

Water pollution in the rivers of the Seybouse basin and their impact on the quality of dam water and the environment

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Abstract

Pollution of surface water continues to be a serious problem for people and their environment. The Seybouse watershed offers significant surface water resources whose exploitation has enabled the development of a multitude of economic activities.

The objective of this work is to control the pollution parameters of the Seybouse basin basing on data collected during the period from 2003 to 2014, by identifying the characteristics of the surface waters of these rivers and by determining their qualities. Chemical analysis of the water has enabled to identify the nature and levels of pollutants.

The results of the sample analysis showed that many pollution factors affected the rivers of the basin and contamination was frequent due to the urban and industrial wastewater discharges and the use of chemical fertilizers.

All waters in the Seybouse watershed had acceptable concentrations of nitrates (NO_3^-) and nitrites (NO_2^-). Turbidity indicated high concentrations in the various hydrometric stations studied. The sulfate (SO_4^{2-}) water concentrations were very remarkable, which gave the water a poor quality of sulfates. Pollution indicator parameters such as dissolved oxygen, BOD5 and COD had levels that far exceeded the standards.

Therefore, given the poor quality in the rivers of the Seybouse basin, it is essential to control domestic and industrial discharges by using the appropriate treatment to get rid of the contaminants found in these waters.

Keywords: pollution, analyzes, concentrations, rivers

I. Introduction

Water resources in Algeria constitute one of the main asset upon which depends the success of its economic and social development. Algeria is characterized by a semi-arid or even arid climate that generates limited and unevenly distributed water resources, whether in terms of their geographical distribution or of their quantity or quality. The increase in industrial facilities, the development of the agricultural sector and the extension of urban areas are causing rapid deterioration and quality of the water in the sub-basin, which is defined by the phenomenon of pollution. To control this pollution, it is imperative to know the quality of the waters of the Seybouse basin and its tributaries, which makes it possible to properly characterize and control the quality of its waters. This study aimed to assess the amount of pollutant load at the study stations in the Seybouse basin, thus showing their impact on the environment.

II. Presentation of the study area

The Seybouse watershed is among the largest basins in Algeria It is located in the northeast of Algeria and covers about 6.5 km², making it the third largest basin after the Oued El Kebir El Rhumel and the Oued Mellegue.

The Seybouse, a Mediterranean Oued appeared in the high semi-arid plains on the southern flank of the Tellian Atlas (ANRH 2003), flowing from south to north. The Seybouse basin consists of three main areas from upstream to downstream.

III. Results and discussion

The analysis of the pollution indicator parameters was carried out based on data measured at several hydrometric stations in the Seybouse watershed.



Figure 1. Geographical location of the Seybouse watershed (ABH, 2004)

The studied and analysed parameters were measured by the National Water Resources Agency (ANRH) during the period (2003-2014).

The analysis of the temporal variation of the pollution indicator parameters was developed in the Bouhamdanne hydrometric station (W. de Guelma). Several graphical representations are shown below.

A. Pollution indicator parameters

-Variation of NH₄⁺

NH₄⁺ high concentrations favored the formation of Chloramines which were very toxic and affected treated water quality. The origin of these concentrations was nitrogenous organic matter (discharge, wastewater, plants, etc.), causing problems of bad taste and odor.

The results in Figure 2 showed the highest levels in this station compared to other stations during the period 2004-2007 (> standard: 4 mg / l). During the periods 2006-2008-2011-2012-2013, the NH₄⁺ concentrations were null, and this could be explained by the absence of industrial chemical discharges.

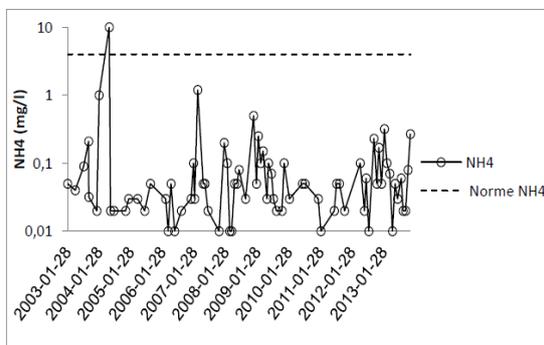


Figure 2. Variation of the NH₄⁺ parameter during (2003-2013)

- Variation of NO₂⁻

The high concentrations of NO₂⁻ were mainly due to the improper use of fertilizers, industrial and domestic waste. This could be fatal, since they

prevented oxygen from binding to hemoglobin in the blood.

The NO₂⁻ levels were obtained in the Bouhamdane station with an average concentration of around 0.5 mg/l which greatly exceeded the standard (0.1 mg / l). The years 2004 -2006-2007-2008-2012-2013 had an average concentration varying between 1.2 and 0.8 mg / l.

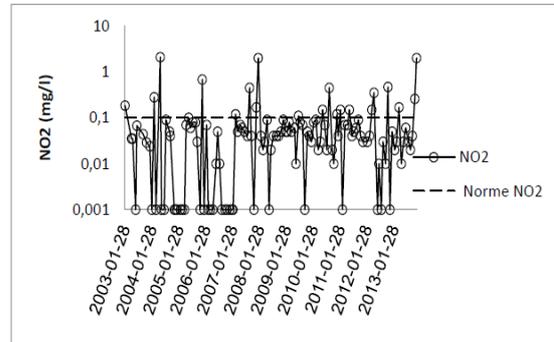


Figure 3. Variation of NO₂⁻ parameter during (2003-2013).

-Variation of NO₃⁻

NO₃⁻ presents their effects on infant health (nitrates reduced to nitrites in the intestine and bind to hemoglobin and decrease oxygen transfer). Throughout the entire analysis period, levels observed in the station Bouhamdanne (Figures 7-9) were lower than the standard (50mg/l) and varied between 5 to 35 mg/l. the origin of these concentrations was organic matter, soil leaching, fertilizers, wastewater, and domestic water.

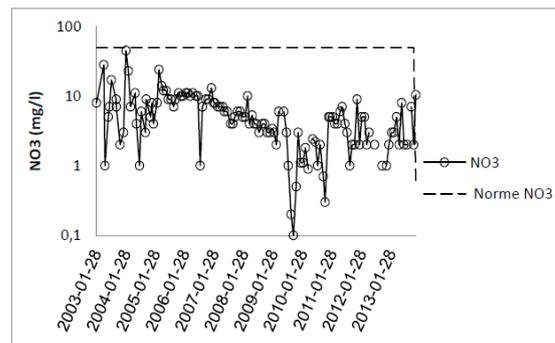


Figure 4. Variation of the NO₃⁻ parameter during (2003-2013).

-Variation of dissolved O₂

The dissolved oxygen analysis result obtained for the Bouhamdanne station showed very low concentrations of dissolved oxygen on monthly and yearly bases, particularly between 2009-2013. This remarkable decrease in dissolved oxygen concentration on a monthly basis was observed in June compared to that in January.

This decrease could be mainly due to their consumption by microorganisms that oxidize organic and mineral matter.

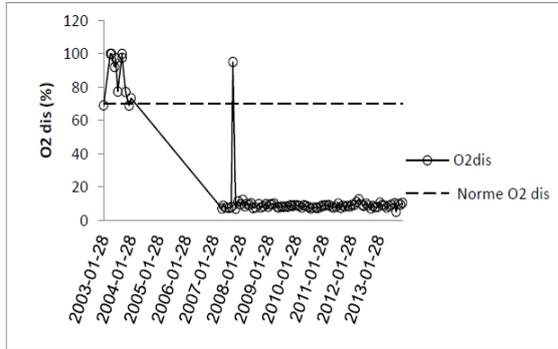


Figure 5. Variation of the dissolved O₂ parameter during (2003-2013).

-Variation of SO₄²⁻

The instantaneous annual values of SO₄²⁻ in the Bouhamdane station were in the range of 1400 mg/L. The concentrations are lower than the standard of 400 mg/l, only the year 2010 presented high concentrations. High concentrations of SO₄ (≥ 250 mg/l) are not dangerous but carry a risk of diarrheal disorders, especially in children.

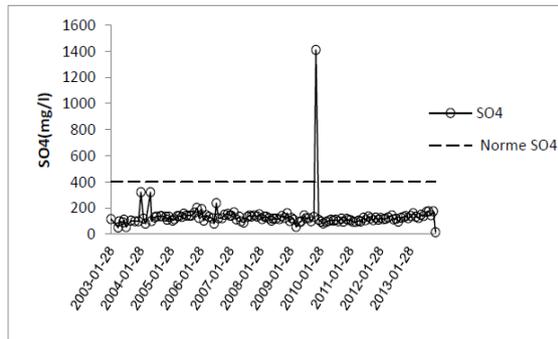


Figure 6. Variation of the SO₄²⁻ parameter during (2003-2013).

-Variation of PO₄⁻

The PO₄⁻ levels observed at Bouhamdane station were generally below standard (1 mg/l). Only the exceptional case of 2013, the average concentration was around 120 mg/l. The high PO₄⁻ contents come mainly from domestic waste (In particular due to the use of phosphate detergents), causing significant development of algae (the proliferation of algae which give a green or brown color to the water).

- Variation of DBO₅

The values measured in the Bouhamdane station generally showed concentrations below the standard (7 mg/l). Except in the case of 2013, the concentrations of BOD₅ were excessive, so this is a potential consumption of oxygen by biological

means (all polluting biodegradable organic materials will lead to water consumption).

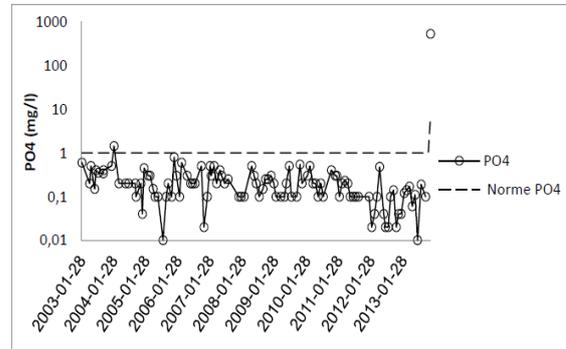


Figure 7. Variation of the PO₄⁻ parameter during (2003-2013)

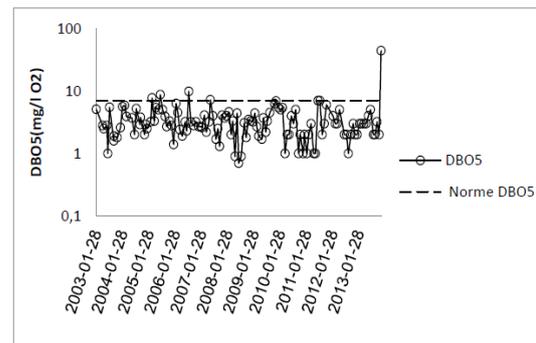


Figure 8. Variation of the BOD₅ parameter during (2003-2013).

-Variation of COD

The majority of the COD values in the Bouhamdane station had concentrations above the standard (30 mg/l). This increase in the chemical oxygen demand indicated a high consumption of oxygen in the watercourse of the basin in certain years, which translates by the natural degradation of the organic matter contained in the water (development of aquatic microorganisms, which are not dangerous but carry a health risk).

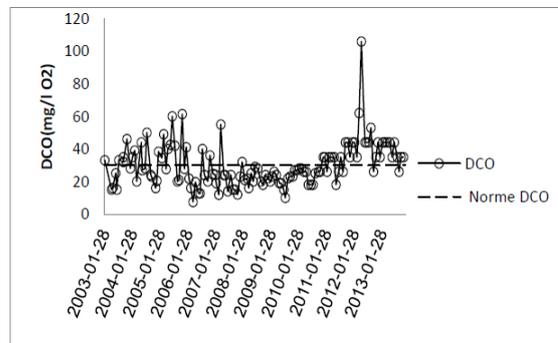


Figure 9. Variation of the COD parameter during (2003-2013).

-COD / BOD₅ ratio

The majority of the values of the COD / BOD₅ ratio in the Bouhamdane station were higher than the standard 4.28 mg of O₂/l this standard (4.28 mg of

O₂/l) presents the relationship between the standard of COD (30 mg of O₂/l) and the BOD₅ standard (7 mg of O₂/l). The COD / BOD₅ ratio in this station exceeded the standard so it can be said that organic matter is not biodegradable.

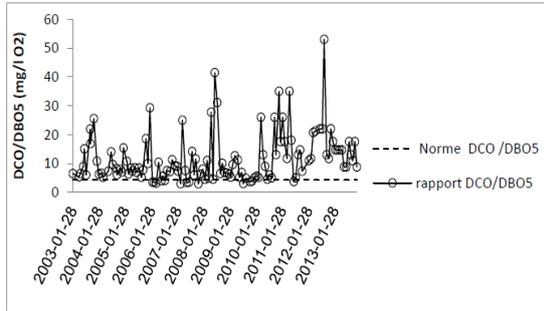


Figure 10. Variation of COD / BOD₅ ratio during (2003-2013).

-Variation of turbidity

The results obtained for the turbidity showed high concentrations in the Bouhamdanne station. This concentration greatly exceeds (2NTU). This parameter presents a health risk since it can reduce the effectiveness of disinfection treatments.

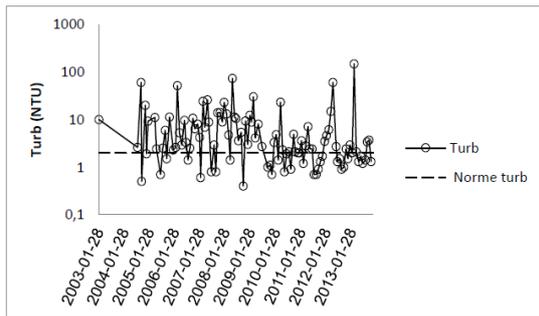


Figure 11. Variation of turbidity during (2003-2013).

III. Conclusion

The Seybouse watershed offers significant surface water resources, an important hydrographic water system made up of one of the richest rivers.

All the Bouhamdanne station waters in the watershed (Seybouse) had moderately low concentrations of nitrates (NO₃⁻) and nitrites (NO₂⁻) and phosphates (PO₄⁻) and ammoniums (NH₄⁺). Indicator parameters pollution such as BOD₅ and COD, dissolved oxygen showed poor water quality. The turbidity showed remarkable concentrations, therefore, a polluted quality.

The water concentrations of sulfates (SO₄⁻²) were high, which gives the water a poor quality of sulfates and therefore poor quality of the water.

In the light of the results obtained, it turned out that the waters of the Seybouse are of poor quality, this source can only be used for irrigation or industry

subject to adequate treatment. However, the use of these waters for drinking water supply requires very thorough treatment.

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