



Physico-chemical and Comparative analysis of Underground Water in Summer and Winter Season 2014 of Rewa city, MP, India

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Abstract

Recent research focuses on the physico-chemical and comparative analysis of underground water in summer and winter season 2014 of Rewa district, Madhya Pradesh state, India. At most of the samples are within prescribed limits as suggested by the world health organization (WHO), Indian Standard Institute (ISI) for drinking purposes and BIS desirable limit. Season wise variation in physical and chemical parameters like Turbidity, colour, odour, Taste, pH Value, Total hardness, calcium, magnesium, Total alkalinity, chloride, Total dissolved solid, Iron, sulphate etc. All parameters of underground water in summer and winter season were found in some limits.

Keywords: Physical-chemical study, physical-chemical analysis, water hardness, physical and chemical property, comparative analysis, Madhya Pradesh India.

Introduction

In this paper results of physical-chemical and comparative analysis of underground water in summer and winter season 2014 of Rewa district, Madhya Pradesh state, India analyzes for Turbidity, colour, odour, taste, pH value, total hardness, calcium, magnesium, total alkalinity, chloride, total dissolved solid, iron, sulphate, etc. Underground water of Nehru Nagar, Engineering hostel, Rathara Rewa sample are indicated by A, B, C (summer season) and underground water Godhar Keri, Kailashpuri, Engineering Colony sample are indicated by sample X, Y, Z (winter season).

Material and Method

Material requirement for sampling and analysis of water, Personnel and sample transport arrangement, Area map, sampling site location map, icebox, weighted bottle sampler, D.O. Sample, Rope, D.O.D. Bottles, Sample containers, Special sample containers, bacteriological and Special sample, heavy metals, D.O. Fixing and traction chemical and glassware, thermometer, Tissue papers, other field measurement are sample identification forms, labels for sampling containers, field note bottle, pen, pencil, markers, soap and towel, matchbox, spirit lamp, torch etc. All analysis was carried out as per APHA (1998), ISI and BIS desirable limit for drinking water. Physical and chemical analysis methods are depicted as follows for Turbidity in water is determined by nephelometric method with sample cells using hydrazine sulfate, distilled water, hexamethylenetetramine, color in water is determined by visual comparison using stock standard equivalent to 500 color units,

potassium chloroplatinate, crystallized cobalt us chloride, hydrochloric acid, odour in water is determined by qualitative human receptor method and taste in water is determined by physically, pH Value in water is determined by pH meter, total dissolved solids in water is determined by TDS measurement apparatus, total hardness in water is determined by EDTA complex metric titration method using EDTA solution, buffer solution, EBT indicator, distilled water and titration apparatus, Calcium in water is determined by EDTA titrimetric method using NaOH, ammonium purpurate, standard EDTA solution, standard calcium solution, magnesium in water are determined by calculation from total hardness and calcium by EDTA method, sulphate in water are determined by nephelometry method using nephelometric turbidity meter with sample cells, magnetic stirrer, timer within dictator of second, Total alkalinity in water is determined by titration method using H₂SO₄ solution, methyl orange indicator, phenolphthalein indicator, chloride in water are determined by argent metric titration method using potassium chromate indicator, standard silver nitrate, aluminum hydroxide suspension, standard sodium chloride¹⁻⁶.

Results and Discussion

Below table-1 shows average values of underground water sample A, B, C (summer season) value of turbidity (NTU) 2.8, 2.0, 2.3, colour of water colourless, colourless, colourless odour of water UN/OBJ, UN/OBJ, UN/OBJ and taste of water unpleasant, unpleasant, unpleasant, value of pH ranges 7.6, 7.8, 7.8, total hardness (mg/l) 328, 310, 340, value of Ca²⁺ (mg/l) 140, 128, 220, value of Mg²⁺ (mg/l) 188, 192, 120 value of total alkalinity (mg/l) 160, 210, 320, value of chloride (mg/l)

33, 38, 30, value of TDS (mg/l)368, 382, 382, value of iron (mg/l) 0.03, 0.06, value of SO₄²⁻ (mg/l) 56, 63, 64,etc. other underground water sample X, Y, Z (winter season) value of turbidity (NTU) 0.1, 0.1, 0.1, colour of water colourless, colourless, colourless odour of water UN/OBJ, UN/OBJ, UN/OBJ and taste of water unpleasant, unpleasant, unpleasant, value of pH ranges 7.6, 7.5, 7.5, total hardness (mg/l) 1440, 640,460, value of Ca²⁺ (mg/l) 20.0, 10.8, 5.64, value of Mg²⁺(mg/l)5.28, 1.10, 2.06,value of total alkalinity (mg/l) 280, 460, 380 value of chloride (mg/l) 35, 87, 61, value of TDS (mg/l) 1165, 930, 710, etc.

Conclusion

Physico-chemical study of the underground water sample indicate the overall alkaline nature and very hard. The underground water pH between desirable limit. Sample have TDS less or more than 1000 mg/l; hence suitable or not suitable for drinking and samples have normal chloride, normal sulfate. The comparison of analyzing data with WHO (1984), ISI (1991) and BIS desirable limit for drinking water indicates that all water is more or less suitable for drinking⁷⁻¹⁰.

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Figure - 1
Map of Rewa District

Table – 1
Average value of underground water parameters in summer and winter season – 2014

Units	Parameters	Sample-a	Sample-b	Sample-c	Sample-x	Sample-y	Sample-z
NTU	Turbidity	2.8	2.0	2.3	0.1	0.1	0.1
Hazen Units	Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
-	Odour	Un/obj	Un/obj	Un/obj	Un/obj	Un/obj	Un/obj
-	Test	Unplasant	Unplasant	Unplasant	Unplasant	Unplasant	Unplasant
PH Scale	PH Value	7.6	7.8	7.8	7.6	7.5	7.5
Mg/l	Total Hardness	328	310	340	1440	640	460
Mg/l	Calcium	140	128	220	20.0	10.8	5.64
Mg/l	Magnesium	188	192	120	5.28	1.10	2.06
Mg/l	Total Alkalinity	160	210	320	280	460	380
Mg/l	Chloride	33	38	30	35	87	61
Mg/l	TDS	368	382	382	1165	930	710
Mg/l	Iron	0.03	0.06	Nil	Nil	Nil	Nil
Mg/l	Sulphate	56	63	64	Nil	Nil	Nil

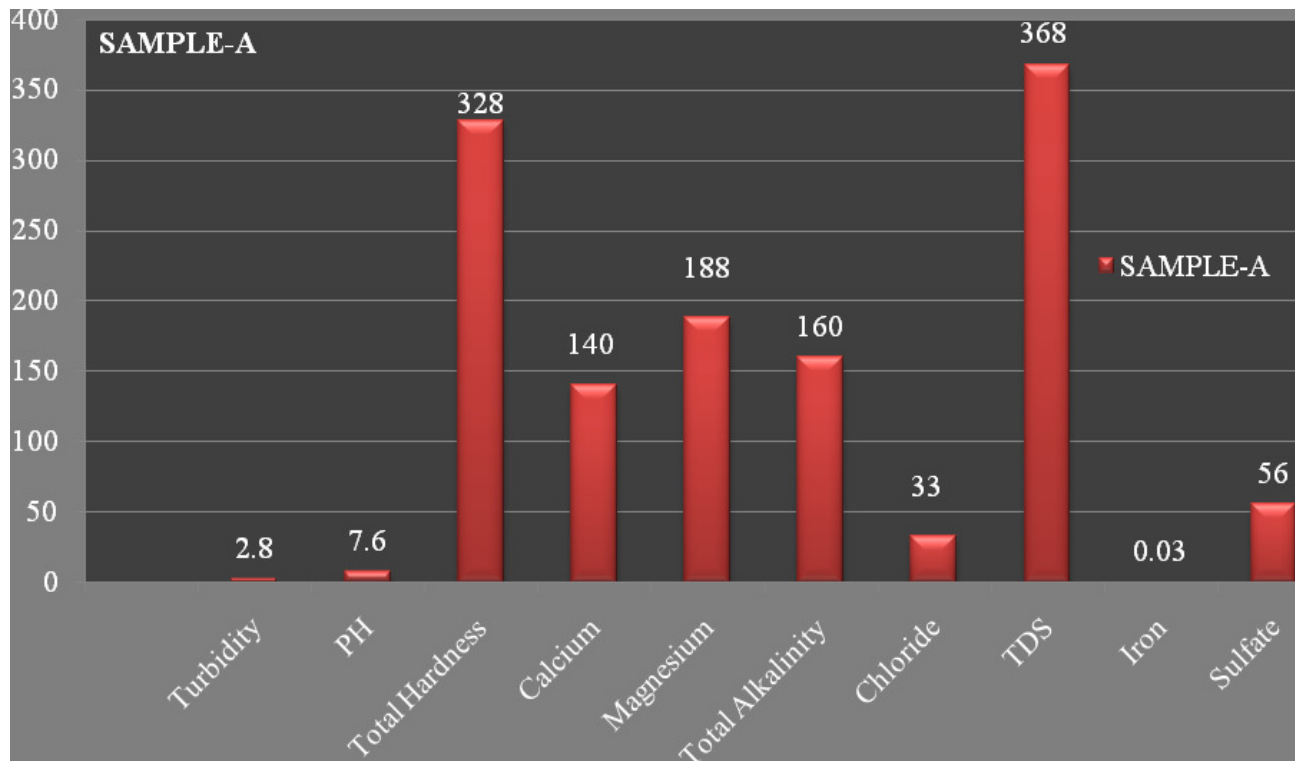


Figure-2
Average value of all parameters in summer season

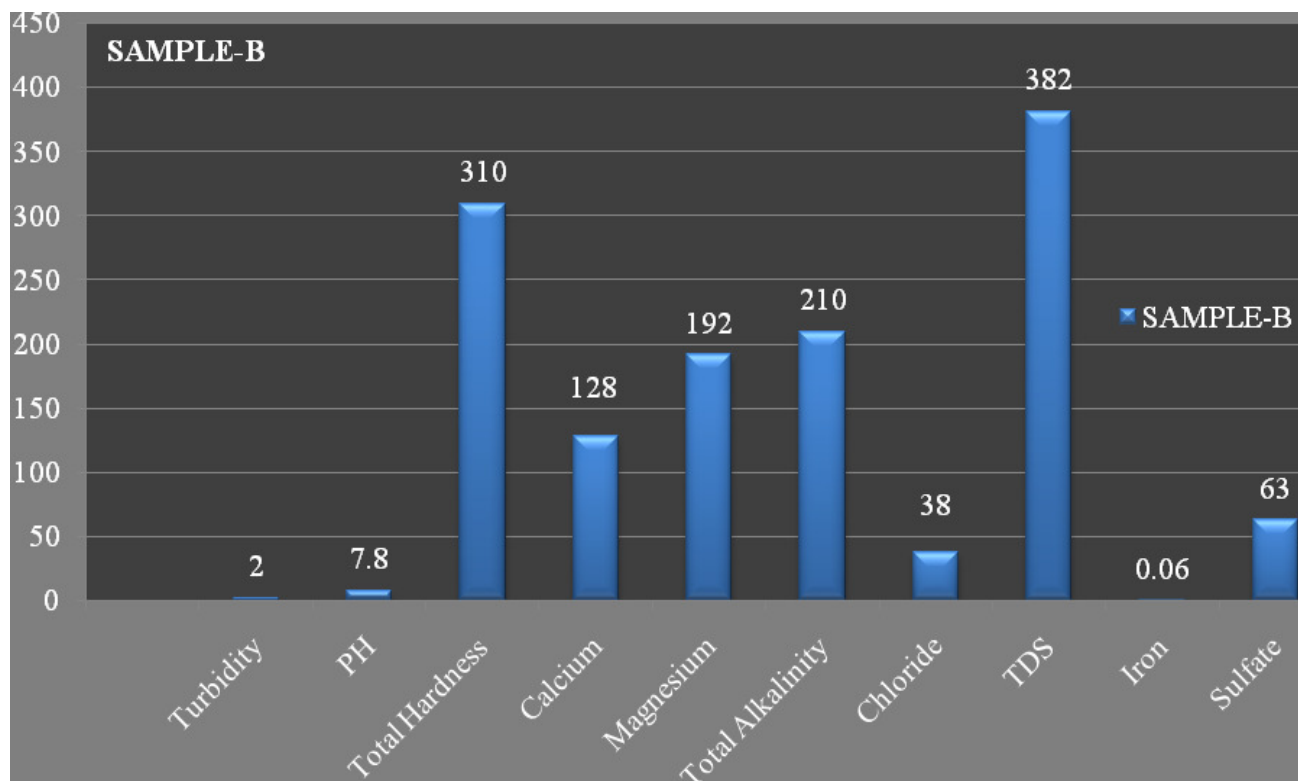


Figure-3
Average value of all parameters in summer season

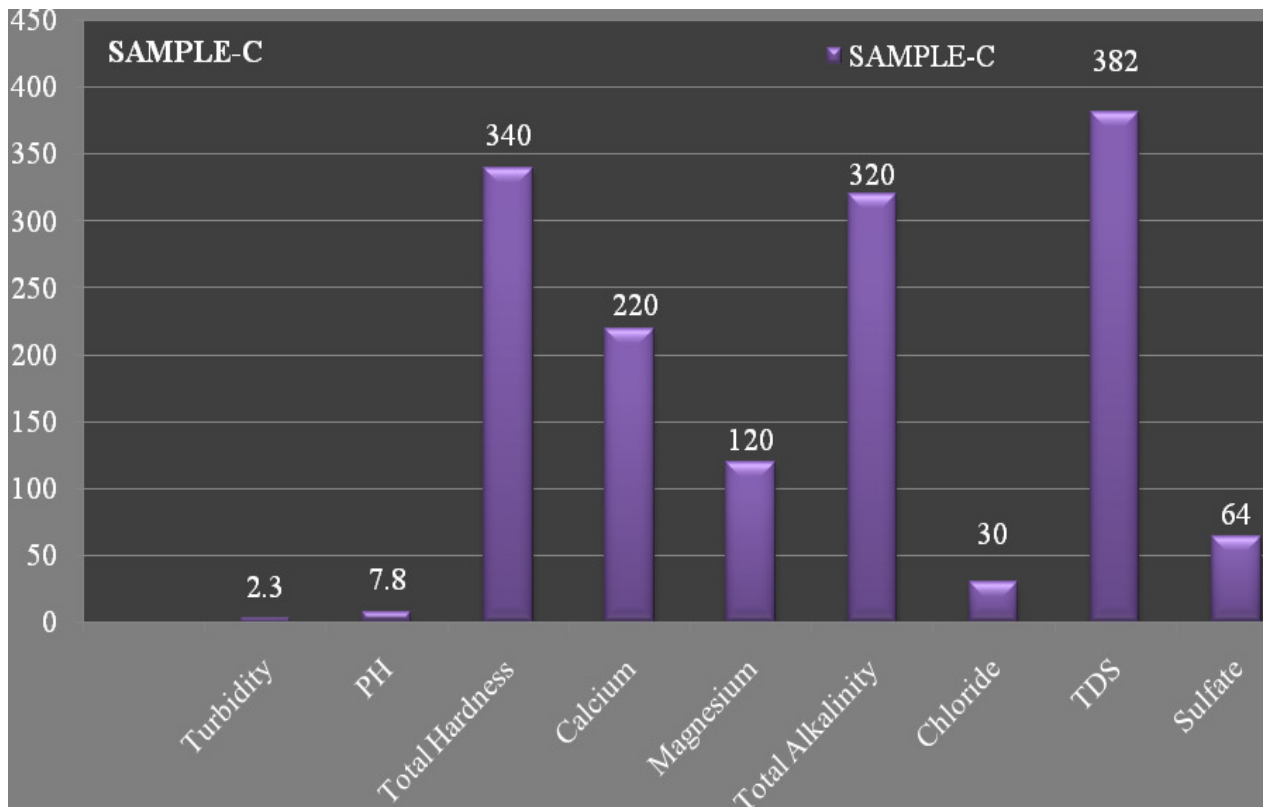


Figure-4
Average value of all parameters in summer season

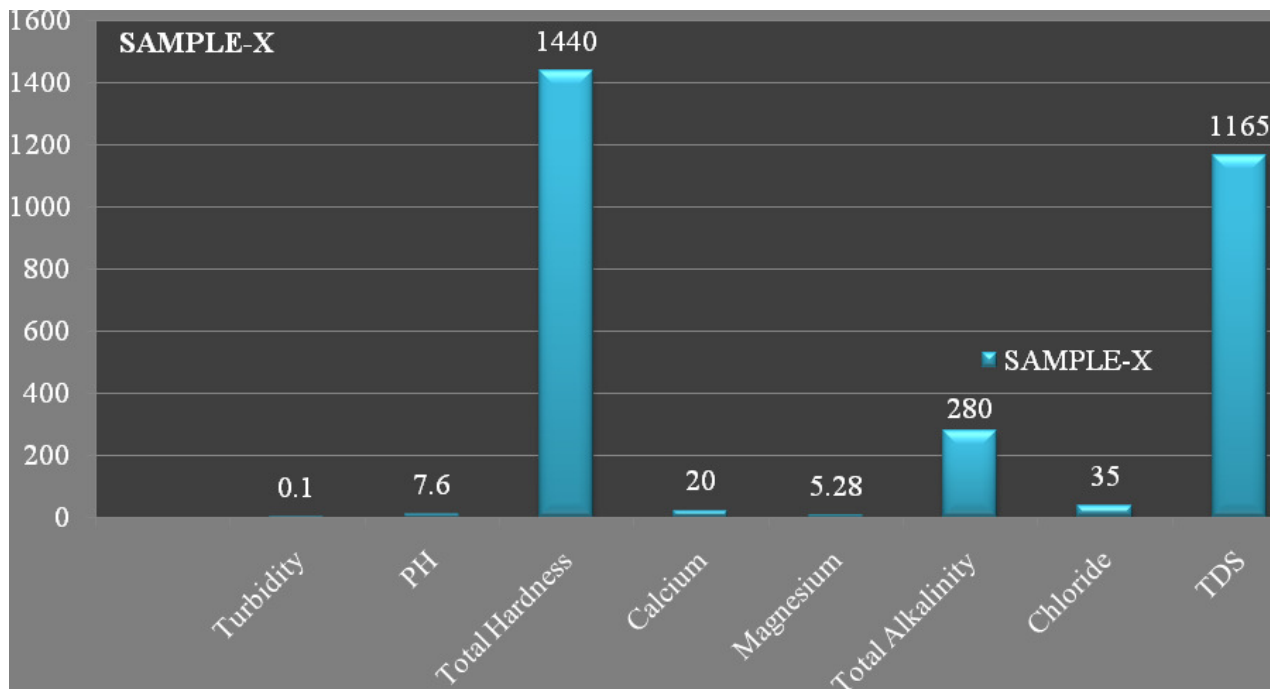


Figure-5
Average value of all parameters in winter season

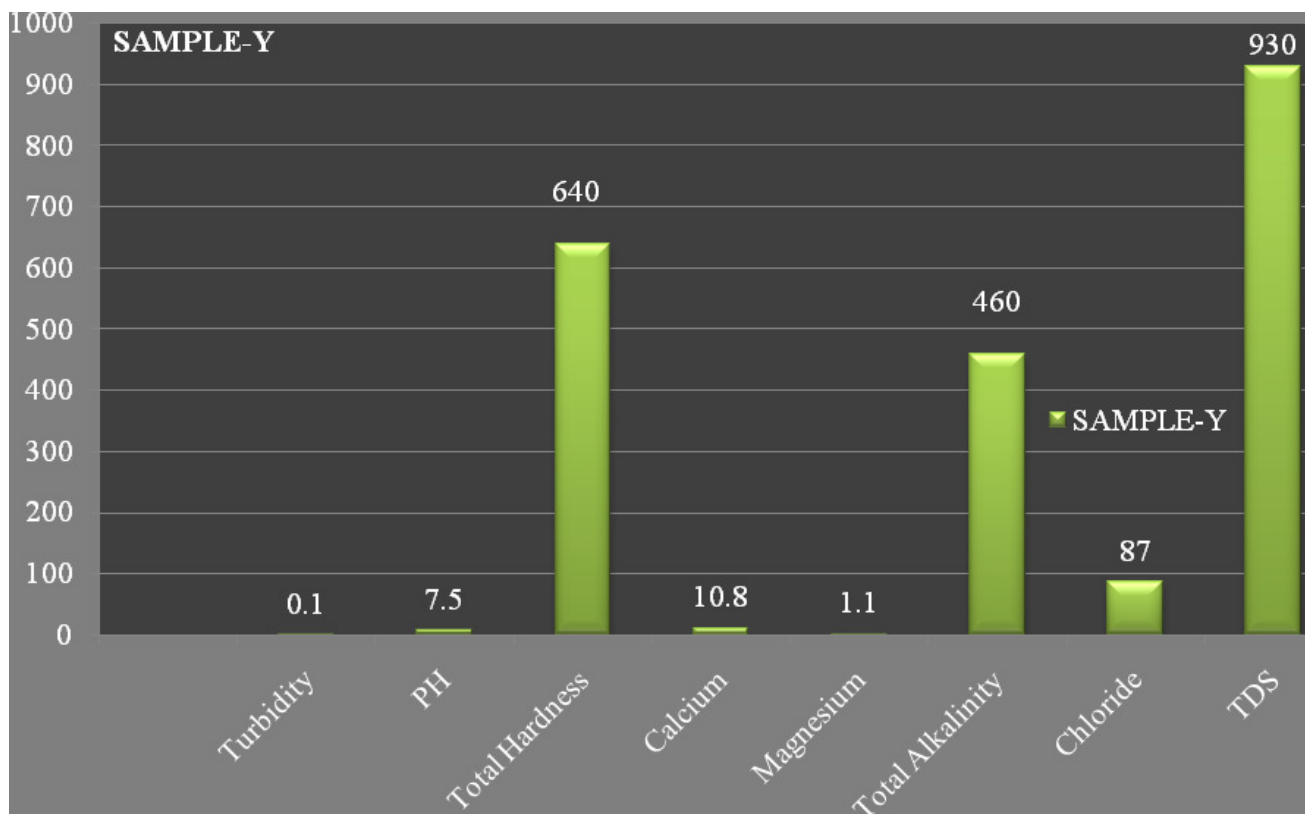


Figure-6
Average value of all parameters in winter season

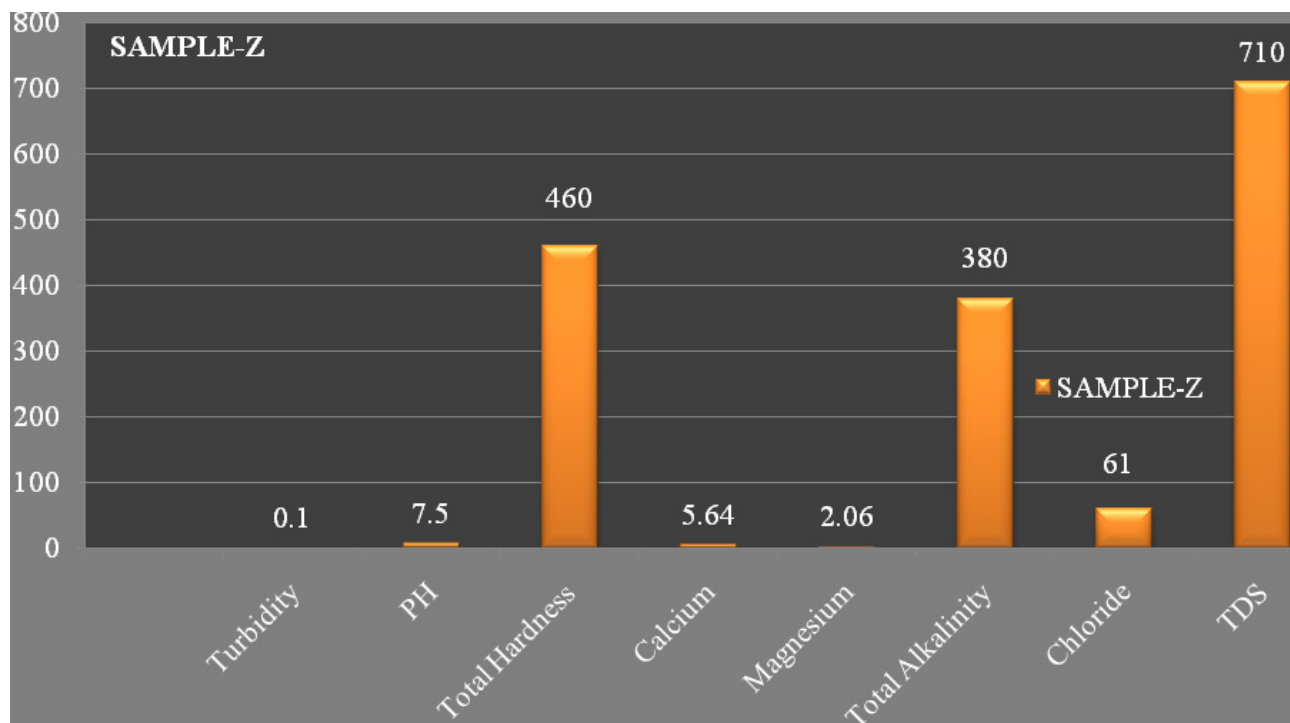


Figure-7
Average value of all parameters in winter season

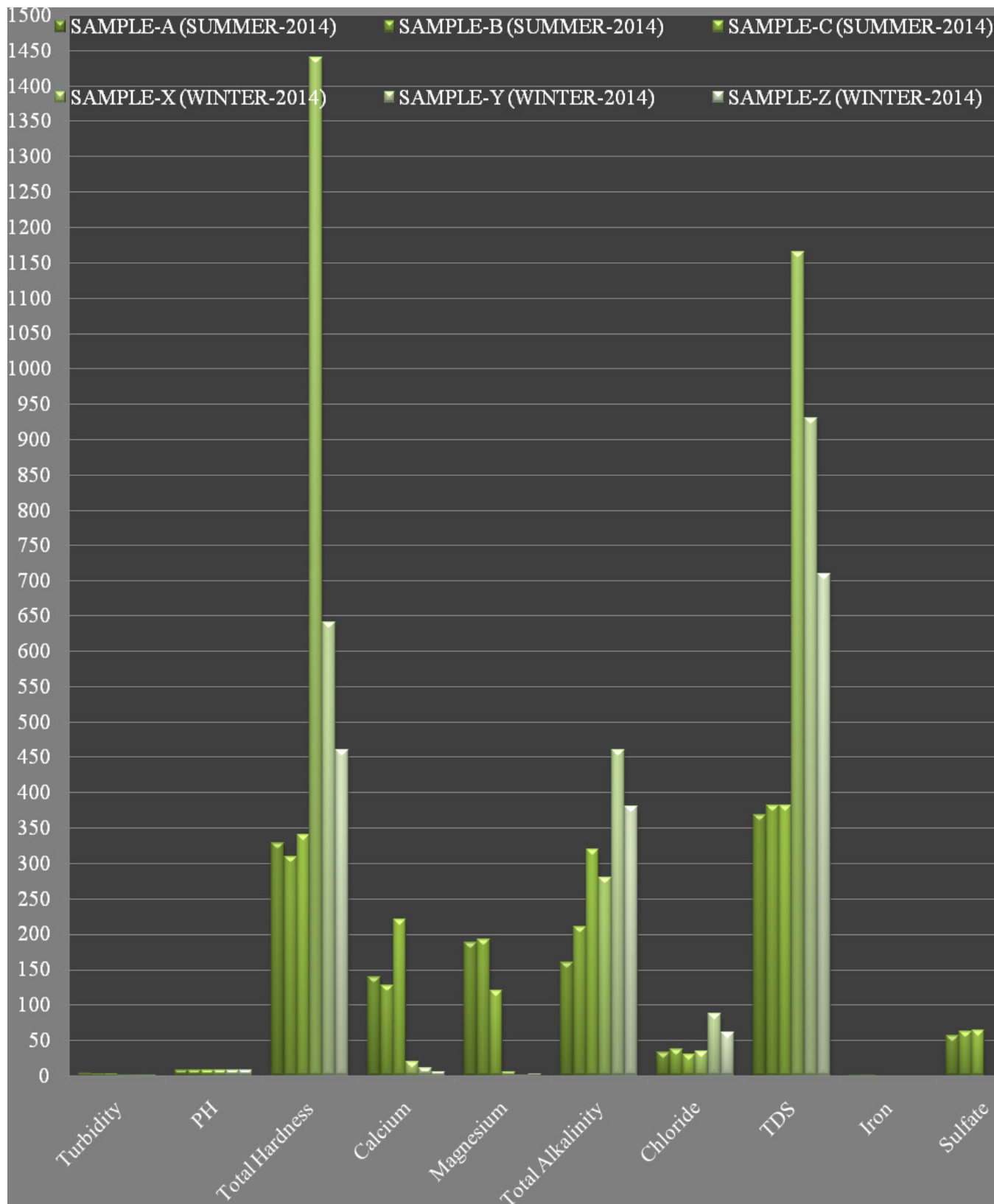


Figure-8
 Average value of all sample parameters in summer and winter season-2014

Table-2

Water quality parameters and drinking water standards

Parameters	Units	Drinking water WHO (1984) and ISI (1991)	
		Desirable	Maximum
pH value	NIL	6.5 to 8.5	No relaxation
Dissolved Solids	Mg/l	500	2000
Colour	Hazen units	5	25
Odour	NIL	Unobjectionable	-
Turbidity	NTU	5	10
Taste	NIL	Agreeable	-
Total hardness (asCaCO ₃)	Mg/l	300	600
Alkalinity	Mg/l	200	600
Calcium	Mg/l	75	200
Manganese	Mg/l	0.1	0.3
Nitrate	Mg/l	50	No relaxation
Chloride	Mg/l	250	1000
Sulphate	Mg/l	200	400

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Table-3

Water quality parameters and drinking water standards

Parameters	BIS Desirable limit for drinking water
PH Value	6.5-8.5
TDS (Mg/l)	500
Total hardness (Mg/l)	300
Total alkalinity (Mg/l)	200
Ca ²⁺ (Mg/l)	75
Mg ²⁺ (Mg/l)	100
Na ⁺ (Mg/l)	60
NO ₃ ⁻ (Mg/l)	45
Chloride (Mg/l)	250
SO ₄ ²⁻ (Mg/l)	200
CO ₃ ²⁻ (Mg/l)	NIL
HCO ₃ ⁻ (Mg/l)	250

Table-4

Range of hardness in various units

Classification	Hardness in Mg/L	Hardness in Mmol/L	Hardness in DGH/°dH	Hardness in GPG	Hardness in PPM
Soft	0-60	0-0.60	0-3.37	0-3.50	Less than 60
Moderately hard	61-120	0.61-1.20	3.38-6.74	3.56-7.01	60-120
Hard	121-180	1.21-1.80	6.75-10.11	7.06-10.51	120-180
Very hard	≥ 181	≥ 1.81	≥ 10.12	≥ 10.57	> 180