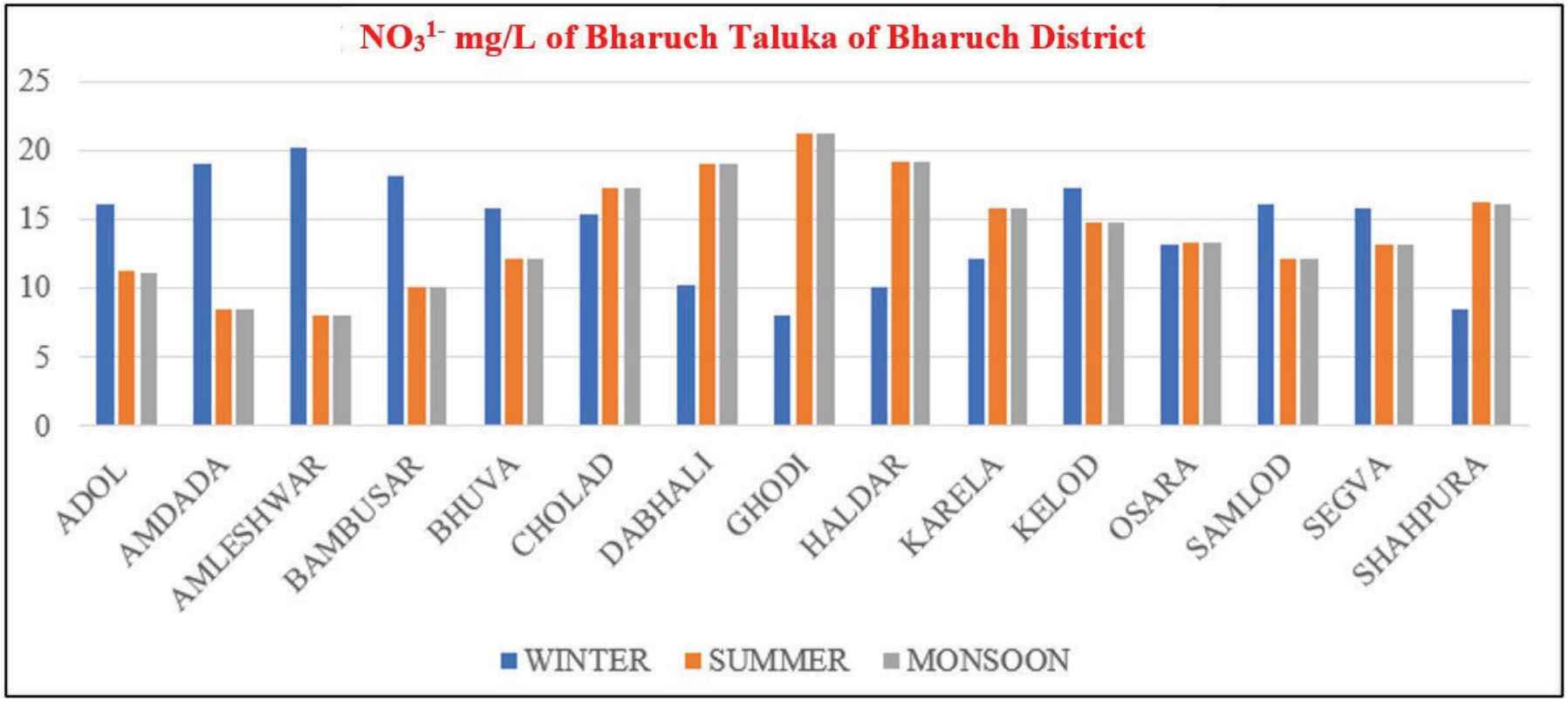

Total Hardness of Bharuch Taluka of Bharuch District
450
400
350
300
250
200
150
100
50
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

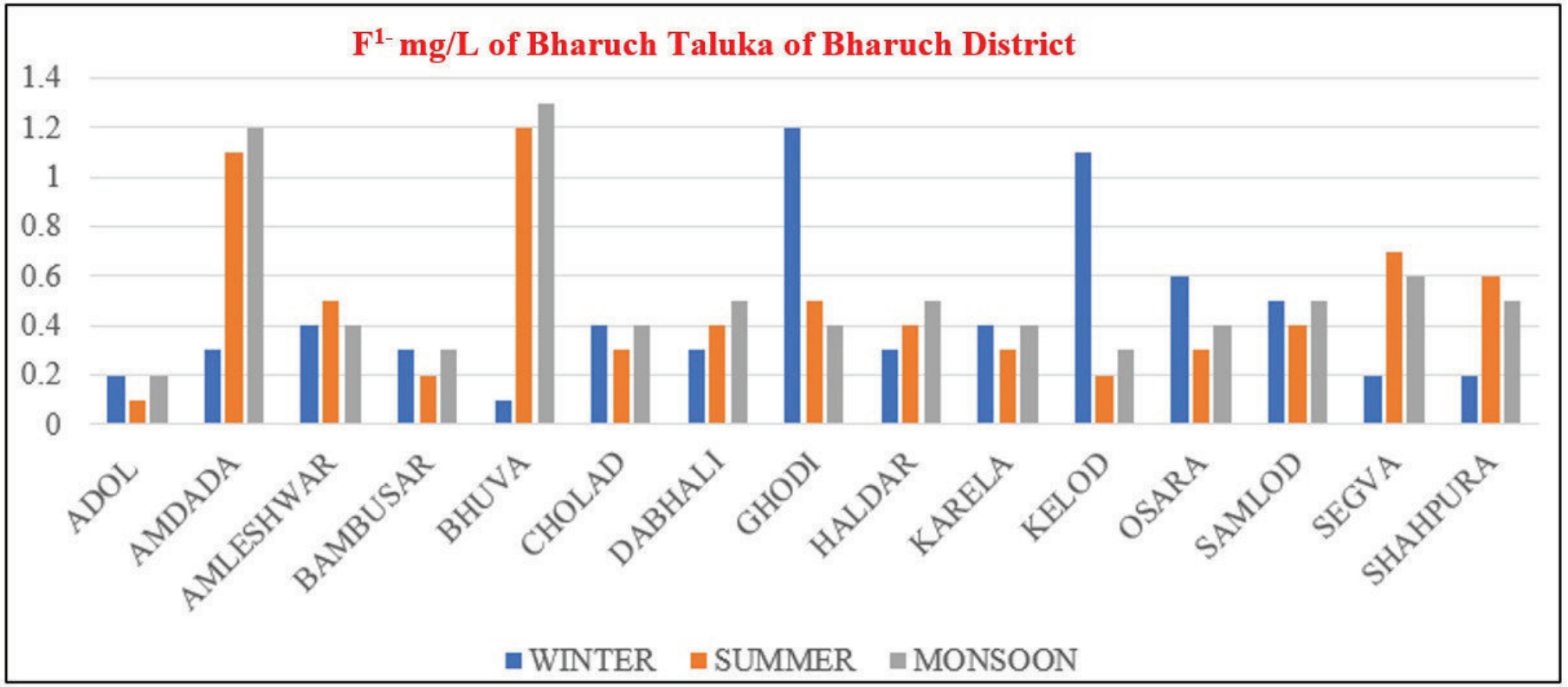

Ca2+ mg/L of Bharuch Taluka of Bharuch District
70
60
50
40
30
20
10
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

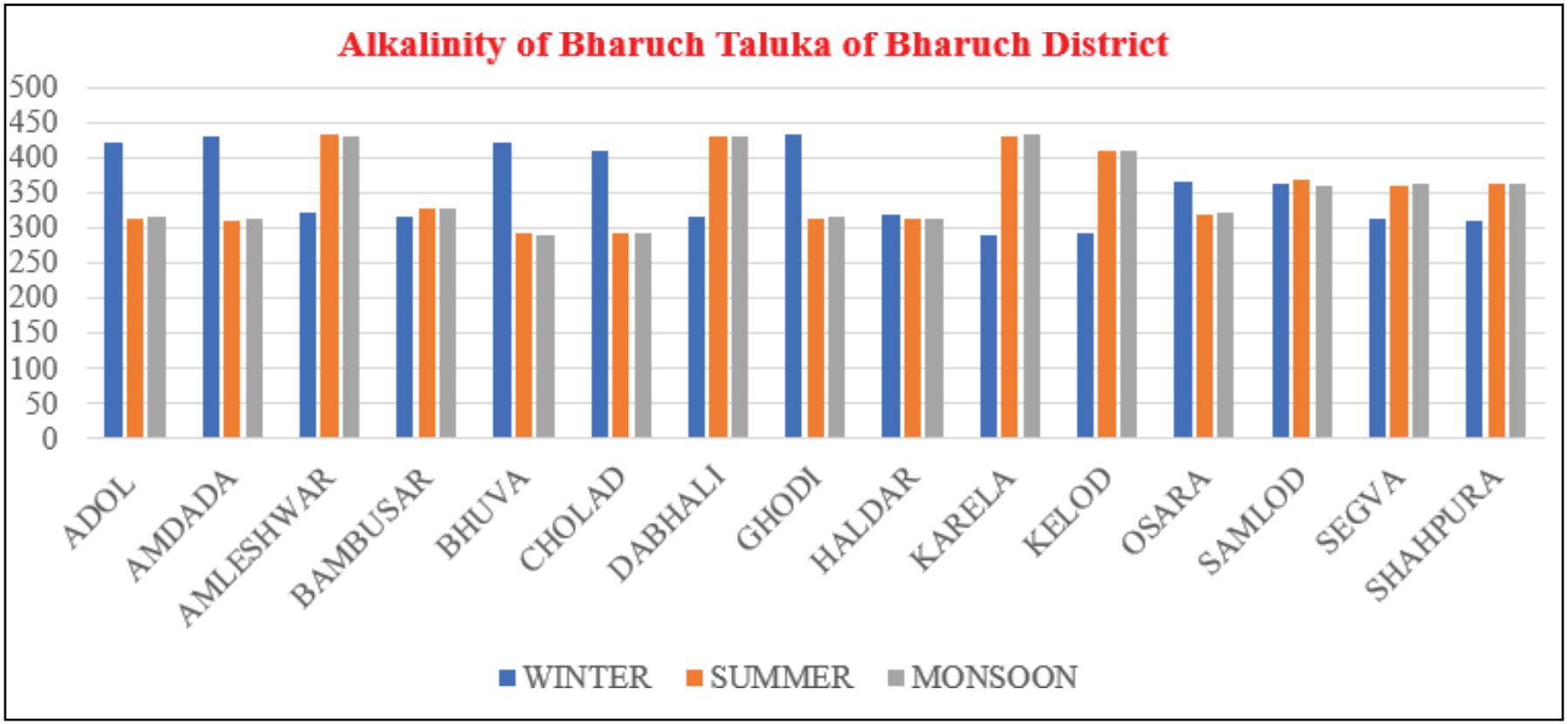

Mg2+ mg/L of Bharuch Taluka of Bharuch District
90
80
70
60
50
40
30
20
10
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

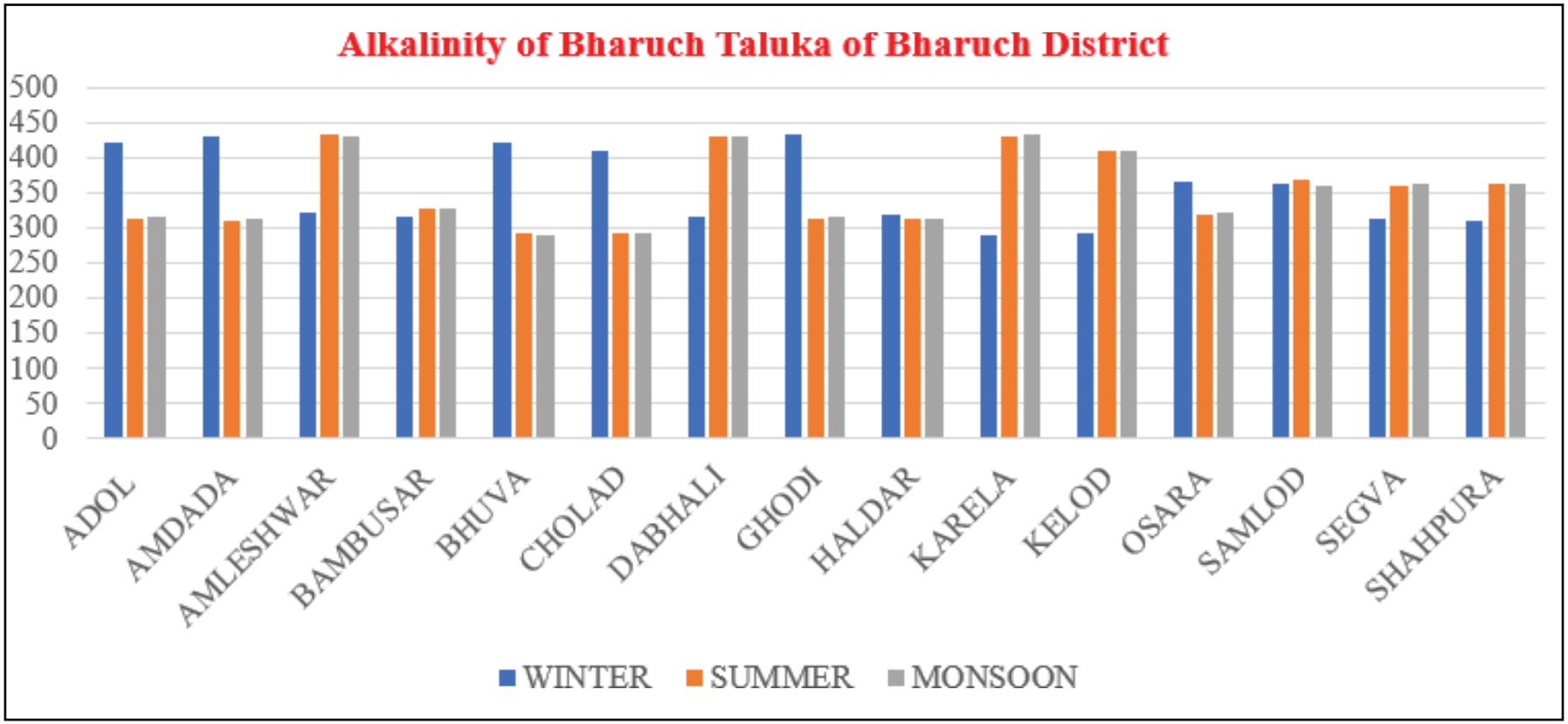

Cl1- mg/L of Bharuch Taluka of Bharuch District
140
120
100
80
60
40
20
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

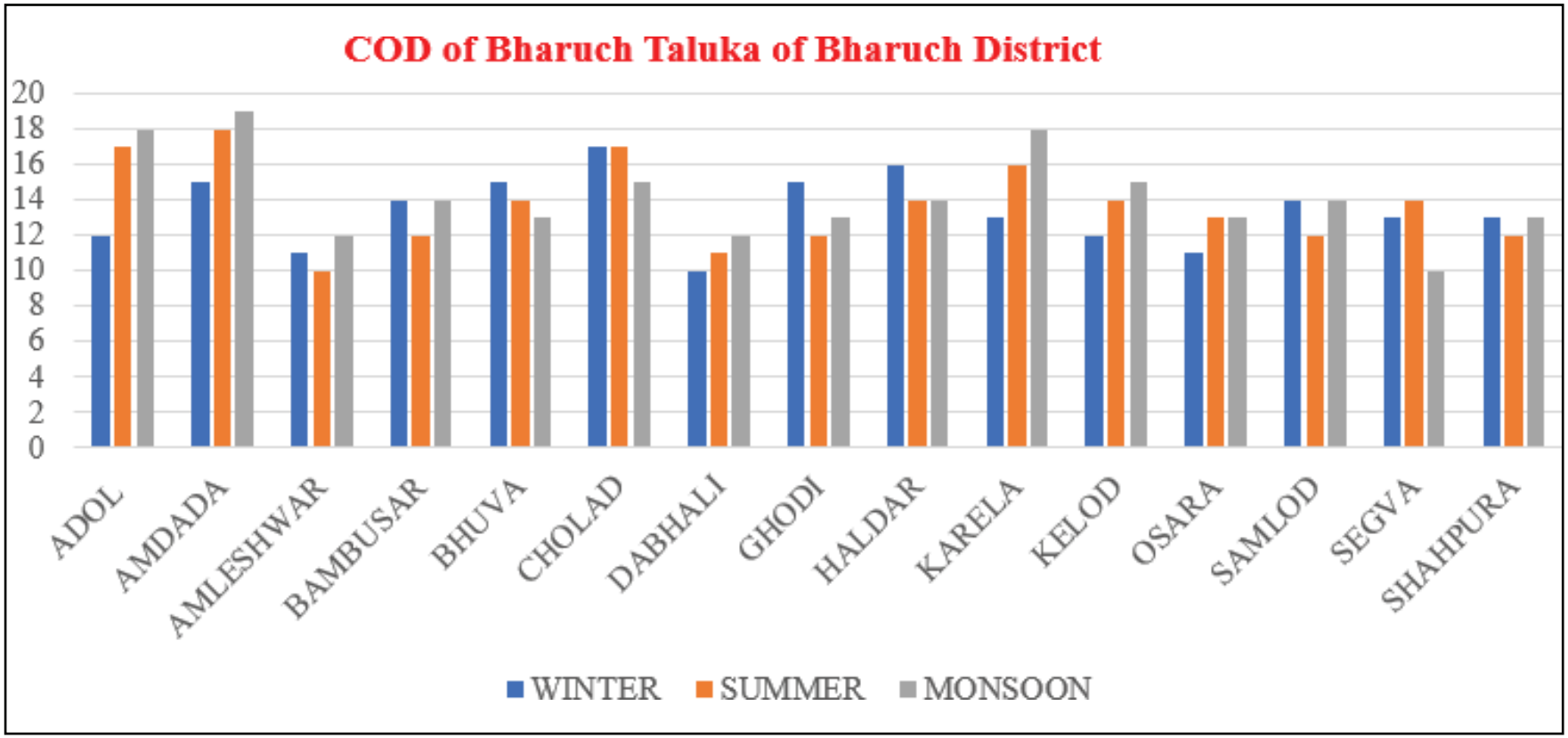

SO_4^{2-} mg/L of Bharuch Taluka of Bharuch District
60
50
40
30
20
10
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

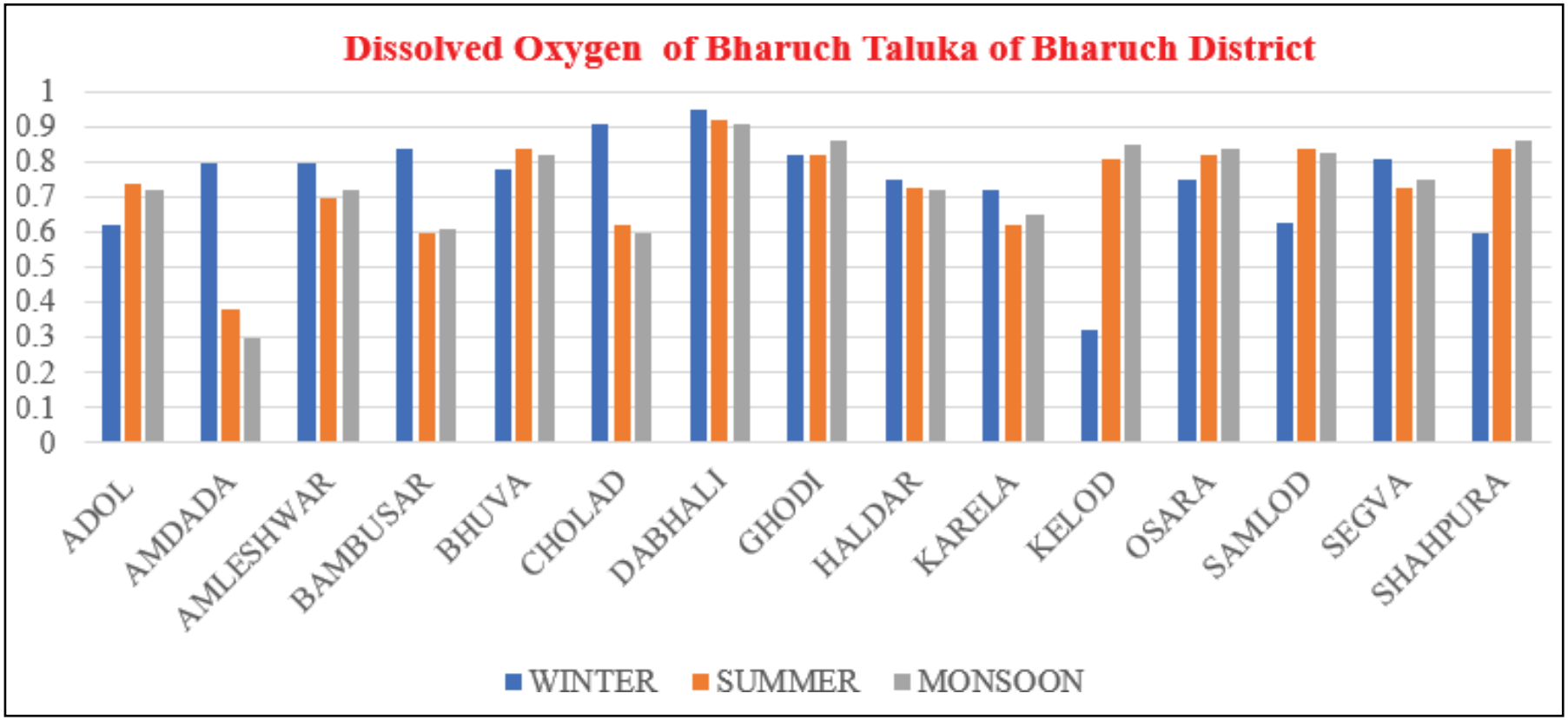

NO_3^{1-} mg/L of Bharuch Taluka of Bharuch District
25
20
15
10
5
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON


F1- mg/L of Bharuch Taluka of Bharuch District
1.4
1.2
1
0.8
0.6
0.4
0.2
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON


Alkalinity of Bharuch Taluka of Bharuch District
500
450
400
350
300
250
200
150
100
50
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON


Alkalinity of Bharuch Taluka of Bharuch District
500
450
400
350
300
250
200
150
100
50
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON


COD of Bharuch Taluka of Bharuch District
20
18
16
14
12
10
8
6
4
2
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON


Dissolved Oxygen of Bharuch Taluka of Bharuch District
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
ADOL
AMDADA
AMLESHWAR
BAMBUSAR
BHUVA
CHOLAD
DABHALI
GHODI
HALDAR
KARELA
KELOD
OSARA
SAMLOD
SEGVA
SHAHPURA
WINTER
SUMMER
MONSOON

4.4 RESULTS AND DISCUSSION OF PHYSICOCHEMICAL PARAMETERS FOR BHARUCH TALUKA

Ground water sample were collected from fifteen different stations of Bharuch Taluka of Bharuch district, Gujarat. Data obtained are discussed for its minimum and maximum values in comparison to standard value.

TDS

Salts, all nonvolatile materials and inorganic impurities are included in Total Dissolved Solid. Upper limit of TDS as 1000 mgL^{-1} specified by World Health Organization in 1993. Higher level of total dissolved solid may cause kidney disease, calcium deposition, stone, etc. Present study shows that TDS comes out to be 400 to 800 mgL^{-1}. Season wise lowest and highest value of this parameter are given below:

Higher value was found for **SAMLOD** station and Lower value was found for **DABHALI** station during winter season.

Higher value was found for **SAMLOD** station and Lower value was found for **BHUVA** station during summer season.

Higher value was found for **SAMLOD** station and Lower value was found for **DABHALI** station during monsoon season.

pH

pH is indicates the acidity and alkalinity of water. Acidic pH range is 0-7 and basic pH range is 7-14. Acceptable pH of water is 6.5-8.5 according to World Health Organization.

Higher value was found for **OSARA** station and Lower value was found for **SEGVA** station during winter season.

Higher value was found for **BAMBUSAR** station and Lower value was found for **SAMLOD** station during summer season.

Higher value was found for **BAMBUSAR** station and Lower value was found for **KARELA** station during monsoon season.

Total Hardness

Water contains anions, salts, minerals and cations such as magnesium and calcium. All these ions are responsible for the hardness of water. Acceptable value of total hardness for potable water is 300 mgL^{-1} according to WHO.

Higher value was found for **SAMLOD** station and Lower value was found for **SHAHPURA** station during winter season.

Higher value was found for **HALDAR** station and Lower value was found for **AMLESHWAR** station during summer season.

Higher value was found for **HALDAR** station and Lower value was found for **AMLESHWAR** station during monsoon season.

Calcium content

Calcium is required to strengthen our bones but excess level of calcium may cause kidney stone and other problems. Desirable limit for calcium is 75 to 200 mgL^{-1} in accordance with WHO.

Higher value was found for **AMLESHWAR** station and Lower value was found for **KARELA** station during winter season.

Higher value was found for **BAMBUSAR** station and Lower value was found for **SAMLOD** station during summer season.

Higher value was found for **BHUVA** station and Lower value was found for **AMLESHWAR** station during monsoon season.

Mg^{2+} content

To keep the digestion better in the body, Magnesium is the one of the important mineral but its values above the desirable value may led to irritation in gastrointestinal tract. Desirable value is 50 to 100 mgL^{-1} according to WHO.

Higher value was found for **BAMBUSAR** station and Lower value was found for **AMLESHWAR** station during winter season.

Higher value was found for **KELOD** station and Lower value was found for **SEGVA** station during summer season.

Higher value was found for **KELOD** station and Lower value was found for **SEGVA** station during monsoon season.

Chloride content

Most of water bodies possess chloride and more than 50% chloride is present in the common salt. Higher level of chloride may cause seance towards test, heart, kidney and laxative effect. Desirable value is up to 250 mgL^{-1} according to WHO.

Higher value was found for **ADOL** station and Lower value was found for **OSARA** station during winter season.

Higher value was found for **AMLESHWAR** station and Lower value was found for **BHUVA** station during summer season.

Higher value was found for **AMLESHWAR** station and Lower value was found for **BHUVA** station during monsoon season.

$SO4^{-2}$ content

As compared to chloride, the sulphate has very slight outcome on the test of water. Higher level of sulphate in comparison to desirable limit may cause intestinal disorder and diarrhea. Desirable value is from 200 to 400 mgL^{-1} according to WHO.

Higher value was found for **ADOL** station and Lower value was found for **OSARA** station during winter season.

Higher value was found for **HALDAR** station and Lower value was found for **BAMBUSAR** station during summer season.

Higher value was found for **HALDAR** station and Lower value was found for **AMDADA** station during monsoon season.

$NO3^{-}$ content

Nitrate is available in combined form such as nitrogen, which is one of the important components for the plant growth. If nitrate containing water is used for preparation of food, it will cause diarrhea in child and adult as well as blue baby syndrome. Desirable value is up to 45 mgL^{-1} according to WHO.

Higher value was found for **AMLESHWAR** station and Lower value was found for **GHODI** station during winter season.

Higher value was found for **GHODI** station and Lower value was found for **AMLESHWAR** station during summer season.

Higher value was found for **GHODI** station and Lower value was found for **AMLESHWAR** station during monsoon season.

Fluoride content

Number of minerals are soluble in water because they form salt with the fluoride. Fluorosis, porous bone disease is caused by the excess limit of the fluoride ion. Desirable value is 0.6 to 1. mgL^{-1} according to WHO.

Higher value was found for **GHODI** station and Lower value was found for **BHUVA** station during winter season.

Higher value was found for **BHUVA** station and Lower value was found for **ADOL** station during summer season.

Higher value was found for **BHUVA** station and Lower value was found for **ADOL** station during monsoon season.

Alkalinity

Water is alkaline because of presence of carbonates, bicarbonates and hydroxides. It is nothing but ability of water to neutralize acidity. Desirable value is up to 600 mgL^{-1} according to WHO.

Higher value was found for **AMDADA** station and Lower value was found for **KARELA** station during winter season.

Higher value was found for **AMLESHWAR** station and Lower value was found for **BHUVA** station during summer season.

Higher value was found for **KARELA** station and Lower value was found for **BHUVA** station during monsoon season.

Turbidity

Desirable value is 10 NTU for drinking water, according to WHO.

Higher value was found for **AMDADA** station and Lower value was found for **SEGVA** station during winter season.

Higher value was found for **SHAHPURA** station and Lower value was found for **BAMBUSAR** station during summer season.

Higher value was found for **HALDAR** station and Lower value was found for **AMLESHWAR** station during monsoon season.

Chemical Oxygen Demand (COD)

It is the oxygen requirement for oxidation. Of organic matter it is one of the significant properties of drinking water. Majority of ground water was dissolve oxygen level 4.2 to 6.0. Desirable limit is 3 mgL^{-1} according to WHO. Water with saturated oxygen gives very pleasant teste. Water with less dissolve oxygen value than desirable limit is fetal for aquatic animals.

Higher value was found for **CHOLAD** station and Lower value was found for **DABHALI** station during winter season.

Higher value was found for **AMDADA** station and Lower value was found for **AMLESHWAR** Station during summer season.

Higher value was found for **AMDADA** station and Lower value was found for **SEGVA** station during monsoon season.

Biological Oxygen Demand (BOD)

It is the Oxygen requirement for the oxidation of organic waste in the water in the presence of bacteria and/or protozoa. High BOD level indicates less dissolved oxygen. Plant kingdom is survived in the water due to nitrate and phosphate salts present in the water. World Health Organization recommends the water having BOD value 30 $mgL-^{1}$.

Higher value was found for **OSARA** station and Lower value was found for **AMLESHWAR** station during winter season.

Higher value was found for **HALDAR** station and Lower value was found for **DABHALI** station during summer season.

Higher value was found for **HALDAR** station and Lower value was found for **BHUVA** station during monsoon season.

Dissolved Oxygen

Higher value was found for **DABHALI** station and Lower value was found for **SHAHPURA** station during winter season.

Higher value was found for **DABHALI** station and Lower value was found for **AMDADA** station during summer season.

Higher value was found for **DABHALI** station and Lower value was found for **AMDADA** station during monsoon season.

❐❐❐