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Physicochemical Analysis of Rainwater Harvested From Different Rooftop along Zaria Road, In Kano Metropolitan

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Abstract- This study assessed heavy metals and some physicochemical properties in rainwater from selected areas along Zaria road, Kano. Rainwater was collected from seven different locations including Gyadi-Gyadi (GY), Kundila (KN); Maikalwa (MK); Naibawa (NB); Unguwa Uku (UK); Wailari (WL) and Yar'akwa (YW). Physicochemical parameters like alkalinity, hardness, colour, turbidity, suspended solids (SS), Total suspended solids (TSS), Total dissolved solids (TDS), pH, temperature, electrical conductivity (EC) and few heavy metals were assessed. The parameters were analyzed using standard methods of water analysis. The results from the physiochemical analysis of water samples collected from different rooftop, shows that the tested parameters were within the recommended specifications of World Health Organization (WHO) and Nigeria Standard on Drinking Water Quality (NSDWQ) thus the harvested rainwater can be used for drinking, domestic or agricultural purpose. Thus, it is recommended that, the first flush from the rooftops should not be used because of the level of accommodation of dirt and rust.

Keywords: Rainwater, hardness, alkalinity, Zaria road, contamination.

I. INTRODUCTION

Water is one of the most valuable resources that is widely distributed all over the world and is available to mankind for sustenance and survival [1,2,3]. Rainwater is an important source of fresh water especially for those who live in rural areas, where water use is limited due to scarcity or where surface and ground water quality is poor [1,4]. Providing quality drinking water to all citizens of the world who are deprived access to water will serve as the breaking point of poverty alleviation in most developing countries especially in Africa, where substantial amount of national budgets are used to treat preventable waterborne diseases [5]. In many areas, rainwater is still considered as a safe and suitable source of potable water, and it is commonly used as such [4,6,7]. Information related to the use of rainwater to meet the water supply demands of urban dwellings is somewhat available [8]. Developments in science and technology have brought improved standard of living, but have also unwittingly introduced some pollution into our environment [7,9,10,11,12]. The World Health Organization (WHO) estimated that about 4.6 million people die each year from causes directly attributed to air pollution [13]. Consequent to the realization of the potential health hazards that may result from contaminated drinking water from industrial source, thus, the contamination of drinking water from this source is of primary importance because of the danger and risk of water borne disease [14]. Therefore, a good knowledge of the chemical qualities of rainwater through regular physicochemical analysis is necessary so as to guild its suitability [15]. In view of the above, the present investigation has the following objectives: To obtain water samples from different locations (Gyadi-Gyadi, Kundila, Maikalwa, Naibawa, Wailari, Unguwa Uku, Yar'akwa) along Zaria road, Kano. The aims of this research was to analyze the physicochemical properties and heavy metals concentration of rainwater (roof collection) from different areas along Zaria road in Kano state. To determine environmental condition of the rainwater and predict pollution status. To compare the results with the standard of national and international guidelines for water quality.

II. MATERIALS AND METHODS

Sample collection equipment used were washed with 10% HCL and then they were thoroughly rinsed with distilled water and dried prior to the collection of samples [16,17].

II.I COLLECTION OF RAIN WATER SAMPLES

Samples of rainwater were collected from seven different locations which include Gyadi-Gyadi, Kundila, Maikalwa, Naibawa, Wailari, Unguwa Uku, Yar'akwa along Zaria road, Kano. The sampling sites were selected in such a way as to cover areas representing the highly populated areas along Zaria road in Kano metropolitan. These samples were collected using pre-cleaned polyethylene bottle (1 liter capacity) for each and labeled accordingly as thus – Gyadi-Gyadi (GY), Kundila (KN); Maikalwa (MK); Naibawa (NB); Unguwa Uku (UK); Wailari (WL) and Yar'akwa (YW).

II.II METHODS OF THE ANALYSIS

The samples were analysed for a number of physicochemical parameters employing standard methods [18]. The parameters included colour, odour, temperature, pH, total hardness, total solids (TS), total dissolved solids (TDS), total solids (TS).TDS and TS determination of the water sample in mg/l was carried out using the standard methods [18].

III. RESULTS

Water for human consumption should be colourless, tasteless, odourless and free of turbidity and must be free of chemicals and should not contain any microorganisms known to be pathogenic capable of causing disease or any bacteria indicative of faecal pollution [19,20]. The results of the physical and chemical analysis carried out are presented in Tables below:

Table 1: physicochemical parameters of rainwater

S/N	ID-CODE	pH	Alkalinity	Hardness	Temperature	Colour
1	GG	7.00	75	22.45	30.3	10
2	KN	6.90	50	26.94	30.5	05
3	MK	6.70	55	31.42	29.8	05
4	NB	6.00	110	130.1	29.8	10
5	UK	7.20	82	125.5	28.9	10
6	WL	6.90	57	30.54	31.0	05
7	YW	7.00	73	45.35	30.5	05

IV. DISCUSSION

The water samples had acceptable levels pH in the range of 6.0- 7.20. Even though the [21,22] limit is 6.5-8.5. Nevertheless, values of 5.0 are still permissible according to the Ghana Water Company standards. The pH value of water sample analyzed in this study was slightly higher than the mean value obtained from Uyo, Akwa Ibom, as reported by [23], while [24] observed values above the present one from Wukari, in Taraba. This implies that the water samples were neither acidic nor basic in nature.

Hardness and alkalinity of drinking water are said to be acceptable at 500mg/L and 200mg/L respectively according to the [22,25]. Also 500mg/L is acceptable by [26]. Based on these standards, the levels of alkalinity and Total Hardness recorded for all the samples can be said to be within safe limits. The values of temperature obtained ranged between 24.78 to 26.80ºC with a general mean of 25.99ºC.

Colour is an important physical quality of water which affects its acceptability by consumer. Fifty seven percent (57%) of the rainwater samples were within the acceptable limit of 5 TCU [21,22]. The mineral composition of the site could affect the colour of the water especially if iron compounds are present.

Table 2: physicochemical parameters of rainwater

S/N	ID-CODE	EC	TDS	SS	TSS	TURBIDITY
1	GG	36.9	20.6	09.00	29.6	16
2	KN	40.8	23.10	02.00	25.1	07
3	MK	52.7	26.70	00.00	26.7	10
4	NB	482	241.0	01.00	242	06
5	UK	38.9	21.45	08.00	29.45	00
6	WL	29.9	14.57	07.00	21.57	13
7	YR	45.6	23.58	10.00	30.58	10

The levels of EC and TDS are related to one another [27] and it can be observed that the EC of the samples increased with increasing TDS as presented in Table 2 above. Also the level of EC and TDS of all the rainwater samples analyzed were found to be below the recommended maximum permissible limits of 1000 mg/l and 1200 µs/cm [21,22] for TDS and EC respectively. In the case of turbidity, the limit is 5NTU. Five of the analyzed sample had turbidity level above 5NTU, while the rest were below the limit (Table 2). In most waters, turbidity is due to colloidal and extremely fine dispersions [28,29,30,31,32,33].

Table 3: Physicochemical parameters of rainwater

S/N	Id-code	Ca	Cr	Cu	Fe	Mg
1	GG	12.62	0.01	0.03	0.06	53.67
2	KN	9.01	0.00	0.00	0.01	50.38
3	MK	7.21	0.00	0.00	0.00	38.34
4	NB	39.65	0.09	0.34	0.10	10.953
5	UK	25.35	0.30	0.31	0.56	28.67
6	WL	30.24	0.08	0.24	0.40	15.68
7	YR	9.30	0.28	0.05	0.35	14.34

The levels of trace metals in harvested rain water are shown in table 3. The mean concentration of Fe were found to be in the ranged 0.00-0.56 mg/l. The Fe concentrations of some of the harvested water samples (UK, WL and YR) exceeded WHO limits 0f 0.3 mg/l for portability. Iron is not hazardous to health, but it is considered a secondary or aesthetic contaminant. Essential for good health, iron helps transport oxygen in the blood [34].

Concentrations of Cu range from 0.00-0.34 mg/l. The mean value was lower than 0.4 mg/l WHO limit. Cr level of the harvested water samples were in 0.00-0.30 mg/l. Some of these values were higher than the WHO limit of 0.05 for portable water. The Magnesium concentration of the rainwater ranged from 10.953-53.670 mg/L. However, the high concentrations of these minerals in rainwater have the tendency of causing health problems since water scarcity is compiling large number of the populace in the metropolis to patronize rainwater highly [5].

V. CONCLUSION

The results of this study indicate that the accelerated economic and population growth brought about by industrialization and congestion of automobiles in the study areas, generated adverse environmental and health impacts. The results from the physiochemical analysis of water samples collected from different rooftop, shows that the tested parameters were within the recommended specifications of WHO and NSDWQ thus the harvested rainwater can be used for drinking, domestic or agricultural purpose. However, the first flush from the rooftops cannot be used because of the level of accommodation of dirt and rust. This usually helps to effectively eliminate bacteriological as well as other contaminants.

VI. RECOMMENDATIONS

It is therefore recommended that treatment of rainwater and all other forms of water should be a matter of great concern to the government, communities, and individuals in areas along Zaria road and other areas especially industrialized and overpopulated cities in Kano state and Nigeria at large, because of the health hazard potential of contaminated water.

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