ASSESSING THE SUITABILITY OF GROUNDWATER AT JHABUA DISTRICT, MADHYA PRADESH, FOR HUMAN CONSUMPTION IN TERMS OF CHEMICAL PURITY

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ABSTRACT

The publication describes chemical quality delineation of ground water suitable for human applicators in Jhabua district, Madhya Pradesh, India for various uses. The major goal is to examine ground water quality in the research region and determine its appropriateness for drinking and domestic use. Chemical analysis was used to determine ground water quality for human use. Piper trilinear graphic shows ground water quality and appropriateness. This research assessed ground water quality in the study region and determined its suitable for residential and drinking use. When comparable ground water samples plot together, it displays their similarities and differences. Ground water meets Bureau of Indian Standards and World Health Organization guidelines for drinking and residential use.

***KEYWORDS**: Chemical Guality Evaluation, Jhabua district, Madhya Pradesh*

INTRODUCTION

95% of rural populations use ground water. Population increase degrades groundwater quality. Humans cannot tolerate excessive ground water ions.

Dissolved salts, climate, soil, rock, topography, human activity, coastal saline water incursion, and other factors affect water quality. It's dirt or rock-based. Physical, chemical, biological, and radiological factors determine ground water quality. Groundwater management requires both quality and quantity (Todd, 1980). Chemical analysis determines water total dissolved salts. In water, dissolved salts breakdown into ions including Calcium, Potassium, and Calcium carbonate. The aquifer system influences groundwater's appropriateness for irrigation, residential water, industrial usage, animal watering, and other applications (Todd, 2001).

Groundwater's physical, chemical, biological, and radioactive qualities determine its home, industrial, and agricultural uses. Groundwater quality data show rock geology, recharge, discharge, transport, and storage. Understanding water quality is essential for water and land resource management (Karanath, ,1994, 2003). Physical quality criteria include temperature, pH, specific conductance, total dissolved solid, etc. Chemical quality parameters include hardness, calcium, magnesium, sodium, potassium, chloride, carbonate, bicarbonate, nitrate, and sulphate. Physical and chemical characteristics of groundwater samples from the study area have been evaluated because they are biologically and radiologically stable.

Surface water is dirtier than groundwater. Dirt and pebbles filter bacteria in water. Some spring and well water is too dissolved to drink. Saltwater contains sodium, calcium, magnesium, potassium, chloride, sulphate, and bicarbonate.

COLLECTION OF GROUND WATER SAMPLES

Rainwater and Thatcher (1968), Hem (1970), Walton (1970), Brown et al. (1970), I.C.M.R. (1975), Todd (2001), Karanth (2003), and others have discussed sample collection, preservation, analysis, and interpretation.

25 groundwater wells gathered study area groundwater samples. The samples were collected in pre-clean sterilized 1-liter polyethylene bottles and labeled with Locality, Sample number, and Collection Date. Water samples were packed and stored in a box. The lab analyzed the samples. pH and EC meters were used to test groundwater samples. Standard laboratory procedures measured the ionic concentrations of sodium, calcium, magnesium, potassium, carbonate, bicarbonate, chloride, and sulphate.

METHOD OF CHEMICAL ANALYSIS

Analyzing water's physical and chemical properties distinguishes its quality: Rainwater and Thatcher (1968), Brown et al. (1970), and American Public Health Association (1970) used chemical analytical techniques (1998). The values were verified using Richards (1954)'s chemical analysis verification method. Physical and chemical properties are shown (Table 3 and 4). Piper (1953) and Sadashivaiah et al. (2008) trilinear diagrams show ionic concentrations. The U.S. Salinity diagram (1954) and Wilcox diagram (1955) determine ground water irrigation quality.

PHYSICAL ANALYSIS

Water physical properties include color, odor, taste, pH, EC, and TDS (TDS). Descriptions and values of physical parameters are documented (Table 1.1).

Colour

Solvents give water its color. These materials are largely organic chemicals from decaying plants and inorganic colored compounds from industrial waste effluents. All groundwater samples in research region are colorless (Table 1.1).

Odour and Taste

Water smells and tastes from degraded organic matter and volatile chemical compounds. Drinking water must be odorless and tasteless. Water aroma and taste are assessed by diluting the sample till the tongue can hardly detect it. All research samples are odorless and tasteless (Table 1.1).

HYDROGEN ION CONCENTRATION

The concentration of H+ ions in water is used to measure acidity or alkalinity as "hydrogen ion concentration" (pH). The purest water at 250 C dissociates to 10-14 g molecules per litre of H+ and OH- ions. According to Garg (1979), water's pH value is the reciprocal of its hydrogen ion concentration, and pure water has 10-7 moles per liter of each. Neutral water pH is 7. If the water's pH is below 7, it's acidic; over 7, it's alkaline. Photosynthesis (Co_2 consumption) raises pH throughout the day, whereas respiratory activity lowers it at night. Air, temperature, industrial waste, and other variables influence pH.

In the research region, excavated well water pH levels vary from 7.01 to 8.10. Jhayara has a pH of 7.09 and Amarpura 8.10. The research shows that study region ground water samples meet WHO and BIS standards.

Electrical Conductivity

Specific Conductivity (E, C) is the reciprocal of electrical resistance. A conductor's electrical conductivity is measured in µ mho/cm. All water conducts electricity. Conductance is somewhat correlated with ionized mineral salt concentration in solution.

Electrical Conductivity in the studied region ranges from 305 to 910 µ moho /cm (Table 1).

Kesariya has the lowest E.C. value of 305, while Kalyanpura has the highest.

Table 1: Physical Parameters of dug water samples of Meghnagar area, Jhabua, District, M. P.

Well No.	Location	Colour	Ordour	Taste	EC at 25°C	TDS ppm	pH
1.	Dhebar	CL	OL	TL	321	268	7.20
2.	Dhebar	CL	OL	TL	785	257	7.04
3.	Bhagaur	CL	OL	TL	515	325	7.95
4.	Balban	CL	OL	TL	310	395	8.00
5.	jhayara	CL	OL	TL	340	301	7.01
6.	Hirapur	CL	OL	TL	810	460	7.02
7.	Barkhera	CL	OL	TL	550	290	7.92
8.	Junwaniya	CL	OL	TL	320	355	7.00
9.	Junwaniya	CL	OL	TL	901	250	7.20
10.	Amlipathar	CL	OL	TL	360	332	7.80
11.	Dundaka	CL	OL	TL	490	295	7.07
12.	Negariya	CL	OL	TL	416	320	7.80
13.	Ishgarh	CL	OL	TL	365	345	7.95
14.	Kalyanpura	CL	OL	TL	910	403	7.30
15.	Kesariya	CL	OL	TL	305	372	7.45
16.	Amarpura	CL	OL	TL	385	395	8.10
17.	Antarbeliya	CL	OL	TL	745	289	7.33
18.	Meghnagar	CL	OL	TL	485	364	7.32
19.	Partapura	CL	OL	TL	355	358	7.71
20.	Rampura	CL	OL	TL	567	290	7.21
21.	Mauripara	CL	OL	TL	360	385	7.95
22.	Bhendarlya	CL	OL	TL	300	415	7.40
23.	Gundipara	CL	OL	TL	625	365	7.32
24.	Gopalpura	CL	OL	TL	430	310	7.20
25.	Nawapara	CL	OL	TL	625	422	7.09

Abbreviation: CL = Colourless, OL = Odourless, TL = Tasteless

Total Dissolved Solids

For groundwater categorization, total dissolved solids indicate salt content. All dissolved solids are mostly minerals. Dissolved solids in natural water are mostly Carbonate, Bicarbonate, Chloride, Sulphate, Phosphate, Nitrate, and Calcium, Magnesium, Sodium, Potassium, Iron, and Manganese.

Drinking water and other water quality criteria depend on dissolved solids (Table

1). Higher concentrations make water taste different and less portable. TDS concentration in drinking water:

Excellent	Less than 300 mg / liter
Good	Between 300 mg to 600 mg / liter
Fair	Between 600 mg and 900 mg / liter
Poor	Between 900 mg and 1200 mg/liter
Unacceptable	Greater than 1200 mg / liter

Dissolved Solids (TDS) range from 250 mg/l (Junwaniya) to 460 mg/l (Hirapur) throughout the research region, within the standard limits. Table 1.

CHEMICAL QUALITY ANALYSIS

The following chemical characteristics are determined, among others: Hardness overall, as well as common cations and anions

Total Hardness

Carbonate and non-carbonate ions are the major causes of water hardness. The calcium carbonate equivalent of the calcium and magnesium ions present in water, given in ppm or mg/l, is how Garg (1979) defined hardness. In general, there are two kinds of water hardness:

Temporary hardness – The hardness of water caused by calcium and magnesium may be reduced by boiling the water or adding lime to it.

Permanent hardness when water contains calcium and magnesium sulphates, chlorides, and nitrates. Boiling cannot get rid of it; instead, specific water treatment is required.

Hardness, mg / liter	**Water class**
0 – 75	Soft
75 –150	Moderately hard
150-300	Hard
Over 300	Very hard

The calculated hardness levels in the ground water samples are shown in Table 1.2. Total hardness in ground water samples in the research region ranged from 160 mg/l (Dhebar) to 315 mg/l (Lshgarh, Amarpura).

Common Cations

Calcium

Groundwater has calcium. From rocks to water. Groundwater calcium originates from volcanic rock silicate minerals such plagioclase, pyroxene, and amphibolites and sedimentary rock limestone and dolomite. Negatively charged soil and rock minerals absorb calcium. Natural water values are 10–100 mg/l. Industrial waste has calcium. CO2 dissociates CaCO3. CO2-weathered silicate rocks emit calcium into groundwater. Calcium is safe. 1800 mg/litre doesn't effect humans (Lehr et al 1980).

Calcium carbonate, sulfide, and occasionally chloride solubility determine groundwater calcium content. The investigation's groundwater calcium readings vary from 64 mg/l (Bhagaur) to 205 mg/l (Table 1.2). (Lshgarh)..

Magnesium

Alkaline earth metal magnesium is found in all natural water with calcium. Calcium outweighs magnesium. Groundwater magnesium comes from basic igneous rocks such dunite, pyroxene, and amphibolites. Magnesium carbonate is found in basalt, talc, tremolite schist, dolomite, and limestone. Ground water from magnesium-rich rock or dolomitic limestone ranges from zero to a few hundred ppm magnesium. Low magnesium levels are safe. Mg at high concentrations may diuretic and cathartic. (Lehr, 1980) 500 mg/litre concentrations make water taste bad. Mg hardens water and causes boiler scale with Ca. The research area's groundwater magnesium content varies from 61 mg/l (Negariya) to 165 mg/l (Gundipara).

Sodium

A major natural cation. Natural water has less calcium and magnesium. Rock weathering salts water. Igneous rock feldspar and its weathering products provide most sodium. High-sodium water comes from shale and clay. Leached and deep percolation water from upper soil layers and salty connate or sea water contamination are additional sodium sources. Disposal of sodium-rich industrial and household waste raises water sodium levels. Sodium is important for irrigation and drinking water but not water hardness. Low levels are safe. Excessive sodium may cause cardiovascular disease and pregnancy-related toxemia. Brine sodium exceeds 100,000 ppm. Well-drained, wet groundwater has less than 10–15 ppm sodium. The study area has groundwater salt concentrations from 40 mg/l (Barkhera) to 76 mg/l (Dhebar).

Potassium

Potassium is naturally occurring like sodium, calcium, and magnesium, but its concentration is much lower. The major source in natural fresh water is weathering of the rocks but the quantities increase in the polluted waste due to disposal of water waste. Potassium feldspar is more frequent in sedimentary rocks than igneous rocks. Its content is usually 10 mg/l and sodium exceeds 15 mg/l in ground water (ppm.).

In the research region, ground water potassium concentrations vary from 0.40 mg/l (Bhagaur) to 2.60 mg/l (Bhendarlya).

Common Anions

Carbonate and Bicarbonate

Electrical conductivity lowers low salinity fluid bicarbonate. Groundwater includes bicarbonate and carbonate, except highly acidic water. Groundwater gets most of its carbonate and bicarbonate ions from rain, which dissolves more carbon dioxide in soil. When Co2 is created in the aquifer, ground eater may have bicarbonate concentrations of 200 mg/liter. pH indicates carbon dioxide. Carbonic acid is below 4.5, bicarbonate between 4.5 and 8.2, and carbonate beyond 8.2.

Carbonate was absent from research groundwater samples. Bicarbonate is 85–260 mg/l (Dhebar) (Bhendarlya).

Sulphate

Sulphate occurs in all natural waterways. Calcium and magnesium make it hard. Industrial and home sewage discharges enhance its concentration. Pyrite and other sulphides in igneous and sedimentary rocks oxidize to create sulphate. All waters have sulphate anion. Around 300-400 mg/l, calcium and magnesium sulphate cause an unpleasant taste, and over 500 mg/l, a bitter flavor. Laxative at 1000 mg/l. Sulphate concentrations in study region ground water samples vary from 60 mg/l (Bhendarlya) to 155 mg/l (Meghnagar).

Chloride

All waters contain chloride. Sulphate and bicarbonates are usually higher than chloride in natural fresh water. Domestic sewage discharge is the main chloride source in water. Rainwater has less than 10 ppm chloride. In this study, chloride content ranges from 74 mg/l (Bakhera) to 220 mg/l (Gundipara).

Nitrate

Nitrogen is a substantial atmospheric component but a tiny rock component.

Rainwater dissolves nitrogen and oxygen. Rainwater averages 0.2 ppm (Riffenburg, 1926). Nitrate from decomposing organic materials, sewage water, and fertilizers dominates groundwater. Polluted groundwater has up to 100 ppm of nitrates, whereas unpolluted water has less than 5 pm. Nitrate ranged from 12 mg/l (Kesariya) to 45 mg/l throughout the research region (Lshgarh).

Fluoride

Humans need fluoride. Ingested water with 1.0 mg/L usually reduces dental caries, especially in youngsters. Groundwater fluoride comes from fluorspar, cryolite, fluorapatite, and hydroxyl apatite. Indian drinking water is allowed 1.5 mg/l fluoride (WH.O, 1983; BIS, 1991). Fluoride is electronegative and attracts positively charged calcium ions in teeth and bones. The research region had fluoride concentrations from 0.20 mg/l (Kalyanpura) to 1.05 mg/l (Jhayara).

Table 2: Determination of Concentration of Ions of Ground Water Sample of Meghnagar study area, Jhabua, District M.P. (Values expressed in ppm)

S. No.	Location	Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4	NO_3	F	TH
1.	Dhebar	82	90	60	1.20	-	85	130	150	30	0.65	172
2.	Dhebar	75	85	76	0.45	-	100	145	120	29	0.47	160
3.	Bhagaur	64	110	62	0.40	-	150	205	90	25	0.32	174
4.	Balban	120	95	55	0.75	-	135	201	110	21	0.30	215
5.	jhayara	66	135	65	2.00	-	140	200	69	23	1.05	201
6.	Hirapur	110	108	64	1.75	-	185	140	100	35	0.40	218
7.	Barkhera	102	110	40	1.20	-	165	74	128	27	0.25	212
8.	Junwaniya	127	119	61	1.65	-	150	105	109	40	0.53	246
9.	Junwaniya	120	130	60	1.50	-	135	125	133	34	0.33	250
10.	Amlipathar	124	105	54	1.25	-	165	130	80	18	0.45	229
11.	Dundaka	165	45	67	1.40	-	140	150	115	30	0.54	210
12.	Negariya	154	61	58	1.60	-	205	110	90	37	0.40	215
13.	Ishgarh	205	110	50	1.25	-	150	205	125	45	0.35	315
14.	Kalyanpura	19	80	63	2.4	-	170	13	150	20	0.2	272

		2			5			5			0	
15.	Kesariya	134	103	48	1.40	-	225	160	80	12	0.65	327
16.	Amarpura	170	145	60	1.65	-	130	145	105	31	0.40	315
17.	Antarbeliya	135	82	55	1.25	-	180	125	75	35	0.25	217
18.	Meghnagar	131	102	70	1.50	-	250	85	155	40	0.60	233
19.	Partapura	107	145	59	2.05	-	135	78	95	29	0.45	252
20.	Rampura	119	105	61	1.75	-	120	110	130	20	1.00	224
21.	Mauripara	128	75	70	1.05	-	195	135	105	25	0.50	203
22.	Bhendarlya	110	95	71	2.60	-	260	90	60	15	0.25	205
23.	Gundipara	116	165	68	1.50	-	220	220	120	21	0.47	281
24.	Gopalpura	135	62	65	1.65	-	90	190	115	35	0.75	197
25.	Nawapara	92	130	67	2.25	-	135	140	100	29	0.60	222

Abbreviation		
Ca = Calcium	Na = Sodium	CO_3 = Carbonate Cl = Chloride
NO_3 = Nitrate	Mg = Magnesium	K = Potassium
HCO_3 = Biocarbonate	SO4 = Sulphate	F = Fluoride

GRAPHIC REPRESENTATION OF ANALYTICAL DATA

Many ground water analyses exist. Graphs were used to compare these studies. These graphs show the groundwater's total cations and anions. Diagrams help. Groundwater ionic concentration is measured in mg/liter or ppm (parts per million). Pie, Piper's trilinear, U.S. salinity, and Wilcox diagrams are used to graphically describe chemical data.

Table 3: Determination of Chemical Parameters of Ground Water Sample of Dug Well of Meghnagar area, Jhabua, District M.P. (Values expressed in epm)

S.No.	Location	Ca	Mg	Na	K	CO3	HCO3	Cl	SO4	NO3	F
1.	Dhebar	1.09	7.40	2.61	0.03	-	1.39	3.66	3.12	0.48	0.03
2.	Dhebar	3.74	6.99	3.08	0.01	-	1.63	4.09	2.49	0.46	0.02
3.	Bhagaur	3.19	9.04	2.69	0.01	-	2.45	5.78	1.87	0.40	0.01
4.	Balban	5.98	7.81	2.39	0.01	-	2.21	5.67	2.29	0.33	0.01
5.	jhayara	3.29	11.10	2.82	0.05	-	2.29	5.64	1.43	0.37	0.06

6.	Hirapur	5.48	8.88	2.78	0.04	-	3.03	3.94	2.08	0.56	0.02
7.	Barkhera	5.08	9.04	1.74	0.03	-	2.70	1.97	2.66	0.43	0.01
8.	Junwaniya	6.33	9.78	2.65	0.04	-	2.45	2.96	2.26	0.64	0.03
9.	Junwaniya	5.98	10.69	2.61	0.03	-	2.21	3.52	2.76	0.54	0.01
10.	Amlipathar	6.18	8.63	2.34	0.03	-	2.70	3.66	1.66	0.29	0.02
11.	Dundaka	8.23	3.70	2.91	0.03	-	2.29	4.23	2.39	0.48	0.03
12.	Negariya	7.68	5.01	2.52	0.04	-	3.35	3.10	1.87	0.59	0.02
13.	Ishgarh	10.22	9.04	2.17	0.03	-	2.45	5.78	2.60	0.72	0.02
14.	Kalyanpura	9.58	6.58	2.74	0.06	-	2.78	3.80	3.12	0.32	0.01
15.	Kesariya	6.68	8.47	1.74	0.03	-	3.68	4.51	1.66	0.16	0.03
16.	Amarpura	8.48	11.92	2.61	0.04	-	2.13	4.09	2.18	0.50	0.02
17.	Antarbeliya	6.73	6.74	2.39	0.03	-	2.95	3.52	1.56	0.56	0.01
18.	Meghnagar	6.53	8.39	3.04	0.06	-	4.09	2.39	3.22	0.64	0.03
19.	Partapura	5.33	11.92	2.56	0.02	-	2.21	1.97	1.97	0.46	0.02
20.	Rampura	5.93	8.63	2.65	0.04	-	1.96	3.10	2.70	0.32	0.05
21.	Mauripara	6.38	6.16	3.04	0.02	-	3.19	3.80	2.18	0.40	0.02
22.	Bhendarlya	5.48	7.81	3.08	0.06	-	4.26	2.53	1.24	0.24	0.01
23.	Gundipara	5.78	13.57	2.95	0.03	-	3.60	6.20	2.49	0.33	0.02
24.	Gopalpura	6.73	5.10	2.82	0.04	-	1.47	5.35	2.39	0.56	0.04
25.	Nawapara	4.59	10.69	2.91	0.05	-	2.21	3.94	2.08	0.46	0.03

Abbreviation:		
Ca = Calcium	Na = Sodium	CO3 = Carbonate Cl = Chloride
NO3 = Nitrate	Mg = Magnessium	K = Potassium
HCO3 = Biocarbonate	SO4 = Sulphate	F = Fluoride

Table 4: Determination of percentage epm of Ground water samples of Meghnagar Area, Jhabua District, M.P.

S.No.	Location	Ca	Mg	Na	K	CO3	HCO3	SO4	Cl	NO3
1.	Dhebar	28.94	52.37	18.47	0.21	-	16.06	36.06	42.31	5.54
2.	Dhebar	27.06	50.57	22.28	0.07	-	18.80	28.71	47.17	5.30
3.	Bhagaur	21.36	60.54	18.01	0.06	-	23.33	17.80	55.04	3.80
4.	Balban	36.93	48.23	14.76	0.06	-	21.04	21.80	54.00	3.14

5.	hayara	19.06	64.31	16.33	0.28	-	23.53	14.69	57.96	3.80
6.	Hirapur	31.89	51.16	16.18	0.23	-	31.52	21.64	40.99	5.82
7.	Barkhera	31.96	56.89	10.95	0.18	-	34.79	34.27	25.38	5.54
8.	Junwaniya	33.67	52.02	14.09	0.21	-	29.48	27.19	35.61	7.70
9.	Junwaniya	30.96	55.35	13.51	0.15	-	24.47	30.56	38.98	5.98
10.	Amlipathar	35.97	50.23	13.62	0.17	-	32.49	19.97	44.04	3.48
11.	Dundaka	55.34	24.88	19.56	0.20	-	24.38	25.45	45.04	5.11
12.	Negariya	50.36	32.85	16.52	0.26	-	37.59	20.98	34.79	6.62
13.	Ishgarh	47.62	42.12	10.11	0.13	-	21.21	22.51	50.04	6.23
14.	Kalyanpura	50.52	34.70	14.45	0.31	-	27.74	31.13	37.92	3.19
15.	Kesariya	39.47	50.05	10.28	0.17	-	36.76	16.58	45.05	15.98
16.	Amarpura	36.78	51.71	11.32	0.17	-	23.93	24.49	45.95	5.6
17.	Antarbeliya	42.35	42.41	15.04	0.18	-	34.34	18.16	40.97	6.51
18.	Meghnagar	36.23	46.55	16.87	0.33	-	39.55	31.14	23.11	6.18
19.	Partapura	26.87	60.11	12.90	0.10	-	33.43	29.80	29.80	6.95
20.	Rampura	34.37	50.02	15.36	0.23	-	24.25	33.41	28.36	3.96
21.	Mauripara	40.89	39.48	19.48	0.12	-	33.33	22.77	39.70	4.17
22.	Bhendarlya	33.35	47.53	18.74	0.36	-	51.51	14.99	30.59	2.90
23.	Gundipara	25.88	60.77	13.21	0.13	-	28.52	19.73	49.12	2.61

24.	Gopalpura	45.81	34.71	19.19	0.27	-	15.04	24.46	54.75	5.73
25.	Nawapara	25.16	58.60	15.95	0.27	-	25.43	23.93	45.33	5.29

Trilinear analysis assessed water quality. Diagrams explain groundwater geochemical evolution. It compares ingredient concentrations. Hence, in a two-coordinate field, calcium, magnesium, sodium, bicarbonate, sulphate, chloride, and athers concentrations are related.

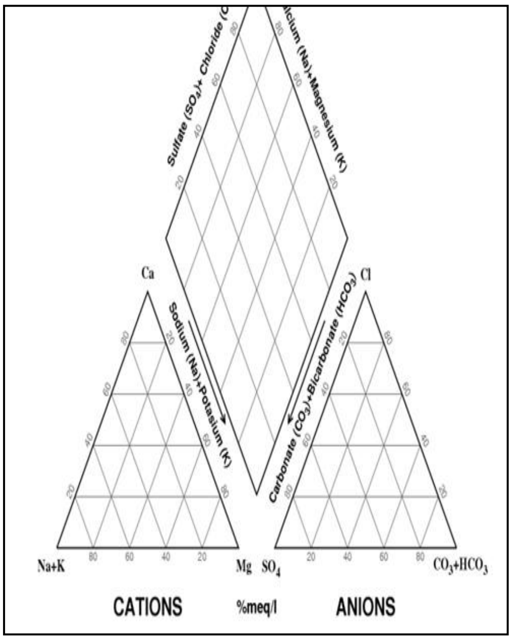

Figure 1: Exhibiting a Piper's Trilimear Diagram of Ground water of study area, Jhanua district Madhya Pradesh.

Palmer (1911), Hill (1940), and Piper (1944, 1953) employed trilinear diagrams. Handa (1965) modified Piper's figure (1953). Piper diagram fields are diamond-shaped and triangular. The left triangle plots cations Ca, Mg, and Na (alkaline earth) as % of total cations in milli equivalents per liter, whereas the right triangle plots anions HCO3 (weak acid) and SO4 (strong acid). These two points are projected into the center diamond-shaped block parallel to the top boundaries to show water's characteristics. Strong acids like iodide, fluoride, and nitrate are associated with potassium.

The types of ground water are recognized on the basis of the position of the plotting in the diamond shaped field as described below –

Area-1	Alkaline earths exceed alkalies
Area-2	Alkaline earths exceed alkalies
Area-3	Weak acids exceed strong acids.
Area-4	Strong acids exceed weak acids.
Area-5	Carbonate hardness exceeds 50%, i.e. chemical properties of the water are dominated by alkaline earths and weak acids.
Area-6	Non-carbonate hardness exceeds 50%.
Area-7	Non-carbonate alkali exceeds 50 % i.e. chemical properties are dominated by alkalis and strong acids-ocean water and many brines plot near the right hand vortex of the sub area.
Area-8	Carbonate alkali exceeds 50% here plot the waters which are inordinately soft in proportion to their content of dissolved solids.
Area-9	No one cation-anion pair exceeds 50%.

Hydrochemical faces contain cation and anion concentrations. Subdivide the trilinear diagram to classify composition classes. Using separate faces from the 0 to 10% and 90 to 100% domains on a diamond-shaped cation to anion graph is more constructive than equal 25% increments. Diagrams clearly show ionic concentrations. Piper trielinear diagrams show ground water quality and appropriateness for drinking and household usage. When comparable ground water samples plot together, it displays their similarities and differences.

GROUND WATER QUALITY FOR DOMESTIC PURPOSE

Drinking water must be clear, tasteless, and odorless. That should be clear. Avoid microbes and radiation. W.H.O. and B.I.S set international standards. Piper's trilinear graphic shows Meghnagar groundwater sample data (Figure 2).

CONCLUSION

Based on 25 samples taken from dug wells in the Meghnagar research region in the Jhabua Area of Madhya Pradesh, India, this report presents the findings of chemical quality delineation of ground water resources. Physical-chemical factors make it possible to assess the composition of chemical properties. Chemical testing of groundwater samples determines if it is suitable for drinking and other uses.

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