

Table 2: Drinking water standards recommending Agency and Unit Weight (All values are in mg/l except pH and Electrical conductivity.

S/N	Parameters	Standards	Recommended Agency	Unit Weight
1	pH	6.5-8.5	ICMR/BIS	0.0302
2	Electrical Conductivity	300	ICMR	0.0009
3	Alkalinity	120	ICMR	0.0021
4	Dissolved Oxygen(DO)	5.0	ICMR/BIS	0.0514
5	Biological Oxygen Demand	5.0	ICMR/BIS	0.0514
6	Phosphate	0.30	IS	0.8566
7	Nitrate	45	ICMR/BIS	0.0057
8	Sulphate	150	ICMR/BIS	0.0017

Table 3: Spatial Values of the Physico-chemical Parameters of the Study Area

S/N	Parameters	Station 1	Station 2	Station 3
1	pH	6.06±0.30	5.90±0.00	5.87±0.29
2	Electrical Conductivity	130.16±26.36	123.70±14.95	127.91±18.49
3	Alkalinity	46.93±0.97	51.93±2.66	51.08±5.97
4	Dissolved Oxygen	6.50±0.62	6.56±0.05	6.60±0.46
5	Biological Oxygen Demand(BOD)	2.01±0.07	2.35±0.25	2.10±0.31
6	Phosphate	0.08±0.00	0.07±0.02	0.04±0.01
7	Nitrate	0.50±0.10	0.52±0.07	0.04±0.17
8	Sulphate	1.83±0.28	1.47±0.23	1.57±0.27
Water Quality Index (WQI)		31.267	29.050	26.429

Table 4: Calculation of Water Quality Index (WQI) for Statio 1

S/N	Parameters	Observed Value	Sn	Wn	qn	Wnqn
1	pH	6.06	6.5-8.5	0.0302	62.667	1.895
2	Conductivity	130.16	300	0.0009	43.387	0.039
3	Alkalinity	46.93	120	0.0021	39.108	0.082
4	DO	6.50	5.0	0.0514	84.375	4.337
5	BOD	2.01	5.0	0.0514	40.200	2.066
6	Phosphate	0.08	0.3	0.8566	26.667	22.843
7	Nitrate	0.50	45	0.0057	1.111	0.006
8	Sulphate	1.83	150	0.0017	1.220	0.002
Summation (Σ)				1.0001	538.735	31.270
$\text{Water Quality Index (WQI)} = \frac{\sum qnWn}{\sum Wn} = 31.267$						

Table 5: Calculation of Water Quality Index (WQI) for Statio 2

S/N	Parameters	Observed Value	Sn	Wn	qn	Wnqn
1	pH	5.90	6.5-8.5	0.0302	73.333	2.215
2	Conductivity	123.70	300	0.0009	41.233	0.037
3	Alkalinity	51.93	120	0.0021	43.275	0.091
4	DO	6.56	5.0	0.0514	83.750	4.305
5	BOD	2.35	5.0	0.0514	47.000	2.416
6	Phosphate	0.07	0.3	0.8566	23.333	19.987
7	Nitrate	0.52	45	0.0057	1.156	0.007
8	Sulphate	1.47	150	0.0017	0.980	0.002
	Summation (Σ)			1.0001	314.060	29.060

$$\text{Water Quality Index (WQI)} = \frac{\sum qnWn}{\sum Wn} = 29.050$$

Table 6: Calculation of Water Quality Index (WQI) for Statio 3

S/N	Parameters	Observed Value	Sn	Wn	qn	Wnqn
1	pH	5.63	6.5-8.5	0.0302	91.333	2.758
2	Conductivity	129.86	300	0.0009	43.287	0.039
3	Alkalinity	54.40	120	0.0021	45.333	0.095
4	DO	6.73	5.0	0.0514	81.979	4.214
5	BOD	1.93	5.0	0.0514	38.600	1.984
6	Phosphate	0.06	0.3	0.8566	20.000	17.334
7	Nitrate	0.20	45	0.0057	0.444	0.003
8	Sulphate	1.43	150	0.0017	0.953	0.002
	Summation (Σ)			1.0001	321.929	26.429

$$\text{Water Quality Index (WQI)} = \frac{\sum qnWn}{\sum Wn} = 26.429$$

Discussion

According to Rumman *et al* (2012) water quality index is a mathematical instrument used to transform large quantities of water data into a single number that expresses overall water quality at a certain location on several water quality variables turning complex water quality data into information understandable and useable by the masses.

The slight deviation of the various water variables studied above and below the permissible limits in this study is a clear indication that the water body could be under slight stress and threat attributed to natural and anthropogenic activities.

The various water quality indices (31.269, 29.050 and 26.429) obtained from the stations of this⁸⁴⁵ water body in this study indicates that the water is of good quality (Chatterji and Raziuddin, 2002) since it falls within the range of 26 – 50. The results also showed that the order of quality of the water is station 3 > 2 > 1 meaning that station 3 is the best of all the stations in terms of quality. The results therefore showed that the water is not polluted but might contain some contaminants whose concentration is not enough to prevent humans from consuming the water.

The water quality rating with respect to all the parameters except dissolved oxygen and pH clearly showed that the water is not eutrophic and therefore suitable for human consumption. pH in this study which ranged between 5.87 ± 0.29 and 6.06 ± 0.30 is acidic and therefore contrary to the alkaline condition reported by Ambasht (1971), Warnalatha and Narasingarao (1993), Shardendu and Ambasht (1988) and Petre (1975) in different water bodies. The low value of pH below the permissible limit (6.5 – 8.5) in this study in the entire stations could be attributed to environmental factors in the area.

Electrical conductivity in this study ranged between 123.70 ± 14.95 and 130.16 ± 26.36 $\mu\text{s}/\text{cm}$ which is equivalent to the permissible limit (130 $\mu\text{s}/\text{cm}$).

Alkalinity ranged between 46.93 ± 0.97 and 51.93 ± 2.66 $\mu\text{s}/\text{cm}$ in this study which is far below the permissible limit (120mg/l) and could be attributed to the carbonate, hydroxide content and contributions from borates, phosphate, silicates and other bases in the area.

DO value in this study ranged between 6.50 ± 0.62 mg/l and 6.60 ± 0.46 mg/l which is slightly above the permissible limit (5mg/l). The DO concentration of a water body regulates distribution of biota in the area. DO value in this study is in disconformity with the observations of Swarnalatha and Narasingarao (1993) and Venkafeswarlu (1993).

BOD ranged between 2.01 ± 0.07 mg/l and 2.35 ± 0.25 mg/l is far below the permissible limit (5.0mg/l). This could be attributed to little level of organic load in the water. This range is in discomformity with the 28mg/l to 33mg/l reported by Chatterjee (1992).

The values of the water nutrients (PO_4 , NO_3 and SO_4) were all far below the permissible limit. The values of the water nutrients (PO_4 , NO_3 and SO_4) show that the water does not have characteristics of eutrophication. This is confirmed by the assertion by Harbel (2009) that water nutrients such as phosphate, nitrate and sulphate control eutrophication and algal growth in the aquatic ecosystem.

Conclusion

The water quality index as calculated from the physicochemical variables showed that the water is neither eutrophic nor polluted and so suitable for human consumption.

Acknowledgement

I want to say at this point that I really appreciate the effort of Prof. J.F.N Alfred-Ockiya in ensuring the success of this research.

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