Physicochemical and Microbiological Characterization of the Singuedala River at Mamou (Republic of Guinea)

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Abstract:
Access to drinking water in rural and semi-rural areas is a major concern for people because of the quality of the resource. The objective of this work is the physicochemical and microbiological characterization of the water of the Singuedala River, in order to evaluate its degree of pollution. The methodology adopted to assess the nature of this pollution consisted in conducting two (2) sampling campaigns to analyze water samples from this river. Thus, the results proved that the waters of this river are acidic, a high pollution by nitrites (0.067 to 2.85 mg/l), nitrates (112 to 230 mg/l) and phosphates (0.14 to 0.27 mg/l). Also, iron levels and conductivity are in WHO standards but have grown during the study period. The waters harbor high densities of Total Coliforms (88 to 500 CFU/100ml), Total Fecal (105 to 400 CFU/100ml) and Fecal Streptococci (22 to 650 UFC/100ml). This study shows that pollutant levels in the waters of the Singuedala River are different in time (study period) and in space (from one point to another). Anthropogenic activity remains the major source of the release of these pollutants into the waters.

Keywords: Characterization, Waters, River, Physicochemical, Microbiological.

I. INTRODUCTION
At present and on a global scale, there is an intensification of industrial and agricultural activities as well as a rapid increase in the population and the growth of the standard of living. These activities have introduced into the hydrosystems (estuaries, groundwater, rivers, lakes, lagoons, oceans...) pollutants that have adverse effects on the environment and subsequently on human health. Indeed, some chemicals can cause the disappearance of certain animal and / or plant species and consequently lead to the dysfunction of the trophic chain [1,2]. Water is an essential element in the life of living beings, especially that of humans and animals, having it available in sufficient quantity and of good quality, contributes to the maintenance of health [3]. Water is necessary for all life, it is a cardinal resource for the life and development of man on earth. This is why water is today at the center of public concerns for its sustainable management. As an element promoting hygiene, the health of individuals and the socio-economic development of human communities, it is fundamental for life but can also be a vector of diseases [4]. The surface of the Earth is 90% covered with water. The 1.4 billion cubic meters of water (97%) is salt water. Of the 3% of fresh water, only a very small amount is available as drinking water, most of it is in the polar ice cap, in the glaciers, in the soil and in the atmosphere. More than one billion people have no access to drinking water. In developing countries, 2.6 billion people do not have the means to treat wastewater. Dirty water and poor hygiene are at the root of most diseases in developing countries and are the main causes of still very high infant mortality in some countries. On the African continent, all countries south of the Sahara suffer from lack of water [5]. In the Republic of Guinea, the deserted drinking water has become increasingly a major problem for the public authorities in recent years. Many are now towns and villages that are running out of water. Some urban municipalities do not even have the facilities of the distribution networks of the Guinea Water Company (SEG). Conakry, the capital of the Republic of Guinea has lacked tap water in several neighborhoods for several years. In the urban commune of Mamou, the majority of the population that is not connected to the water distribution network of the Guinea Water Company (SEG) uses water from watercourses that cross the city for water. Domestic needs including the Mamouwol and Singuedala rivers. Thus, the present study aims to study certain physico-chemical and microbiological parameters (pH, Conductivity, Nitrites, Nitrates, Phosphates, Dissolved Oxygen, Iron, Zinc, Total Coliforms, Fecal Coliforms and Fecal Streptococci) of the waters of this Singuedala river, in to compare the results obtained with the standards of the World Health Organization (WHO).

II. MATERIALS AND METHODS
A. Description of the study area
This study took place in the Mamou prefecture located 270 km from the capital Conakry between 10°22'39.93''N and 12°5'2.57''W at an average altitude of 700 m, with a climate characterized by the alternating two seasons of the same duration, the dry season from November to April and the rainy season from May to October, the rainfall oscillates between 1600 mm and 2000 mm, with an average annual temperature of 25°C. It covers an area of 8000km² with a population of 318738 inhabitants (2014) [6].

B. Materials
As part of this study, we used the following equipment: a HANA HI 1832 pH meter, HANA LF 330 conductivity meter, DR 2800
spectrophotometer Oximeter, Olympus 4B binocular microscope; an ultraviolet sterilizer, petri dishes of about 49mm x 9mm, sterile 0.45μm and 47mm diameter porous filter membranes, an autoclave, an incubator whose temperature is adjusted to 35±0.5°C, an analytical balance with an accuracy of 0.0001g, Model NBL124i; a filtration ramp with funnels and filter supports, a vacuum pump and other laboratory equipment.

C. Methods
A series of two (2) water sampling campaigns was conducted. The first took place on October 20, 2018 (period of high flow of the watercourse), the second on 20 March 2019 (period of low flow). Three (3) sampling points were chosen for a total of six (6) samples, including three (3) samples per campaign. Certain physicochemical parameters such as pH and conductivity were measured directly using the HANA 209 pH / conductivity multimeter. The Nitrites, Nitrates, Phosphates, Iron and Zinc were measured through the DR 2800 spectrophotometer. Dissolved oxygen was measured with the HI 4421 oximeter. Total Fecal coliforms and Fecal Streptococci were determined by inoculation on specific culture media after filtration of 100 ml of sample and incubation at 37 ° C according to standards. NF EN ISO 9308-1.

III. RESULTS AND DISCUSSIONS
The results obtained during this study were presented as graphs.

A. Physicochemical parameters
The physicochemical parameters of the Singuedala River are illustrated by the diagrams below (Figure 1).

![Figure 1. Variation of physicochemical parameters](image-url)
pH:
The pH values between 6.7 and 6.9 over the two (2) campaigns indicate that the waters of this river are acidic with an average of 6.8 for the first season and 6.77 for the second season. However, the pH varies according to the sampling points, with stability at point 1 and point 3 sampling. The change in pH at sampling point 2 could be due to the passage of pollutants [7].

Conductivity
The conductivity varies for all two (2) campaigns from 68.8 to 152.67 μs/cm² with stability for sampling point 1, an increase for point 2 caused by anthropogenic (bathing, washing of rolling machines). A larger increase for point 3 which would be due to the fact that this sampling point is located downstream of the abattoir of the urban commune. The increase in conductivity at sampling points 2 and 3 shows the influence that anthropogenic activities can have on the variation of the conductivity [8].

Nitrites
The variation in the nitrite level in the waters of the Singuedala River shows that the quantity is higher for the second sampling campaign with a maximum at point 3 located downstream of the slaughterhouse of the urban commune.

Nitrates
Like Nitrites, the amount of Nitrates increased on the second sampling campaign with the maximum on point 3. Thus, the discharge of animal waste in the river deteriorates the water quality of the river and promotes eutrophication.

Phosphates:
The Phosphate values are very high compared to WHO standards (≤ 0.05 mg/l). The presence of phosphates in water may be of organic or mineral origin. These large quantities of phosphates come from the fertilizer used for agriculture in the fields along the river, the use of water for laundry. The high concentrations of these waters in nitrites, nitrates and phosphates are reflected in the contribution of agriculture and domestic waste [9].

Iron and Zinc
Over all two sampling campaigns, iron and zinc levels in the waters of the Singuedala River meet WHO standards. However, there is an increase in Points 1 and 3. This could be due to observed erosion and anthropogenic activities [10].

Dissolved Oxygen
The dissolved oxygen level is not in WHO standards, so this rate has decreased compared to the first campaign. This could be due to anthropogenic activities that lead to oxidation reactions. At Point 3 (located downstream of the slaughterhouse of the urban commune), we observed the almost disappearance of the river with an excessive development of algae, the disappearance of aquatic fauna and a part of the flora at 1, 2 and 3.

B. Microbiological parameters
The microbiological parameters of the Singuedala River are illustrated by the diagrams below (Figure 2).

The enumeration of pollution indicators shows that the waters of the Singuedala River are polluted by Total Coliforms (TC), Fecal Coliforms (CF) and also Fecal Streptococci (SF). Over the two (2) campaigns, we found that almost all sampling points are polluted by these three (3) indicators (CT, CF and SF). The presence of these indicators in water indicates the presence of...
animal and human waste [11]. The high concentrations of these indicators are likely to be the result of wastewater discharges, sewage and manure from slaughter animals.

IV. CONCLUSION

The data collected during this study made it possible to know the physicochemical and microbiological quality of the Singuedala river in the urban commune of Mamou. This study shows that the waters of the Singuedala River are acidic, which can lead to impaired quality through the formation of toxic compounds. The conductivity of this river is in line with WHO standards. Nitrites, Nitrates, Phosphates, Iron and Zinc, which are the main indicators of chemical pollution, are present in this watercourse. This river also hosts high densities of Total Coliforms, Fecal and Fecal Streptococci. The sources of pollution are mainly of anthropic origin. The high concentration of these microorganisms is related to the strong stressing of the river's waters by agriculture, livestock, laundry and also by the invasion of the riverbed by animal and human waste from the river. Slaughter house of animals.

V. REFERENCES


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