International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 12; Issue: 2; February 2025
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Assessment of the Level of Pollution of the Waters of the Source Head of the Niger River and Three Tributary Rivers in the Rural Commune of Kobikoro, District of Forokonia, Faranah-Guinea

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DOI : https://doi.org/10.52403/ijrr.20250213

ABSTRACT

Today, water is affected by pollution caused by human activity. Therefore, to assess the degree of degradation of water resources, it is essential to know the quality of the water in order to create a management system that will guarantee water supply in the future. The pollution of water resources is attributed to : - the presence of microorganisms harmful to health (excrement of domestic and wild animals). The circulation of chemical substances resulting from the degradation of plastics or agricultural pollution by the use of phytosanitary products (herbicides, insecticides, fungicides), the use of simple fertilizers such as ammonium nitrate which releases nitrate ions that are not soluble in water. They then circulate in the soil to reach groundwater, watercourses and water tables under the effect of rainwater infiltration, as well as natural hazards. To help preserve its protection, a study was conducted from October 9, 2023 to August 30, 2024 inclusive through physicochemical analyzes of the waters of the head of the Niger River and three (3) of its tributaries in the C R of Kobikoro district Forokonia / Bakando in order to determine the level of pollution through parameters that determine the quality of the water, namely temperature, pH, nitrates, suspended matter. The results showed that the majority of physical and chemical properties comply with the standards in force (standard NM 03.07). /200.

Keywords: Niger River, head of source, pollution, physico-chemistry, Faranah.

INTRODUCTION

Water is a natural substance that is essential for the life of living organisms because it is involved in all human activities (e.g. Among the resources and waters used, groundwater and spring heads are traditionally the most popular waters for drinking water, as they are more protected from pollution than other resources and water source heads. (Diallo et al., 2018). In addition, the chemical and physical properties of water are the basis of the ecology of rivers and spring heads: these properties facilitate aquatic life. It has always been the first to present itself Aquatic resources are essential for the survival of

humanity. However, the limited availability of this resource and the increasing degradation of aquatic ecosystems have become a widespread problem in recent decades, making this problem one of the most worrying environmental aspects of the 21st century. There is degradation caused mainly by biological diseases, but also by chemical compounds created by humans. The presence of these in the environment, and particularly in water, constitutes an unprecedented development for humanity due to their volume and their.

They are responsible for the increase in the scale and frequency of pollution incidents, which makes it difficult, if not impossible, to preserve the quality of ecosystems (Sally Zgheib; 2009). In addition, they play an essential role in human life, health and dignity (Niambele et al, 2020; Adetunde and Glover, 2011; WHO and UNICEF, 2018; Diallo, 2017). The quality of drinking water is determined by its chemical and bacteriological properties (Adesakin et al, 2020; Bello et al, 2013; Okoli, 2012). Consumption and use of polluted or contaminated water is one of the causes of various human diseases (Dovonouf et al, 2011; WHO and United Nations Children's Fund, 2018; Ounoki and Achour, 2014). Water infection by pathogens is considered a pollution problem that has a long history, today, these diseases are the cause of a significant mortality rate in developing countries. In addition, when the water from a spring head comes from a discharge of animal or human origin, the number and type of bacteria present are capable of making the water unfit for human consumption (Belghiti et al, 2013; Sila, 2019; Esharegoma et al, 2018). Water-related diseases are mainly transmitted by the fecal-oral route and human contamination is mainly caused by the consumption of water-related products, such as food or bathing, or by direct contact with recreational waters (Adesakin et al, 2020 et al, Mehanned et al, 2014; Diallo, 2017; Traore et al, 2012). It is indirectly represented by the ecological value or potential of the water surface.

Water pollution or contamination is Water pollution or contamination can be defined as the degradation of its physical, chemical and biological properties by discharges, direct or indirect deposits of foreign substances or having a negative effect on water quality, such as microorganisms, toxic products, industrial waste (Tek fi, 2006). It is characterized by a large number of parameters.

The indicator presents data for the headwaters of the Niger River and its tributaries, including Djaliba, Firakona, Woulnouba and Bondaji, the information is more specific and the quality of the indicator mainly concerns the description of two physical and chemical parameters.

MATERIALS AND METHODS

MATERIALS

STUDY AREA

The rural commune (RC) of Kobikoro is one of the 13 sub-prefectures of the Faranah prefecture located 125km from the urban commune of Faranah, the chief town, and 450km from the capital Conakry according to the Faranah transport service. The source of the Niger River is located in one of the 57 sectors of the RC located 13km from the Forokonia district and covers an area of 3500 hectares.

It is bordered to the north by the village Gbayifè

- To the east by the village Datouya, Forokonia and Kolakoya,
- To the south by the village Nialia and Farakoro
- And to the west by the Republic of Sierra Leone
- To the north.

In the Forokonia/Bakando district, the activities carried out by the population are numerous and diversified: agriculture, hunting; fishing, livestock breeding, carbonization and crafts.

Figure 1 shows the location of the Kobikoro CR.

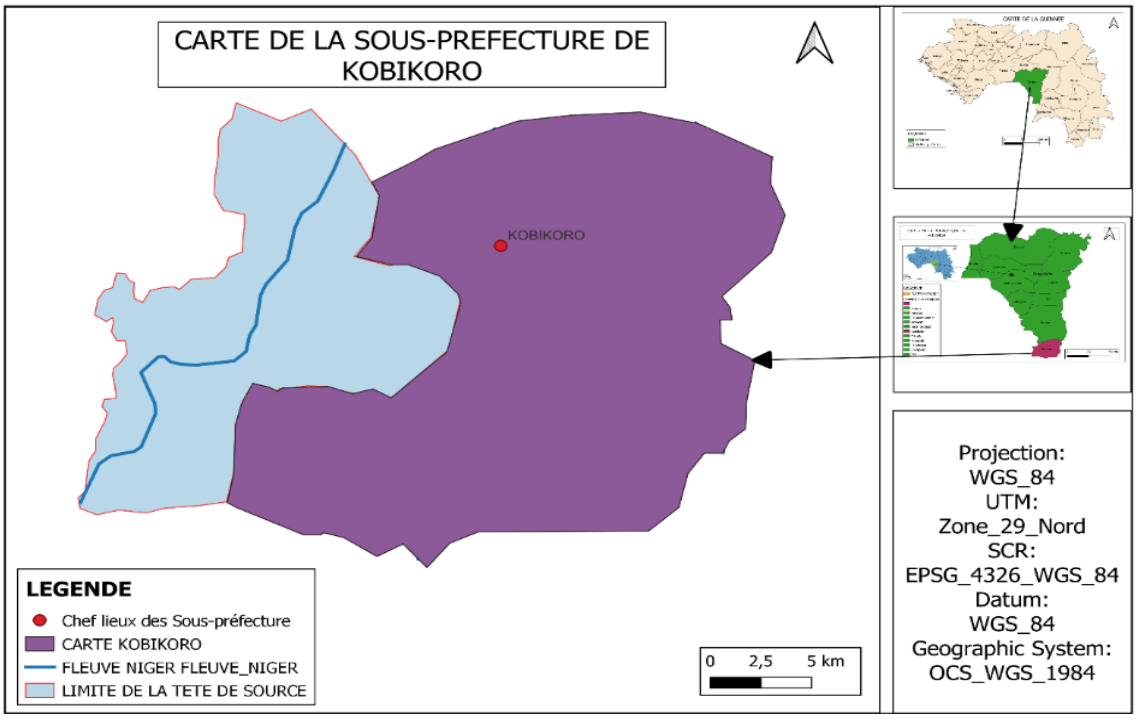

Figure 1 : Study area

SAMPLING SITE

Four 4 spring heads were the subject of our study. These are chosen in order to assess the level of pollution of the water of the head of the source of the Niger River and three courses that are directly tributary to it.

The sampling was done on:

- The head of the source of the Niger River;
- The Bondaji tributary;
- The Firakona tributary;
- The Woulnouba tributary.

Figure 2 shows the location of the source head of the Niger River.

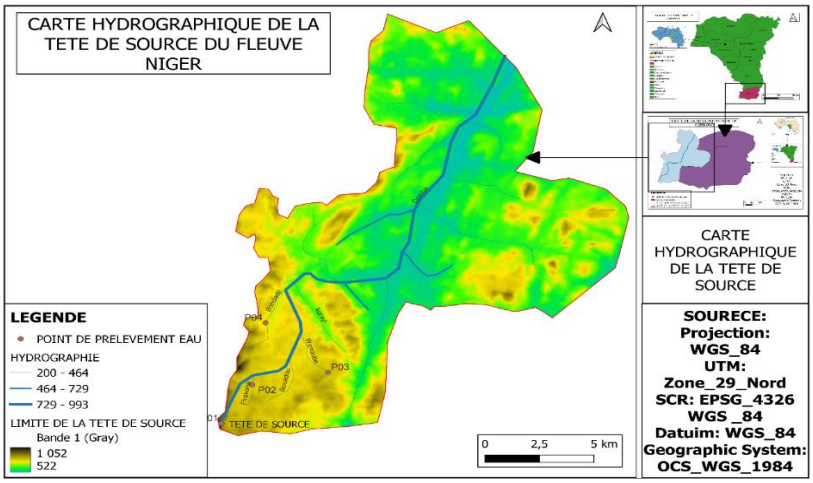

Figure 2 : Location of the Niger River

METHOD

Sample collection

The water samples were collected in clean containers, rinsed several times with the water to be analyzed, and hermetically sealed without leaving air bubbles in the bottle. The bottles are made of plastic. They were stored in a cooler (at 4 ° C) until the time of analysis.

The analyses were carried out 72 hours after taking the samples.

Three campaigns to collect headwaters from the Niger River and three tributaries were carried out in the period from October 9, 2023 to August 30, 2024. To assess the level of water pollution, the samples to be analyzed were collected using sterilized 1-liter bottles and immersing them with the opening 30 cm deep in the water ; the bottles were finally labeled. The samples collected were transported in a cooler, keeping the samples at a temperature of 4°C to slow down microbial activity; they were then sent to the laboratory for physical and chemical analysis.

Physicochemical analysis of water

According to MONTHEIT and JAKEMAN (1995), the taking and storage of samples, as well as the analysis methods chosen, are fundamental aspects of the measurement process. Indeed, it is not difficult to obtain values for each parameter, but these values only make sense if they are as close as possible to reality.

Table I : List of analysis materials

N	Designation	Parameter	Method
1	HANNA	Determination of temperature and pH	Electrometry
2	Analytical balance and oven	Determination of suspended matter	Volumetry
3	Turbidimeter	Determination of turbidity	Nephelometry
4	AL450 Photometer	Détermination des nitrates	Chromo Tropic Acid
		Determination of sulfates	-
5	1.5 Liter Bottle	Prélèvement des échantillons	-
6	Cooler	Sample storage	-

RESULTS AND DISCUSSION

Results

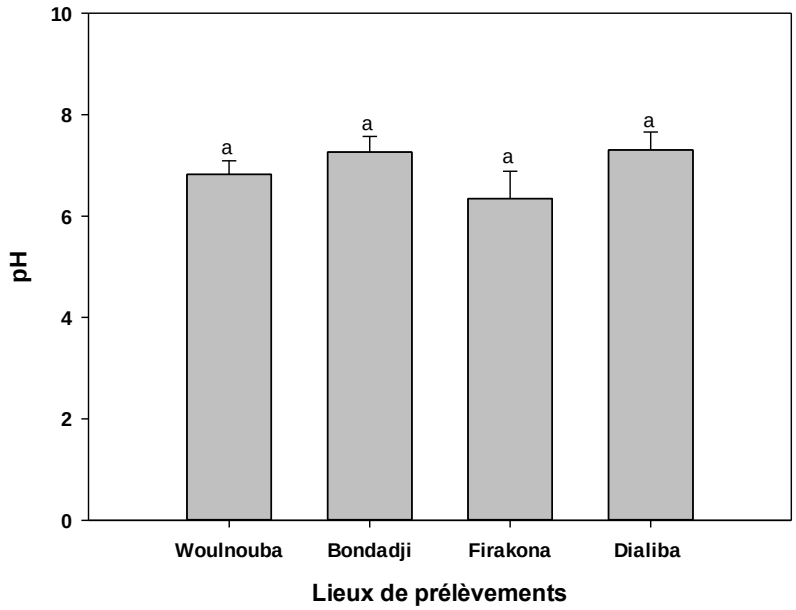

Figure 3. pH of the waters of the head of the spring and its tributaries.

This figure 3 shows that there is no significant difference between the pH values of the tributaries. Thus, the pH values found in the waters of the three tributaries were 6.82 for Woulnouba; 7.26 for Bondaji and 6.34 for Firakona and 7.30 for Dialiba (the head of the spring). From this we see that the waters of

the tributaries are slightly acidic, while the waters of the head are slightly basic.

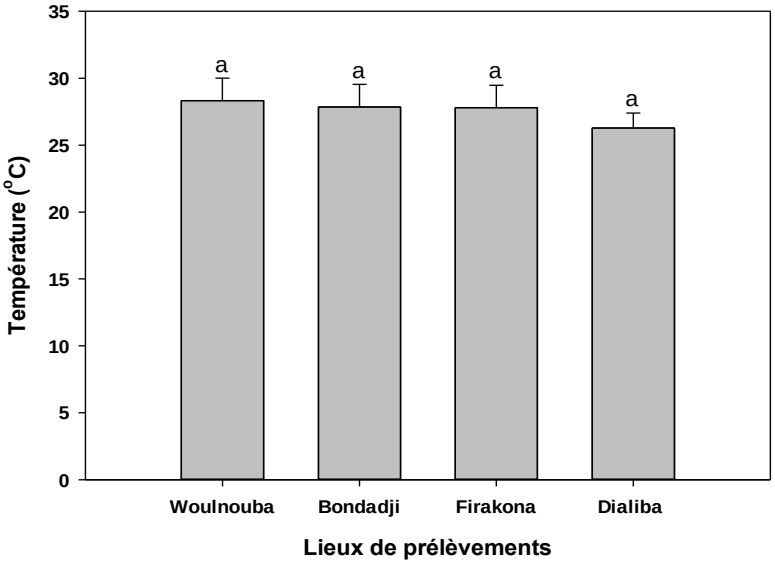

Figure 4. Temperature of the waters of the head of the source and its tributaries.

This figure 4 shows that the temperature values found in the waters of the three tributaries are: 30.0°C for Woulnouba, 27.85°C for Bondaji, 27.80°C, for Firakona; 26.28°C for Dialiba the head of the source of the Niger River. These values do not present any significant difference between them. This is due to their location.

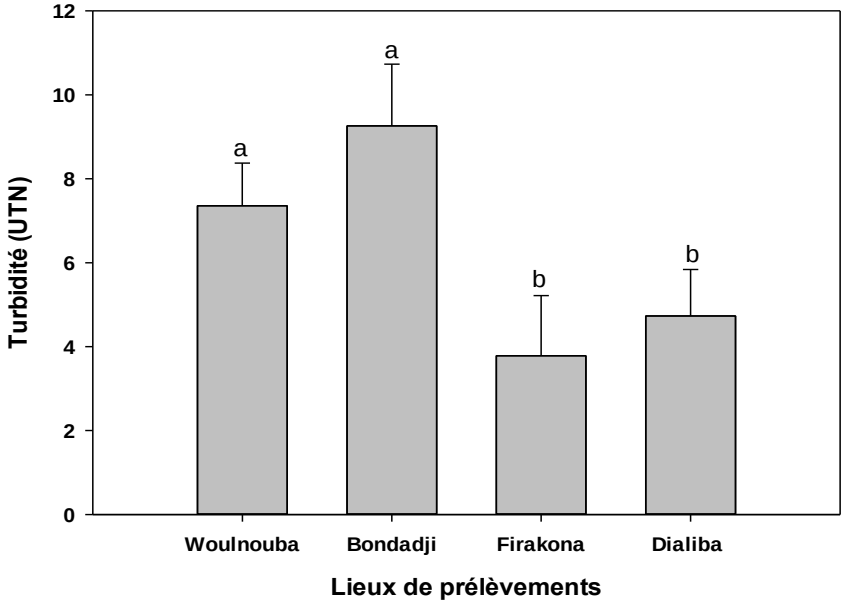

Figure 5 : Turbidity of the waters of the head of the spring and its tributaries.

Figure 5 shows a highly significant difference between the tributaries Woulnouba 5.33 NTU, Bondaji 3.69 NTU, Firakona 1.24 NTU and Djaliba head of the spring 3.5 NTU. This difference is due on the one hand to the presence of organic debris in the flow beds and on the other hand to the presence of other minerals.

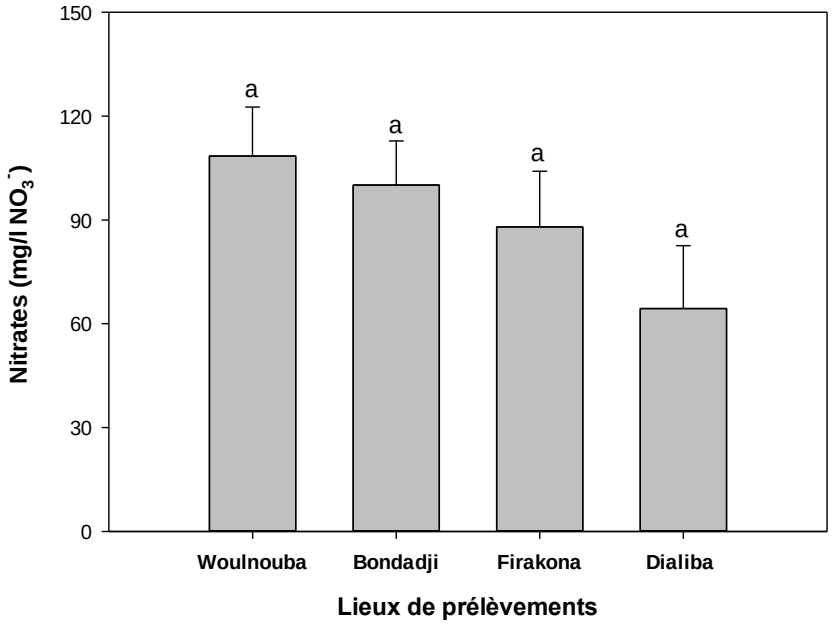

Figure 6 : Quantity of Nitrates contained in the waters of the head of its tributaries.

Figure 6 shows that the quantities of nitrates obtained in the waters of the tributaries after analysis are between 20.37 NO3mg/l for Firakona, 21.26 NO3mg/l for, 31.45 NO3 mg/l for Bondaji and 22.15 NO3mg/for Djaliba the head of the source which has a value of l. This difference is due to the external inputs of nitrogen fertilizers from the slopes.

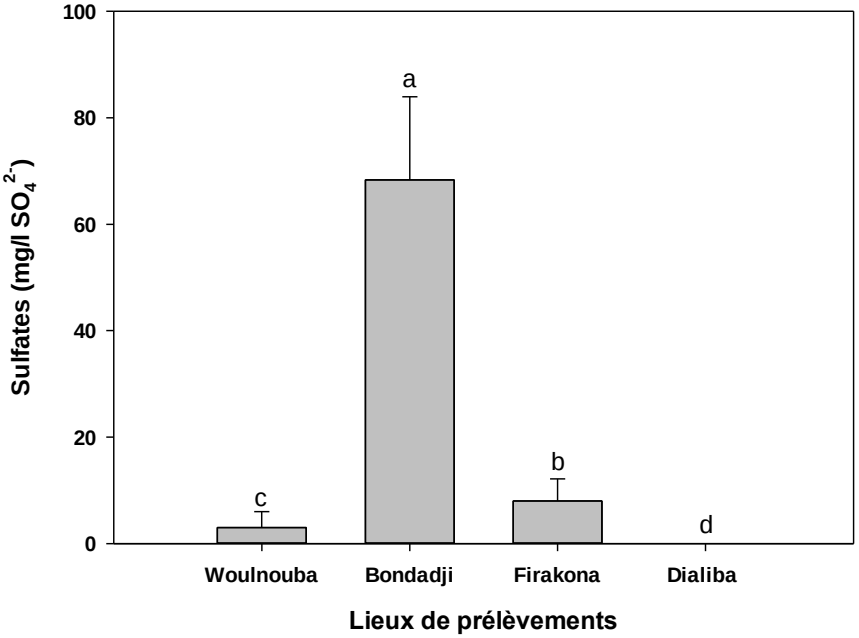

Figure 7. Quantity of sulfates contained in the waters of the head of its tributaries.

Figure 7. Shows that the sulfates of the tributary Bondaji present values of 68.33 mg/l, significantly different from the other tributaries (B C) at the threshold of ($P<0.05$). However, the tributary Firakona (8.00 m/l) is also significantly higher than Woulnouba

(3.00m/l). This increase proves that the waters of the tributaries contain sulfates ; this comes from sedimentary deposits rich in evaporite of saline rocks. Dialiba (0.00 mg/l) does not contain any sulfate pollution.

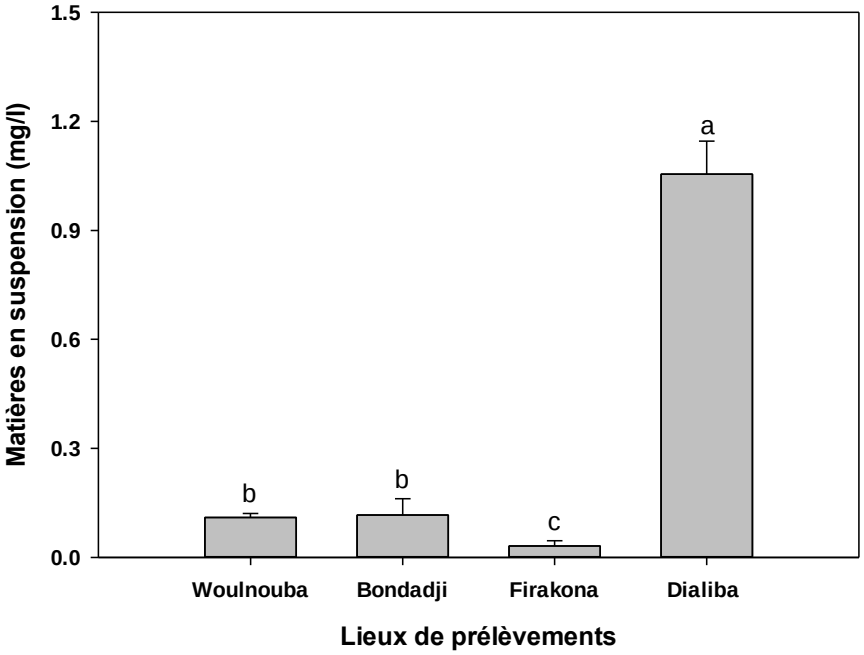

Figure 8 : suspended matter contained in the waters of the head of its tributaries.

In view of this figure 8, we notice a non-significant difference between Woulnouba and Bondaji. Firakona presents the lowest quantity of suspended matter in the waters of the three tributaries and the head of the source analyzed. The values found vary between 0.0 NTU 1 and 0.088 NTU. This low fluctuation is due to the low deposition of suspended matter in the beds of the head of flow and its tributaries. We note a highly significant difference between Dialiba and the tributaries.

DISCUSSION

In our study, the pH values of the 4 samples were between 6.82 and 7.31. These results agree with the acidity and basicity of these waters in comparison with the Algerian standards of 6.5 and 9, as well as with the WHO standards of 6.5 and 9.5. This acidity and basicity of the pH depend on the origin of the water and the geological nature of the substrate as well as the watershed crossed (Bidi Zaina and Djidja Célia, 2013).

The temperature of the water depends on its origin (superficial or deep) (Rodier, 1984). In our study, we observed that the temperature indicates that temperatures between 28.32 and 26.28 are the average values, which indicates that the head of the Niger River and its three tributaries constitute an exceptional thermal spring.

The turbidity of the water is due to the presence of suspended matter: clay, silt, silica, organic matter, etc. Evaluating the quantity of these materials is equivalent to evaluating their degree of openness. In our research, the turbidity values that were determined during the analyses in the volume of water vary from 7.36 to 4.73 NTU; These averages indicate that the turbidity of the water of the tributaries and the head of the spring is below the maximum admissible level which is 30 NTU (Youssef Azami et al., 2015).

In our study, the waters of the sources of the Niger River were free of sulfates, however, the contents of the Firakona and Woulnouba tributaries were between 8.00 mg/l and 3.00

mg/l, and they still did not respect the recommended content of 50 mg/l, which demonstrates that the waters in question comply with the regulations in force (NM 03.07.001/2006). On the other hand, the waters of the Bondaji tributary exceed the recommended limit (NM 03.07.001/2006).
The quantities of MES in the water samples from the head of the spring and its tributaries vary between 0.11 mg/l for Woulnouba, 0.12 mg/l for Bondaji, 0.03 mg/l for Firakona, and these values are always lower than the recommended value of 1 mg/L of the WHO [34] on the other hand, the head of the spring (1.06 mg/l) slightly exceeds the recommended value of (1 mg/L) of the WHO [34].

CONCLUSION AND RECOMMENDATIONS

The objective of our study is the analysis of some physicochemical parameters of the head of the Niger River and three rivers directly flowing into it in the C R of Kobikoro, District of Forokonia / Bakando with a view to its use. The observation is that the pH, temperature, turbidity are in accordance with the standards of use, on the other hand the sulfate, nitrates and suspended matter are not in accordance with the standards of use; this is why in relation to these parameters we recommend:

- Restore the head of the source and the banks;
- Regulate logging;
- Promote environmental literacy;
- Create community forests.

Declaration by Authors

Acknowledgement: None
Source of Funding: None
Conflict of Interest: No conflicts of interest declared.

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How to cite this article: Sayon Saran CONDE, Hamidou BAH, Ibrahima BARY, Abdoulaye CISSE, Mamadou Aliou DIALLO, Diariou DIALLO et.al. Assessment of the level of pollution of the waters of the source head of the Niger River and Three Tributary Rivers in the rural commune of Kobikoro, district of Forokonia, Faranah-Guinea. *International Journal of Research and Review*. 2025 ; 12(2) : 114-122. DOI: *10.52403/ijrr.20250213*

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