

Assessment of Water Quality from the Mani River, the Water Source of the Yalenzou Water Supply System in N'Zérékoré Prefecture, Guinea

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Abstract High concentrations of chemical elements and bacteria (enteropathogenic bacteria) in water can cause waterborne diseases that are potentially dangerous to humans without prior effective treatment. The aim of this study was to evaluate the physico-chemical and bacteriological quality of the water from the Mani River and the Yalenzou water supply system in order to establish the occasional presence of contaminants. Water was sampled from March to May 2025 (towards the end of the dry season and the beginning of the rainy season), which corresponds to the increase in surface water. Results showed significant differences ($P < 0.05$) in conductivity, total dissolved solids (TDS), salinity and biological oxygen demand (BOD5) among the two sampling sites. Mani River recorded the highest mean value of BOD5 (191.33 ± 1.52 mg/L versus 189 ± 3.00 mg/L). Fecal coliforms in the Mani River and raw water of Yalenzou water supply system were 332.33 ± 17.61 and 165 ± 5.00 CFU/100mL respectively. These values were far above the minimum standards set by the World Health Organization (3 coliforms/100 mL of water). Iron, turbidity, nitrite, temperature and salinity characterized the raw water from the water supply system, whereas conductivity, turbidity, salinity, BOD5, fecal and total coliforms characterized water from the Mani River. This study highlights the level of contamination of the Mani River and the questionable quality of water consumed in households of the forest region, Guinea.

Keywords: Water quality, physico-chemical characteristics, fecal coliform, Mani River, N'Zérékoré

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1. Introduction

Water is essential for living beings on the planet and life cannot exist without water [1]. The quality of surface water is essential for aquatic life. Waterbodies such as rivers and streams are crucial and vital sources of freshwater for various human activities like agriculture and industry [2,3,4]. The pollution of waterbodies in recent decades combined with the climate change are causing increased degradation of water resources. They

represent a major challenge for public health and environmental sustainability [5]. Indeed, the development of agriculture (with the use of phytosanitary products) along the banks of the river is the primary cause of pollution and degradation of water quality [6,7,8].

Although Guinea is called the "water tower of Africa", its population is facing drinking water problem. The Mani River located in the sub-prefecture of Yalenzou is the source of water for the drinking water supply of the population of the city of N'Zérékoré. The rapid increase in the population of the city has led to the development of agricultural activities upstream of the river. The Guinean

Water Company (SEG) despite having made prior arrangements by planning to remove all suspicious activities is not listened to by a population in search of cultivable land. The aim of this study was to evaluate the physico-chemical and bacteriological quality of the water from the Mani River and the Yalenzou water supply system in order to establish the occasional presence of contaminants. The physico-chemical parameters have been used throughout the literature to assess the water quality [9,10,11]. Apart from the physico-chemical analysis, the study of microbial pollution is determined through the assessment of indicators including faecal and total coliforms. The combination of the two approaches (physico-chemical and bacteriological) allows a comprehensive assessment of the water quality of the Mani River and the associated risks for public health.

2. Materials and Methods

The study took place within the sub-prefecture of Yalenzou. The sub-prefecture of Yalenzou is a rural council located in the prefecture of N'Zérékoré, in the south east of Guinea in the forest region (Figure 1). It is distant of about 15 km from the city of N'Zérékoré. The administrative region of N'Zérékoré borders the Republic of Liberia, 3km from the border.

The administrative region of N'Zérékoré shares borders with the Haute Guinée region to the North, the Republics of Côte d'Ivoire to the East, Liberia to the South and Sierra Leone to the West (www.guineeplus.net).

The study area is characterized by a humid tropical climate (or sub-equatorial climate) with an extended rainy season of about nine (9) months. There are two main seasons during the year: a rainy season, which runs from April to November, and a dry season from December to March. Annual rainfall varies between 1,700 and 3,000 mm and temperatures between 19°C and 29°C (with an annual average of 24°C) (www.guineeplus.net).

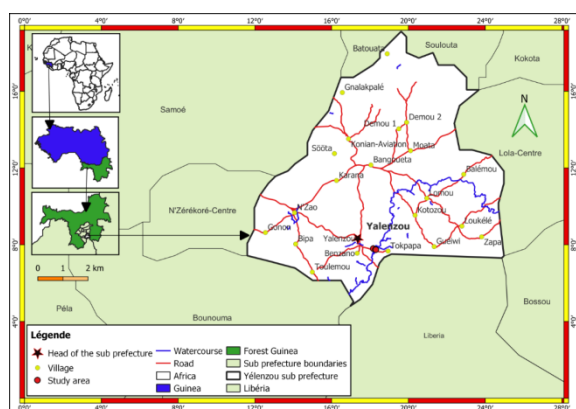


Figure 1. Map of the study area showing the Mani River in the sub-prefecture of Yalenzou

Water sampling

Water sampling was carried out from March to May 2025 (towards the end of the dry season and the beginning of the rainy season), which corresponds to the increase in surface water. Samples were collected from the Mani River and the Yalenzou water supply system (raw water). Water sampling was carried out the Mani River and then

at the water distribution station after pumping water from the Mani River (raw water). Raw water from the distribution station is the river water that has undergone pre-treatment (screening and/or sieving). Water samples were collected using 500 ml bottles that had been previously washed and disinfected. Once on the field, the bottles were washed three times with the water to be sampled. The bottles were filled to the brim and then the cap was screwed on to avoid any gas exchange with the atmosphere. The samples were stored in a refrigerated cooler during transport to the laboratory of water analysis, where the analyses were carried out immediately.

Physico-chemical parameters determination

The physico-chemical parameters of collected water samples such pH, conductivity, temperature, salinity, dissolved oxygen (DO) and total dissolved solid (TDS) were determined in situ using a multi-probe parameter (version AZ86031 with an accuracy of ± 0.01 pH and $\pm 0.1^\circ\text{C}$ per mg/L). Secchi disk was used to measure the transparency of the water from the Many River. Concentrations of nitrate (Cadmium reduction method using NitraVer 5 reagent (HACH 8039), nitrite (Diazotization method using NitraVer 3 reagent (HACH 8507), ammonium (Salicylate method using AmVer reagent for ammonia (HACH 10031) and phosphate (PhosVer 3 method (ascorbic acid) (HACH 8048). Iron was determined by the photometric method using the 7500 photometer and manganese were determined by respectively the 1.10 phenanthroline method using the AL450 photometer and using the 7500 photometric methods. Turbidity was measured with a turbidimeter (Radiation attenuation method (HACH 8237). The biochemical oxygen demand over 5 days (BOD_5) was determined by the method of [12].

Bacteriological analysis

Fecal and total coliforms were the main bacteriological parameters investigated. These germs were determined by the membrane filtration method as described by [12]. This method is widely used for the enumeration of coliforms in water intended for human consumption.

Statistical analysis

All data were analyzed using the statistical software Statistica (Statsoftinc.,Tulsa,OK,USA). The influence of the physico-chemical parameters and the levels of bacteriological contamination of the Mani River and the raw water from the Yalenzou water supply system were studied using the analysis of variance (ANOVA). In the case of significant differences, the significance of the differences between the mean values was tested using Fisher's least significance difference (LSD) test. For each test, the significance threshold was set at $\alpha=5\%$.

3. Results and Discussion

Physico-chemical parameters of water of Mani River and Yalenzou water supply system

Analysis of variance of the water physico-chemical parameters showed a highly significant difference between the two sampling sites ($F_{(16, 64)} = 3.98$, $P < 0.0001$) (Table 1).

The mean values of the physico-chemical parameters from the Mani River and Yalenzou water supply system

are shown in Table 2. Statistical analysis showed significant differences ($P < 0.05$) in conductivity, total dissolved solids (TDS), salinity and biological oxygen demand (BOD₅) among the two sampling sites. Mani River recorded the highest mean value of BOD₅ (191.33±1.52 mg/L versus 189±3.00 mg/L) (Table 2). The mean values of BOD₅ recorded in both the Mani River and Yalenzou water supply system were above the means found in water bodies of Benue South in Nigeria [13]. The average values of BOD₅ in both water sampled were higher than the values recommended by the World Health Organization [14] and the Nigerian standard for surface water quality, which are 6 and 10 mg/L, respectively. Similarly, the average values of turbidity recorded in the present study were higher than the standards set by WHO (5 mg/L, [14]). Studies have shown that an increase in turbidity of the Nun River in the Niger Delta in Nigeria is due to anthropogenic activities [15,16]. In the present study, the high mean values of turbidity, conductivity and

BOD₅ recorded in both the Mani River and the Yalenzou water supply system are likely due to the development of agricultural activities along the banks of the river. However, parameters such as pH, temperature, turbidity, nitrite, nitrate, ammonium, phosphate, dissolved oxygen, manganese and iron from the Mani River and the Yalenzou water supply system did not show any significant differences ($F_{(1, 4)} = 0.91$, $p = 0.39$). These results are comparable to those obtained by [17] in the water bodies of Korea. Similar results were recorded in rivers of China [18]. In the present study, raw water from the Yalenzou water supply system, which had not undergone any treatments for water purification (mainly secondary or tertiary treatment), still shares some physico-chemical characteristics with the water of the Mani River (source of withdrawal). Indeed, the raw water from the Yalenzou water supply system had undergone only pre-treatment or primary treatment, which consists of removing bulky materials that may interfere with subsequent processing steps.

Table 1. F value and significance level of the two sampling sites considering the physico-chemical and bacteriological parameters using ANOVA

	SC	Degree of freedom	MC	F	P
Sampling site	204.00	1	204.00	0.02	$p > 0.898$
Parameter	984E3	16	615E2	18.03	$P < 0.000^*$
Parameters* Sampling site	218E3	16	136E 2	3,99	$P < 0.000^*$

Table 2. Physico-chemical parameters of the Mani River and the Yalenzou water supply system

	pH	T°C	Sal	Cond	TDS	OD	Turb	Transp
Yalenzou water supply system	7.21±0.14 a	27.3±1.11 a	127.33±14.80a	255.33±29.0 2a	127±14.22a	4.8±0.28a	18.33±1.52 a	-
Mani River	7.34±0.18 a	25.8±0.30 a	42.66±0.57b	86±1.00b	42.66±0.57 b	4.83±0.28 a	15.3±2.00a	43.33±5.7 7
	Mn	Fe ²⁺	PO ₄ ³⁻	NO ₃ ⁻	NO ₂ ⁻	NH ₄ ⁺	DBO	
Yalenzou water supply system	0.12±0.03 a	2.2±0.52a	2.28±0.18a	6.91±0.08a	0.05±0.04a	0.04±0.03a	189±3.00b	
Mani River	0.26±0.20 a	1.76±0.25a	2.9±0.52a	6.46±0.12a	0.06±0.04a	0.34±0.36a	191.33±1.52a	

BOD₅= five days biochemical oxygen demand, water temp = water temperature, Cond =conductivity, DO = dissolved oxygen, TDS = total dissolved solids, pH: hydrogen potential, Turb: turbidity, Transp: transparency. The means with the same letter on the same column are not significantly different at the threshold 5% according to LSD.

Coliforms in water of Mani River and Yalenzou water supply system

Fecal coliforms in the Mani River and raw water of Yalenzou water supply system were 332.33±17.61 and 165±5.00 CFU/100mL respectively (Figure 2). Similarly, total coliforms in both waters were 360±20.81 and 195.33±5.50 CFU/100mL in the Mani River and Yalenzou water supply system respectively (Figure 2). These values suggest that both waters are contaminated by potentially harmful microorganisms [19]. Indeed, coliforms are enteropathogenic bacteria of fecal origin (animal or human) and are often the cause of waterborne diseases in humans [20]. According to [20], the aquatic environment contaminated by a high level of coliforms could suffer adverse effects on the balance of this ecosystem. Coliform levels found in our water samples were higher than the minimum standards set by the World Health Organization (3 coliforms per 100 mL of water). The river water and the raw water from the Yalenzou water supply system are

therefore of doubtful quality.

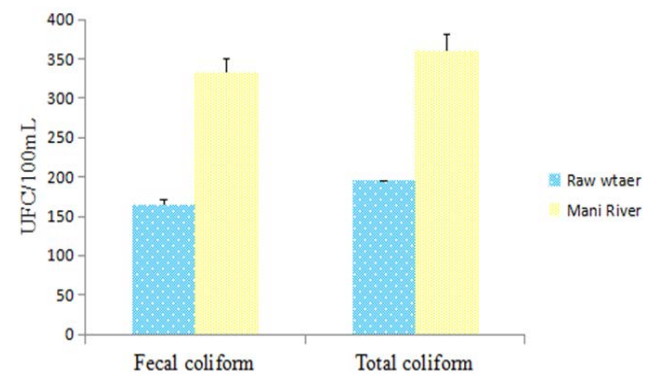


Figure 2. Fecal and total coliforms in the waters of the Mani River and raw water from the Yalenzou station

Relationship between physico-chemical and bacteriological parameters of water samples

The principal component analysis highlights the relationship between the physico-chemical and bacteriological parameters of the Mani River on the one hand and the raw water of the Yalenzou water supply system on the other hand (Figure 3). The two factors (F1 and F2) expressed almost 80% of the correlation between the physico-chemical and bacteriological parameters and the different water sources (Figure 3A). There was a strong positive correlation between F1 and temperature, salinity, conductivity, nitrate, turbidity and transparency on the one hand and a negative correlation between BOD₅, fecal and total coliforms on the other hand (Figure 3A,

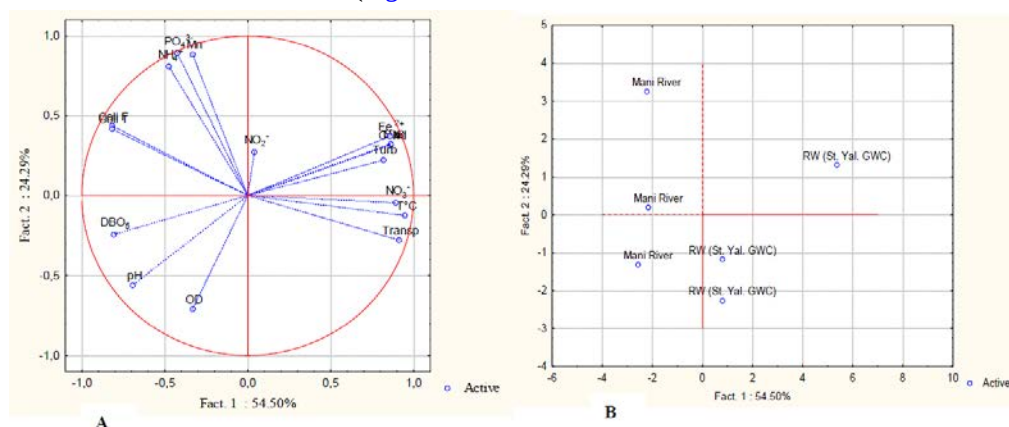


Figure 3. Principal component analysis (PCA) based on correlation matrix showing the relationship between physico-chemical variables and sampling sites. Abbreviations: BOD₅= five days biochemical oxygen demand, water temp = water temperature, Cond =conductivity, DO = dissolved oxygen, TDS = total dissolved solids, Coli F: Fecal coliform, Coli T: Total coliform, pH: hydrogen potential, Turb: turbidity, Transp: transparency

Table 3. Correlation coefficients between variables and axis principal

	Fact.1	Fact. 2
pH	-0.69	-0.56
T°C	0.94	-0.12
Sal	0.86	0.32
Cond	0.86	0.31
TDS	0.86	0.32
OD	-0.33	-0.70
Coli F	-0.82	0.43
Coli T	-0.81	0.41
Mn	-0.33	0.88
Fe ²⁺	0.85	0.37
PO ₄ ³⁻	-0.42	0.89
NO ₃ ⁻	0.89	-0.04
NO ₂ ⁻	0.04	0.27
NH ₄ ⁺	-0.47	0.80
Turb	0.81	0.22
DBO	-0.80	-0.24
Transp	0.91	-0.27

4. Conclusion

The present study assessed the physico-chemical and bacteriological quality of the Mani River, the water source of the Yalenzou water supply system in the N'Zérékoré Prefecture. Variables such as turbidity, salinity, conductivity, five days biochemical oxygen demand, iron, total dissolved solids, temperature, fecal and total coliforms significantly characterized the quality of water

(Table 3). All these physico-chemical and bacteriological parameters characterize the quality of river water [21,22]. Our results are similar to those obtained in the Ganga River in India [21] and Dhaka River in Bangladesh [22]. Manganese, phosphate and ammonium were positively correlated with factor 2, while dissolved oxygen was negatively correlated with factor 2 (Table 3). Iron, turbidity, nitrite, 204 temperature and salinity characterized the raw water from the water supply system (Figure 3A), whereas conductivity, turbidity, salinity, five days biochemical oxygen demand, fecal and total coliforms characterized water from the Mani River.

from the Mani River, the water source of the Yalenzou water supply system. Furthermore, the results of this study showed that certain parameters exceed the standards set by the WHO. This study highlights the level of contamination of the Mani River and the questionable quality of water consumed in households of the forest region of Guinea. Future studies on the water quality of the Yalenzou water supply system after subsequent treatments (and before the provision of drinking water to the population by the Guinean water company) will provide useful information on the necessary measures needed to improve water quality in order to protect the health of the population and the environment.

Ethics Approval and Consent to Participate

Not applicable.

Consent for Publication

Not applicable.

Availability of Data and Material

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare that they don't have any financial and personal relationships with other people or organizations that could inappropriately influence their research.

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Author Contributions

ADANDE Richard: Writing - review and editing, Formal analysis.

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CISSE Aboubacar: Writing-review and editing, Formal analysis

BALDÉ Oumar Alpha: Formal analysis

SOSSOUKPE Edmond: Writing-original draft, Writing-review and editing, Formal analysis, Resources

References

- [1] Khan, F. A. and Ansari, A. A., "Eutrophication: An ecological vision". The Botanical Review, 71, 449-482. 2005.
- [2] Singh, B.P., Choudhury, M., Gupta, P., Chadha, U. and Zewude, D., "Physicochemical and Biological Characteristics of River Hindon at Galheta Station from 2009 to 2020". Environ. Qual. Manag, 33: 331-344. 2024.
- [3] Sunil, C., Somashekar, R. K. and Nagaraja, B. C., "Riparian vegetation assessment of Cauvery River basin of South India". Environ. Monit. and Assess, 170: 545-553. 2010.
- [4] Yadav, S., Gupta, P., Vatsa, P. and Singh, R. P., "Use of pyroaurite type sorbent, activated carbon and fly ash in reducing COD of domestic waste water". Enpro. Jour, 1: 30-36. 2011.
- [5] Adam, M., "Contre la ville durable. Une écologie sans transition", éd. Grevis, 2024. p.140.
- [6] Chung, S. Y., Venkatramanan, S., Park, N., Ramkumar, T., Sujitha, S. B. and Jonathan, M. P., "Evaluation of physico-chemical parameters in water and total heavy metals in sediments at Nakdong River Basin", Korea. Environ. Earth Sci, 75: 1-12. 2016.
- [7] Gupta, A. K., Kumar, A., Maurya, U. K., Singh, D., Islam, S., Rathore, A. C. and Madhu, M., "Comprehensive spatio-temporal benchmarking of surface water quality of Hindon River, a tributary of river Yamuna, India: Adopting multivariate statistical approach". Environ. Sci. and Poll. Res, 1-27. 2022.
- [8] Purkayastha, S. P., Choudhury, M., Deb, D. and Paul, C., "Arsenic contamination in ground water is a serious threat in the North Karimganj block of Karimganj district, Southern part of Assam, India". Jour. of Chem. and Pharm. Res, 7: 371-378. 2015.
- [9] Agwu, E. J., Odanwu, S. E., Ezewudo, B. I., Odo, G. E., Nzei, J. I., Iheanacho, S. C. and Islam, M. S., "Assessment of water quality status using heavy metal pollution indices: A case from Eha-Amufu catchment area of Ebonyi River, Nigeria". Acta Ecol. Sinica, 43: 989-1000. 2023.
- [10] Gbekley, E. H., Komi, K., Houedakor, K. Z., Poli, S., Kpoezou, K., Adjalo, D. K., Zinsou Klassou, K., Tchacondo, T., Ameyapoh, Y. and Adjoussi, P., "The physico chemical and bacteriological characterization of domestic wastewater in Adétikopé (Togo, West Africa)". Sustainability, 15(18), 13787. 2023.
- [11] Taiwo, A. M., Ogunsola, D. O., Babawale, M. K., Isichei, O. T., Olayinka, S. O., Adeoye, I. A., Adekoya, G. A. and Tayo, O. E., "Assessment of water quality index and the probable human health implications of consuming packaged groundwater from Abeokuta and Sagamu, Southwestern Nigeria". Sust. (Switzerland), 15: 3566. 2023.
- [12] Rodier, J.: 2009. "L'analyse de l'eau: Eaux naturelles. Eaux résiduaires. Eau de mer". 9eme édition: Dunod. Paris. p. 1579.
- [13] Edegbene, A.O., Doowuese Y., Temidayo, O. Omotehinwa, H. Z. and Blessing, O. A.: 2025. "Water quality assessment in Benue South, Nigeria: An investigation of physico chemical and microbial characteristics". Water Sci., 39: 279-290.
- [14] World Health Organization WHO., "Guidelines for drinking water quality. V-I recommendations. World Health Organization". 2004.
- [15] Goyenola, G., Graeber, D., Meerhoff, M., Jeppesen, E., Teixeira de Mello, F., Vidal, N., Fosalba, C., Ovesen, N. B., Gelbrecht, J., Mazzeo, N. and Kronvang, B., "Influence of farming intensity and climate on lowland stream nitrogen". Water, 12: 1021. 2020.
- [16] Ifelebuegu, A. O., Ukpebor, J. E., Ahukannah, A. U., Nnadi, E. O. and Theophilus, S. C., "Environmental effects of crude oil spill on the physicochemical and hydrobiological characteristics of the Nun River, Niger Delta". Environ. Monitor. and Assess., 189: 173. 2017.
- [17] Chang, H., "Spatial and Temporal Variations of Water Quality in the Han River and Its Tributaries, Seoul, Korea, 1993-2002". Water Air Soil Pollut., 161: 26-284. 2005.
- [18] Wu Z., Wang X., Chen Y., Cai Y., Deng J., "Assessing river water quality using water quality index in Lake Taihu Basin, China". Science of the Total Environment. 612-914. 2018.
- [19] Shen, C., and Zhang, Y., "Chapter 25-total plate counts & coliform counts of pond water. In C. Shen & Y. Zhang (Eds.), Introductory microbiology lab skills and techniques in food science (pp. 143-148)". Academic Press. 2022.
- [20] Curutiu, C., Iordache, F., Gurban, P., Lazar, V. and Chifiriuc, M. C., "14-main microbiological pollutants of bottled waters and beverages. In A. M. Grumezescu & A. M. Holban (Eds.), Bottled and packaged water (pp.403-422)". Woodhead Publishing. 2019.
- [21] Tripathi, M., Singal, S.K., "Use of Principal Component Analysis for parameter selection for development of a novel Water Quality Index: A case study of river Ganga India". Ecol Ind; 96: 430-6. 2019.
- [22] Roya, B.N., Roya, H., Rahman, K.S et al., "Principal component analysis incorporated water quality index modeling for Dhaka-based rivers". City and Environ. Inter. 23: 100150. 2024.



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