
Health Assessment of the Physico-chemical Quality Treated Water of the City of Nouakchott

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Abstract: Follow the physicochemical quality of treated water from the city of Nouakchott, capital of Mauritania, which plays a very important role as the main source of drinking water in the Nouakchott area, we made a sample every two months Sites: Water treated with the release of the processing station and consumer castle in Nouakchott between 08/2018 and 09/2019. The results of the analysis of the physicochemical parameters of treated water in the city of Nouakchott presented in this work have shown that the pH is close to neutrality (7.85), the average conductivity is 130 $\mu\text{s}/\text{cm}$. Average hardness values, calcium ions, magnesium, chloride, sulfate, sodium and potassium are 5.1 $^{\circ}\text{F}$, 14 mg/l, 3.1 mg/l, 22.1 mg/l, 7 mg/L and 2 mg/L. Regarding nitrogen compounds, content in nitrates, nitrite and ammonium is 0.60 mg/l, 0.005 mg/l and 0.04 mg respectively respectively/L, these values are much lower values to the standard of drinking water. Regarding turbidity, total chlorine, chlorine chlorine and aluminum are very low and are respectively 2.34 NTU, 0.50 mg/l, 0.45 mg/l and 0.06 mg/L. The values of physicochemical parameters show that surface water supplying the city of Nouakchott are classified as excellent.

Keywords: Health Assessment, Water, Quality, Physicochemical, Nouakchott, Mauritania

1. Introduction

It is a problem of the quantity and quality of water necessary for the population and its economic development in many countries, including those that receive little rainfall such as the Sahel countries. Mauritania, for example, because of its coastal climate is a water deficit in the country. Indeed, the lack of rainfall and the importance of evaporation as well as the natural geological survey of the countries make Mauritania poor water resources. The country's water resources are very limited, while its needs of this vital substance are increasing. It is the case of Nouakchott, part of those parts of the world where drinking water resources are

very limited.

Nouakchott is the capital of Mauritania, located along the Atlantic Ocean. Nouakchott is stored in drinking water from the Senegal River. The river water is pre-treated for Beni Naji and then chlorinated at the PK 17 plant in Nouakchott before the water is distributed into the network.

Even if the objective risk of infection has always remained the number one objective of water treatment, the problem of chemical pollution is becoming more and more important. This is largely due to the availability of new techniques that

detect the presence of many chemical pollutants in very low concentration due to the lack of knowledge about their effects [1]. It is a special case for products resulting from water purification [2].

2. Materials and Methods

The nineteen (19) physicochemical parameters studied are temperature, pH, electric conductivity, turbidity, hardness, calcium, magnesium, sodium, potassium, nitrate, nitrite, ammonium, aluminum, sulphate, chloride, carbonates, oxidability, total chlorine and free chlorine.

The pH and temperature were determined by a pH meter Hanna brand with a probe measuring the temperature. The electrical conductivity was measured by conductivity meter Hanna brand. Hardness, calcium and magnesium ions are assayed by volumetric method with EDTA 0.02N. The chlorides are assayed by volumetric method with Silver Nitrate 0.1N, carbonate are assayed by volumetric method with HCl 0.1N. Nitrates, nitrites, ammonium and sulphate were determined by a UV-visible spectrophotometer type 722 S Beijing. Nitrates are determined by the colorimetric method in the presence of sodium salicylate. Nitrites are determined by the colorimetric method in the presence of ethylene diamine and naphthylamine. Ammonium ions are assayed by the colorimetric method on the presence of the Nessler reagent. Sulphate were assayed by the colorimetric method in the presence of barium chloride reagent.

Sodium and potassium ions are measured by a photometer atomic emission type Coming 410. Aluminum, total chlorine and free chlorine are determined by a photometer Watech 7100 with the DPD method.

3. Results

The physicochemical quality of the water treated in Nouakchott in Mauritania was followed through the analysis of water collected at two (2) sites: Treated water at the release of treatment station and the consumer castle in Nouakchott.

Table 1. Results of physical water parameters.

Parameters	Unit	Minimum	Maximum	Average
pH	--	7.25	8.50	7.85
Conductivity	μS/cm	106	138	130.0
TDS	g/l	0.050	0.065	0.060
Turbidity	NTU	0.74	3.90	2.30

Analyses show that the pH of all samples is between 7.25 and 8.50 (Table 1). As regards the water mineralization of Nouakchott, measurement of the conductivity of all the samples shows that they are between 106 μS/cm and 138 μS/cm (Table 1). Measures of the TDS of all samples show that they are between 0.050g/l and 0.065g/l (Table 1). The turbidity values are between 0.74NTU and 3.90NTU (Table 1).

Table 2. Results of chemical parameters of water.

Parameters	Unit	Minimum	Maximum	Average
Hardness	°f	4.45	5.85	5.6
Calcium	mg/l	12.0	16.0	14.0
Magnesium	mg/l	2.1	3.99	2.90
Sodium	mg/l	6	7	6.5
Potassium	mg/l	1	2	1.5
Chloride	mg/l	14	28	21
Carbonates	mg/l	24	49	37
Oxydability	mgd'O2/l	0.19	0.70	0.45

The contents of sodium and potassium of the samples were varied respectively from 6mg/l to 7mg/l and from 1mg/l to 2mg/l (Table 2). The contents of calcium and magnesium ranged from 12.0 to 16.0mg/l and from 2.1mg/l to 3.99mg/l (Table 2). The levels of chloride and carbonates ranged from 14mg/l to 28mg/l and from 24mg/l to 48mg/l (Table 2). The contents of oxidability in mgd'O2/l vary between 0.19 and 0.70 (Table 2).

Table 3. Results of toxic water parameters.

Parameters	Unit	Minimum	Maximum	Average
Total chlorine	mg/l	0.08	0.09	0.48
Free chlorine	mg/l	0.02	0.79	0.40
Nitrates	mg/l	0.24	0.95	0.59
Nitrites	mg/l	0.00	0.01	0.005
Ammonium	mg/l	0.00	0.06	0.03
Sulphate	mg/l	16	23	19.5
Aluminium	mg/l	0.02	0.08	0.05

Concentrations of total chlorine and free chlorine of samples vary respectively from 0.080mg/l to 0.09mg/l and from 0.02mg/l to 0.79mg/l (Table 3). Regarding nitrogen compounds (nitrates, nitrites and ammonium), their contents are very low.

Nitrate and nitrite vary respectively from 0.24mg/l to 0.95mg/l and from 0.00mg/l to 0.01mg/l (Table 3). The contents of ammonium vary from 0.00mg/l to 0.006mg/l (Table 3).

The contents of sulphates vary from 16mg/l to 23mg/l (Table 3).

The contents of aluminum vary from 0.02mg/ to 0.08mg/l (Table 3).

4. Discussion

As part of our study we have done total 100 samples for the physicochemical analysis. Different samples of raw water (river Senegal), treated water at the release of treatment station and the consumer castle in Nouakchott are taken to be analyzed.

The samples were put in the polyethylene bottles of 1 liter capacity. Because of variations which may affect the water samples during transport, some parameters were determined immediately on the site such as pH, temperature, electrical conductivity, the TDS, chlorine total, chlorine free and turbidity.

The most important effect related to the health of turbidity is probably its ability to protect against bacteria and virus disinfection [3]. The outbreak of infectious hepatitis occurred in Delhi, India, due to communication by weight of a raw water source supplying a processing plant with sewage, also accompanied by a significant increase in turbidity of raw water [4].

Turbidity content of the raw water in the studies had varied between 87NTU to 350 NTU.

The high presence of indicator organisms of fecal contamination, undoubtedly constitute a threat to the people who draw water for most of their needs [5], thus the turbidity of treated water at Nouakchott was measured and it proved between 0.74NTU and 3.90NTU (Table 1).

The water treatment at Nouakchott is currently done with Aluminum Sulphate that has been shown by several studies that induces the risk of developing a degenerative neuron disease Alzheimer's.

The content of aluminum varied over the study from 0.02 mg/L to 0.08 mg/L (Table 3), the standard rate of aluminum is set by the European Committee between 0.1mg/L and 0.2mg/L.

During the study, it was observed a variation in the aluminum content in the samples from the various sites. This variation can be explained by the methods of coagulation-flocculation treatment used by the aluminum sulphate.

The electrical conductivity reflects the degree of overall mineralization; it provides information on the salinity level [6]. Measurements of the conductivity of all the samples show that they are between 106 μ S/cm and 138 μ S/cm (Table 1). Very small variations observed between sampling points.

Ammonium is the final product of the reduction of nitrogenous organic substances and inorganic matter in the water. It also comes from the excretion of living organisms and the reduction and biodegradation of waste, without neglecting the contributions of domestic origin, industrial and agricultural [7]. Ammonium ions derived from the degradation of animal proteins (nitrogen cycle), domestic effluent (urea) and urban runoff [2, 8]. Ammonia is toxic to the human organism, the presence of a large amount degrades the quality of the water. It's an indicator element of pollution [9]. Note that the content of ammonium varied during the study from 0.00mg/l to 0.06mg/l. the normal rate of ammonium is set at 0.5mg/l according to WHO [10].

During the study, it was observed a change of the ammonium content in the samples from the various sites. This increase can be explained by the treatment methods used.

Nitrates can cause the formation of nitrites and nitrosamines responsible for both phenomena potentially pathological: methemoglobinemia and cancer risk. Nitrate varied during the study from 0.24mg/l to 0.95mg/l (Table 3).

The nitrate levels recorded at all sites are below 50 mg/L considered the limit value for drinking water according to WHO standards [10].

Nitrites are powerful oxidants that have the ability to transform hemoglobin to methemoglobin, rendering blood unable to carry oxygen to tissues. Such effects have been observed in many animal species. Nitrates are toxic to the human organism; its presence in large quantities degrades water quality [3]. Note that the nitrite content varied during the studies from 0.00mg/l to 0.001mg/l (Table 3).

5. Conclusion

The results of the analysis of physicochemical parameters

of the treated water city of Nouakchott city in Mauritania presented in this work have shown that the pH is close to neutral (7.85), mineralization is average due to conductivity with an average of 130 μ S/cm. The average values of hardness, calcium ions, magnesium, sodium and potassium are respectively 5.6 ° f, 14 mg/L, 2.90 mg/L, 6.5 mg/L and 1.5 mg/L.

Regarding nitrogen compounds, the concentrations of nitrates, nitrites and ammonium are very low. Nitrate, Nitrite and Ammonium average concentrations are respectively 0.59mg/l, 0.005 mg/L and 0.03 mg/L (Table 3).

The average contents of sulphate in samples are very low and are of 19.5mg/l (Table 3).

Regarding the total chlorine, free chlorine and aluminum values are very low and respectively are 0.48 mg/L, 0.40mg/l and 0.05mg/l (Table 3).

Thus, all the physicochemical parameters studied are compatible with the standards of water supply.

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