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ORIGINAL ARTICLE

Comparative Study of Physico Chemical Parameters of Water from a River and its Surrounding Wells for Possible Interactive Effect

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ABSTRACT

Physico-chemical parameters of River Asa in Ilorin metropolis, Kwara state, Nigeria and three surrounding wells were determined and compared for possible interaction and correlation. Water samples were collected accordingly during the raining and harmattan period, physico-chemical analyses were carried out on the samples. Results obtained indicate that apart from the temperature and pH that were related (33 – 35^{o}C); (23 – 26^{o}C) and (7 – 8); (6 – 7) in the harmattan and raining season respectively, variations were observed in other parameters. In comparison, the river sample relatively has higher values than that of the well samples in some parameters such as colour (33 – 66 ptco), turbidity (0.5 – 0.8 FAU), total dissolved solid (127 – 275 mg/ml) and total suspended solid (0.8 – 0.9 mg/ml) . On the other hand, the total hardness, alkalinity, chloride as well as nitrate were found to be relatively higher in the surrounding wells while sulphate & phosphate were relatively low. Similarly, heavy metal ions were of higher value in the river, Fe^{2+} (1.9 – 3.07 mg/l); Ni^{2+} (0.09 – 0.39 mg/l), but lower values Fe^{2+} (0.74 – 1.12 mg/l) and Ni^{2+} (0.005 – 0.01 mg/l) for the well samples. The result generally showed that properties of the different bodies of water have their respective distinct properties.This suggests that the two bodies of water have little or no interaction.

Key words:

Introduction

Historically from time immemorial point of rural settlement was being determined by water source such as stream, river and spring. Besides the inhabitants of this early settlement relied on underground water, often within a few metres of the surface and which they exploited in well digging. The practice has been a common water source for rural community[7]. Surface water is generally poor in quality and there has been a deliberate shift toward reliance on ground water for domestic needs. The ground water is only 0.6% of total water resources. The preference as a source of drinking water in rural area is because of the relatively better quality than river sample (http://www.well.owner.org).

Quality of water is increasingly being affected by anthropogenic activities through which natural waters are contaminated[8,14]. Recent studies described pollution of Asa River (Ilorin, Nigeria) especially with various industrial discharges as alarming[5]. There are wells very close around the river; this study was thus undertaken as a comparative examination of the physiochemical nature of both bodies of water, with special consideration to wells along the river route.

Expermental:

Samples were collected both in dry and wet season. A section of the river, running through human settlement was selected. Two river sample points and three close well locations were selected as shown in fig.1 & 2. The samples were stored in

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plastic bottle previously & thoroughly washed with concentrated HNO_3 acid and later rinsed with deionised water followed by the sample water. Quantitative analyses were carried out on the sample. Sample for elemental analysis such as alkaline earth and trace metals were acidified with 2M HNO_3. This was to maintain stability of the oxidation state of the various elements in solution and prevent precipitation (ie metal adhering to wall of the containers[11]. All the sample bottles were properly labeled and tests were repeated 2 – 3 times. Temperature, pH and electrical conductivity of the samples were determined on collection at the location point. All reagents used were of analytical grade.

Physical parameters determined were electrical conductivity, pH, temperature, colour, turbidity, odour, taste, TDS, and TSS. Temperature measurement was carried out using mercury in glass thermometer. Both the colour and turbidity were measured using DR 800 set to same appropriate wave length but different programme number, in the case of colour the water was first filtered[11]. Electrical conductivity was determined using conductivity meter of model EC214. TDS and TSS were determined by evaporation and filtration respectively[2]. Chemical analyses were determined using standard methods. pH meter Tenwen model was used to measure the pH. Titrimetric method

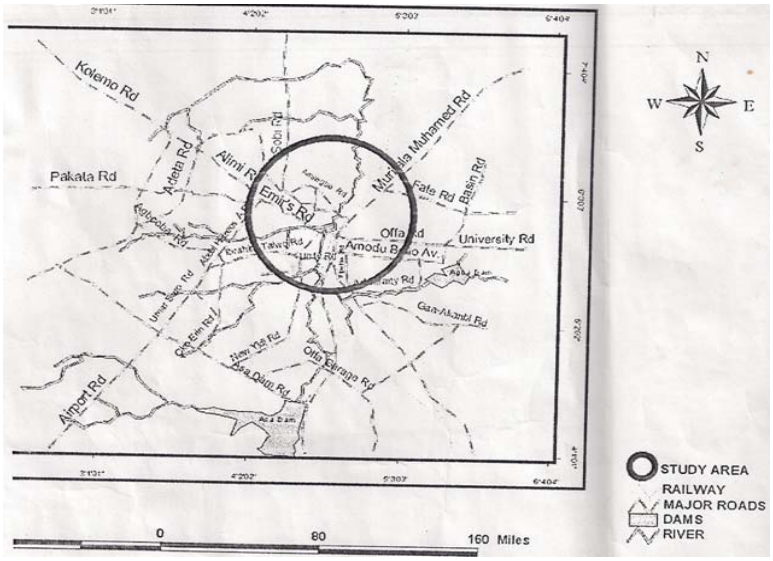

Fig. 1: The map of Ilorin, Nigeria, Showing the Study Area

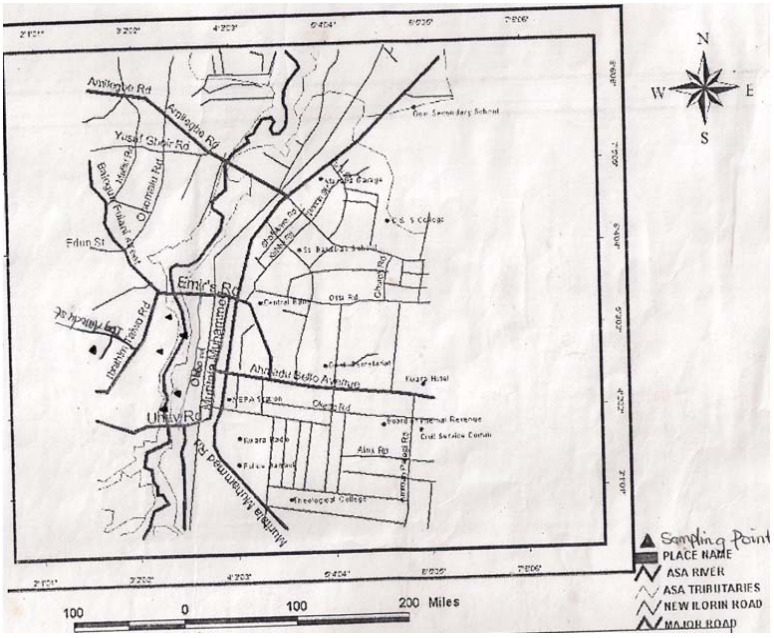

Fig. 2: Extracted Map of Asa River and the surroundings

was employed for total hardness and alkalinity [2]. Mohrs method was employed in the analysis of chloride content[12]. For the determination of the anions (sulphate, phosphate and nitrate) Dr 2800 model spectrophotometer was employed, applying Hach corporation powder pillow method[3]. The heavy metals (Fe, Zn, Cr, Pb, Mn and Ni) were determined using the atomic absorption spectrophotometer technique[1,13]. Determination of dissolved O_2 was also based on the literature [12,6].

Results and discussion

The results of physical and chemical parameters obtained from the analysis during harmattan period are presented in table 1 & 2 respectively, while table 3 contained the results of the selected physiochemical parameters during raining season. The samples are coded RS1 & RS2 for river sources 1 & 2, while WS1, WS2 & WS3 for the surrounding well 1, 2 and 3 respectively. The recorded results are average of 2 – 3 tests.

Table 1: Physicochemical Data of the Asa River and the Surrounding wells Physical parameters (Harmattan period)

PHYSICAL PARAMETERS	RSI	RS2	Means RS1 & RS2	WS1	WS 2	WS 3	W.H.O STANDARD
Temperature °C	32.5	35	33.75	36	33	34	25
Electrical Conductivity (µscm^{-1})	0.19	0.17	0.18	0.35	0.71	0.82	1.0
Taste/Odour	Objectionable	Objectionable	Objectionable	Non Objectionable	Non Objectionable	Non Objectionable	
Colour(ptco)	33.0	66.0	49.5	0.0	23.0	0.0	colourless
Turbidity(FAU)	0.508	0.785	0.640	0.316	0.018	0.00	Clear
Total suspended solid (mg/l)	0.809	0.903	0.860	0.203	0.132	0.008	1.0
Total dissolved solid(mg/l)	127.0	275.5	201.25	80.0	33.0	24.2	500

	Value of well sample with positive difference from river sample value
	Value of well sample with negative difference from river sample value
	Average value of river samples
	Value of well sample similar to river sample value

Table 2: Physicochemical Data of the Asa River and the Surrounding wells Chemical Parameters (Harmattan period)

	RSI	RS2	Means RS1& RS2	WS 1	WS 2	WS 3	W.H.O STANDARD
Total alkalinity mg/l	37.5	30.0	33.75	42.5	35.0	47.50	200
Total hardness mg/l	88.5	85.0	86.75	309	263.5	314	100
Chloride mg/l	40	48	44	76	305	354	250
Nitrate mg/l	7.4	7.6	7.5	Trace	35.5	26.0	10
Phosphate mg/l	0.76	0.89	0.83	0.35	0.26	0.30	5.0
Sulphate mg/l	30.60	32.49	31.55	20.24	12.24	5.20	250
Iron mg/l	1.92	3.07	2.50	1.01	0.74	1.12	0.3
Nickel mg/l	0.08	0.396	0.238	0.005	BDL	0.01	0.02
Zinc mg/l	0.01	0 .01	0.01	BDL	BDL	0.04	1.0
Chromium mg/l	0.058	0.109	0.133	0.007	0.018	0.015	0.01
Lead mg/l	0.015	0.006	0.011	BDL	0.004	BDL	0.001
Manganese mg/l	0.055	0.165	0.112	0.008	0.059	0.026	0.5
Dissolved oxygen mg/l	1.4	Trace	1.4	2.13	1.63	2.13	2.0

Table 3: Selected Physicochemical Data of the Asa River and the Surrounding wells (Raining period)

	RSI	RS2	**Means RS1 & RS2**	**WS 1**	**WS 2**	**WS 3**
Temperature°C	25.5	26.5	27.75	23.5	23.0	23.0
Taste/Odour	Objectionable	Objectionable	Objectionable	Non Objectionable	Non Objectionable	Non Objectionable
pH	6.21	6.01	6.11	6.94	6.85	6.47
Electrical Conductivity(µscm^{-1}	0.345	0.338	0.345	0.190	0.207	0.410
Total hardness mg/l	113.0	132.5	122.7	152.5	188.5	190
Chloride mg/l	16.0	26.5	21.25	23.0	112.5	134
Total alkalinity mg/l	15.75	17.25	16.5	25.5	23.5	18.75
Total dissolved solid(mg/l)	2.02	2.06	2.04	2.50	2.44	2.95

Comparing the results obtained for the means values for the river samples with each of the well samples, many of the tested properties were observed with many differences. On the table, the dark grey column represents the average results of the river sample, while each of the well sample with positive differences or deviations from the corresponding river average value is indicated black or blue, those with negative differences are indicated in lighter grey or red, while the well samples of relatively similar values with that of the river sample remained white, except the taste result which is descriptive in nature that is not colour related.

The results obtained showed that the temperature and pH of both bodies of water were closely related (Table 1). The river sample in both seasons have relatively higher values in the following physical parameters colour (33 – 66 ptco), turbidity (0.5 – 0.8 FAU), total dissolved solid (127 – 275 mg/l) and total suspended solid (0.8 – 0.9 mg/l),while lower in electrical conductivity value compared to each of the WS. The total hardness, alkalinity, nitrate chloride were found relatively lower in the river sample generally both in harmattan and rainy period while sulphate & phosphate were relatively high. Also differences were observed in heavy metals with relatively higher result in the river sample. The result generally showed that properties of the two bodies of water the river sample were distinct from that of the well, suggesting that two bodies of water have little or no interaction.

Relatively similar temperature and pH was in line with the same geographical location and the time zone[7,5]. The observation for the river sample is traceable to various anthropogenic effects[10]. Fatoki [7] also reported the trace metals pollution in major rivers in South Africa and according to Howard[9] the geological base of the body of water was reported to contributes to the various differences of physico-chemical qualities of each body water, hence the variant in the two different bodies of water.

Conclusion:

The results and the analyses suggest the distinct nature of different bodies of water. Their distinct natures however depend on geographical location, time zone and geological foundation of the water area. Anthropogenic factor also contribute to the physico-chemical properties, especially the flowing water.

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