



## **WATER POLLUTION OF OUED MINA UNDER CATCHMENTS, IN ALGERIAN TIARET REGION**

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### **ABSTRACT:**

This work concerns with the evaluation of the hydrous pollution evaluation of industrial effluents, in the principal manufacturing units of Tiaret industrial park, as well as in the receiving dam of worn water of this city. Collected data were treated by correspondent factorial analysis between sites and sampling periods, in summer and winter. This analysis made us possible to focus obvious signs of pollution with the following evolutionary tendencies:

**On the level of Giplait:** We have recorded an increase in the COD and the BOD<sub>5</sub> during the two periods of sampling, as well as increasing rate of suspended solids.

**On the level of Sotrefit:** We have recorded a strong phosphates concentration during the summer and winter periods, as well as a raised rate of Chromium (in winter) and Copper (in summer).

**On the level of the ENF:** We have noted that heavy metals prevail in these site effluents.

**On the level of the Barrage:** We have noted a high concentration of nitrates, organic matter and suspended matter, as a source of pollution of the dam, which is currently used for the supply drinking water in Tiaret region. This work proved that Tiaret region become polluted.

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### **INTRODUCTION:**

Algeria is one of the most underprivileged areas of the world as regards to hydrous availability. However, the demographic explosion and the economic growth involves a very high water demand which exceeds the available resources by far, but moreover, nothing indicates that the dryness which prevailed these two last decades will leave room to an abundant rainfall.

This dryness had a negative impact on the modes of flow the rivers, the level of filling of dam's reserves, and recharging groundwater,

involving serious consequences on the environment and the whole of the socio-economic activities of the country<sup>[2]</sup>.

The annual availability of water in Algeria reach to 600 m<sup>3</sup>/people/year. Algeria therefore locates in the category of the countries low in water resources<sup>[7]</sup>. Taking into consideration threshold of scarcity, fixed by the World Bank, (1000 m<sup>3</sup>/people/year)<sup>[1]</sup>.

In Tiaret area, the industrial and urban untreated wastes, in a hydrous context of pronounced deficit and thus of capacity of recycling limited, lead to concentrations of

pollutants exceeding, in a very significant way, the prescribed standards<sup>[5]</sup>.

In this context, we have been particularly interested in the physicochemical characterization of rejections of three production units, which are currently and directly pouring Oued Mina which feeds the dam of "Bakhadda".

**1-Under catchment's area of "Oued Mina":** Tiaret area belongs to the west Algerian highlands. It is characterized by an altitude ranging between 800 and 1200 m, an area of cereal and pastoral vocation. The potential of the water resources (underground and surface) is of about 200 million m<sup>3</sup> [6]. The under basin has a surface of 2056 km<sup>2</sup> and contributes in feeding "Oued Mina", which prolongs its course until the dam. Indeed, we

can locate "Oued Mina" between the plain of Relizane in the North West, and the parallel of Tiaret in the East. This "Oued" overlaps in fact a part of the Western foothills of the "Ouarsenis" solid mass of and the northern part of the west highlands.

**2-Climate of the area:** The climate of Tiaret area is semi-arid, cold in winter; the annual average precipitations are of about 350 mm. The temperatures raise know great fluctuations in the area (less than 0°C to up to 40°C); this influence of the temperature somewhat slows down the process of food of the underground layers which in fact takes place only over one rather short period (January to April)<sup>[3]</sup>. The averages of climatic data in Tiaret area, among periods of 1993 to 2003, illustrated in table (1).

Table (1): Climatic data of Tiaret area

Months	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.
P(mm)	5	10	15	20.6	33.4	40	41.5	36.6	22.2	13.2	9.6	5
T°C	25.4	20.7	12.2	11	9.2	9.6	10.9	12	16	23	27	30

## MATERIAL AND METHODS:

**Sampling:** A number of 10 samples was carried out in two periods: in winter (February) and in summer (July), during the year 2003.

The aim of this work concerns the evaluation of hydrous pollution of industrial effluents in the principal production units of the industrial park of Tiaret, as well as in the receiving dam of waste water of this city.

### Description of the sampling sites:

**A-Company of Wiredrawing of Tiaret (Sotrefit):** This site is located in the industrial park of Tiaret. It is conceived to produce wire drawn cold starting from the rolled wire rod of El-Hadjar. The various processes of

wiredrawing, the surface treatments and the production of chains and steel fabrics require needs such as:

- Demineralised water.
- Hydrochloric acid and sulphuric acid.

This company has specific equipment to remove pollution, which is composed of two lines:

- Treatment of the worn baths of sulphuric and hydrochloric acid.
- A line of water treatment of coppering.

The nature of the rejections of this company and the receiving medium are reproduced on table (2).

**B-Complex of Foundry of Tiaret "E.N.F":** The national company of foundry is located in

the industrial park of Tiaret. Its activity consists in manufacturing castings made up of various alloys (Table 3).

**C-Dairy Group of Tiaret “Giplait”:** It is located in the industrial park of Tiaret whose activity is the production of milk and derived products. The quantity of industrial waste water

produced by this company is 400 m<sup>3</sup>/day whose principal rejection is the whey (Table 4).

**D-Bakhadda’s dam water:** The Bakhadda’s dam water built in 1930 is the receiving medium of the quoted rejections of the cited three companies. It has a capacity of 45 million m<sup>3</sup> intended for the drinking water supply of Tiaret area<sup>[2]</sup>.

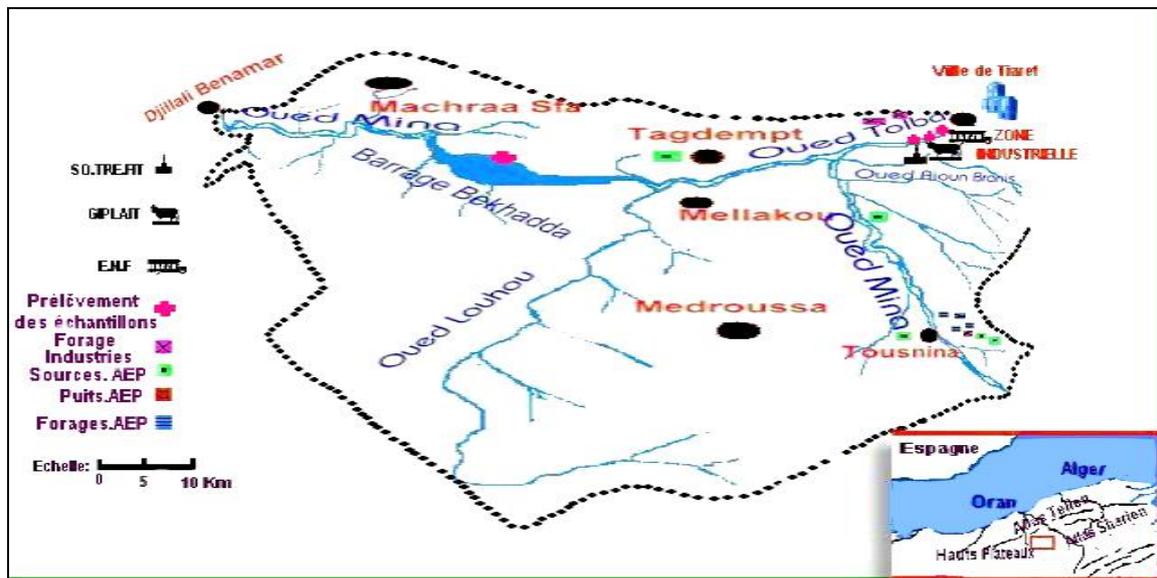


Fig. (1): Localization of study zone

Table (2): Characteristics of the rejections of the Wiredrawing Company of Tiaret

Nature of the rejections	Volume of the waste water (m <sup>3</sup> /j)/Quantity of waste T/year	Receiving medium	Type of rejections	Type of pollution
Liquid	210	Oued Tolba	Rejections acid and basic, -Heavy metals (Iron, Copper, Zinc). - Oils and greases. - Oxydable Matters.	Physico-chemical pollution
Solid	600	Stored on site	-Muds containers of heavy metals. -Ferrous sulphates coming from the station of treatment.	Soil Pollution

Table (3): Characteristics of the rejections of the complex of Foundry of Tiaret “E.N.F”

Nature of the rejections	Volume of the waste water (m <sup>3</sup> /day/Quantity of waste T/year)	Receiving medium	Type of rejections	Type of pollution
Liquid	100	Oued Tolba	-Suspended matter. - Heavy metals. - Organic matters. - Matters Oxydable.	Physico-chemical pollution
Solid	3000	Stored on site	Sands of moulding slag’s of fusion.	Soil pollution

Table (4): Characteristics of the rejections of the dairy group of Tiaret “Giplait”

Nature of the rejections	Volume of the waste water (m <sup>3</sup> /j)/Quantity of waste T/year	Receiving medium	Type of rejections (polluting)	Type of pollution
Liquid	360	Around company	Suspended matter: - Fat contents. - Matter organic. -Oxydable Matters. - Detergent	Physico-chemical pollution
Solid	0.4	-Beds of drying. -Refuse tip for incineration	Mud's containing of the organic matters. -Packing soiled or contaminated.	Emanation of toxic smoke

## RESULTS AND DISCUSSION:

### 1-Analyses of liquid rejections of under catchment area of Mina:

The whole of the analytical results is present in the following graphs (Fig. 2).

### 2-Study links between parameters of water pollution and sites polluted by factor analysis matches:

Factorial analyses Sites correspondences/ Parameters of hydrous pollution is investigated. The results of this FCA are illustrated in figure (3).

The complete analytical results are related in the following graphs. Two axes are likely to be interpreted (they show that meadows of 75% of the dispersion of the variables is done in the plan of these two axes (50% of the total inertia of the cloud). The variables which contribute primarily to the inertia of this axis are:

**Negativeside:** On this side, the axis represents primarily the methods: Zn1 (Zinc measured in summer), Zn2 (Zinc measured in winter), Cu1 (in summer), Pb1 (in summer), Pb2 (in winter) and Cr2 (in winter); these elements are well connected in the ENF site, in every period,

compared to the other sites. Generally, metal pollution poses a particular problem, because metals are not biodegradable. Moreover, it is to be taken into account throughout the food chain, some concentrate in the living organisms.

On the negative side also, our results show the existence of a dispersion of certain polluting parameters such as the COD, the BOD5 and the suspended matter in association with the Giplait site, during the summer season. The measurement of these parameters gives an evaluation of the oxydable matter contained in an effluent. This matter in general, for its greater part, consists of organic matter whose oxidation involves a fall of the quantity of oxygen dissolved in water, element essential to the survival of fauna and the flora. Associated with this containment, the high temperature in this site will promote the appearance of tastes and unpleasant odours. Moreover, this situation will accelerate the majority of the physicochemical and biological reactions in the considered network; it also influences the bacterial growth and dissipates effects of the residual disinfectant while acting on the constants of balance, and by accelerating corrosion also<sup>[8]</sup>. We also noted that the rejections of Giplait have a high pH (basic medium).

Temperature

pH

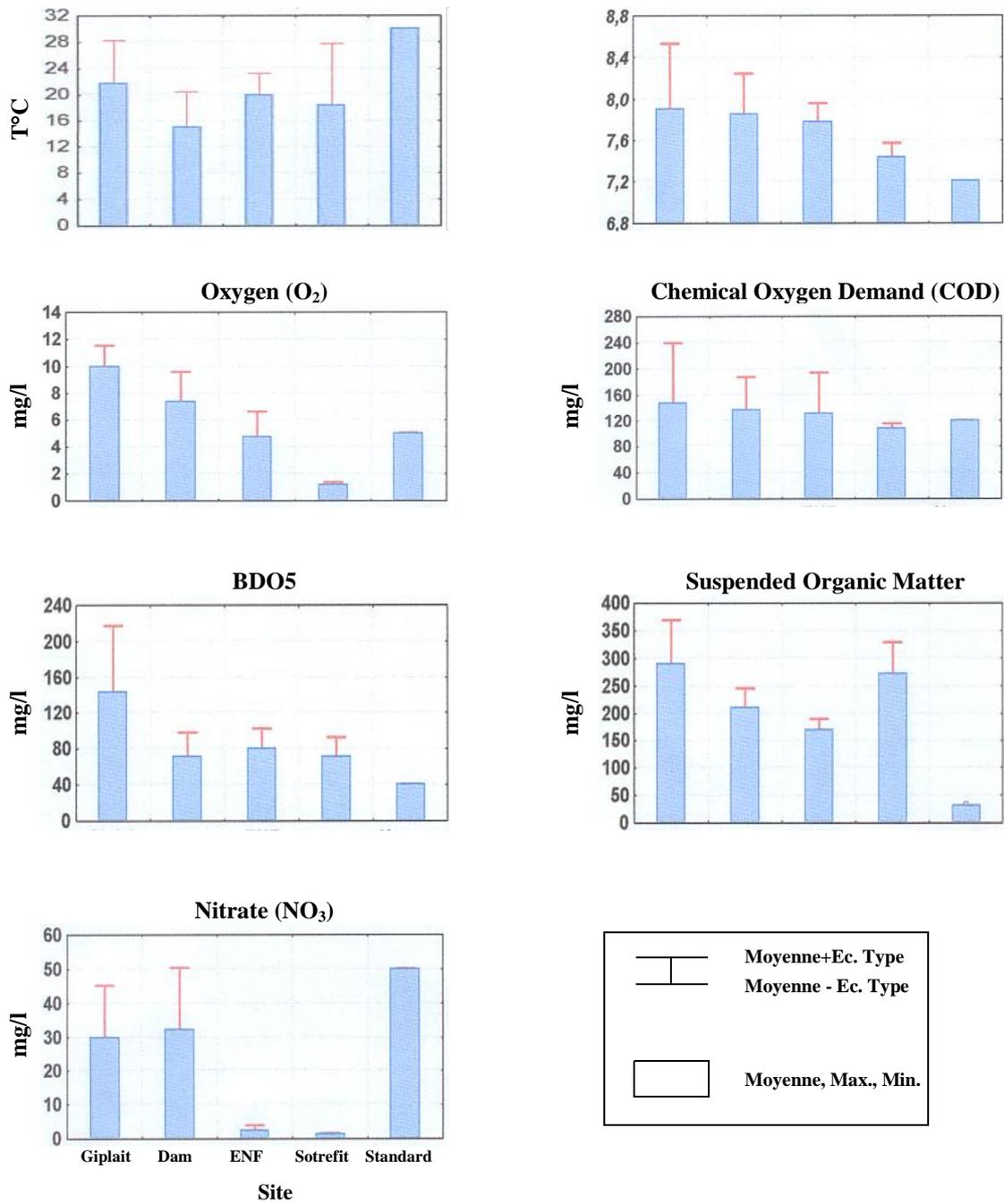
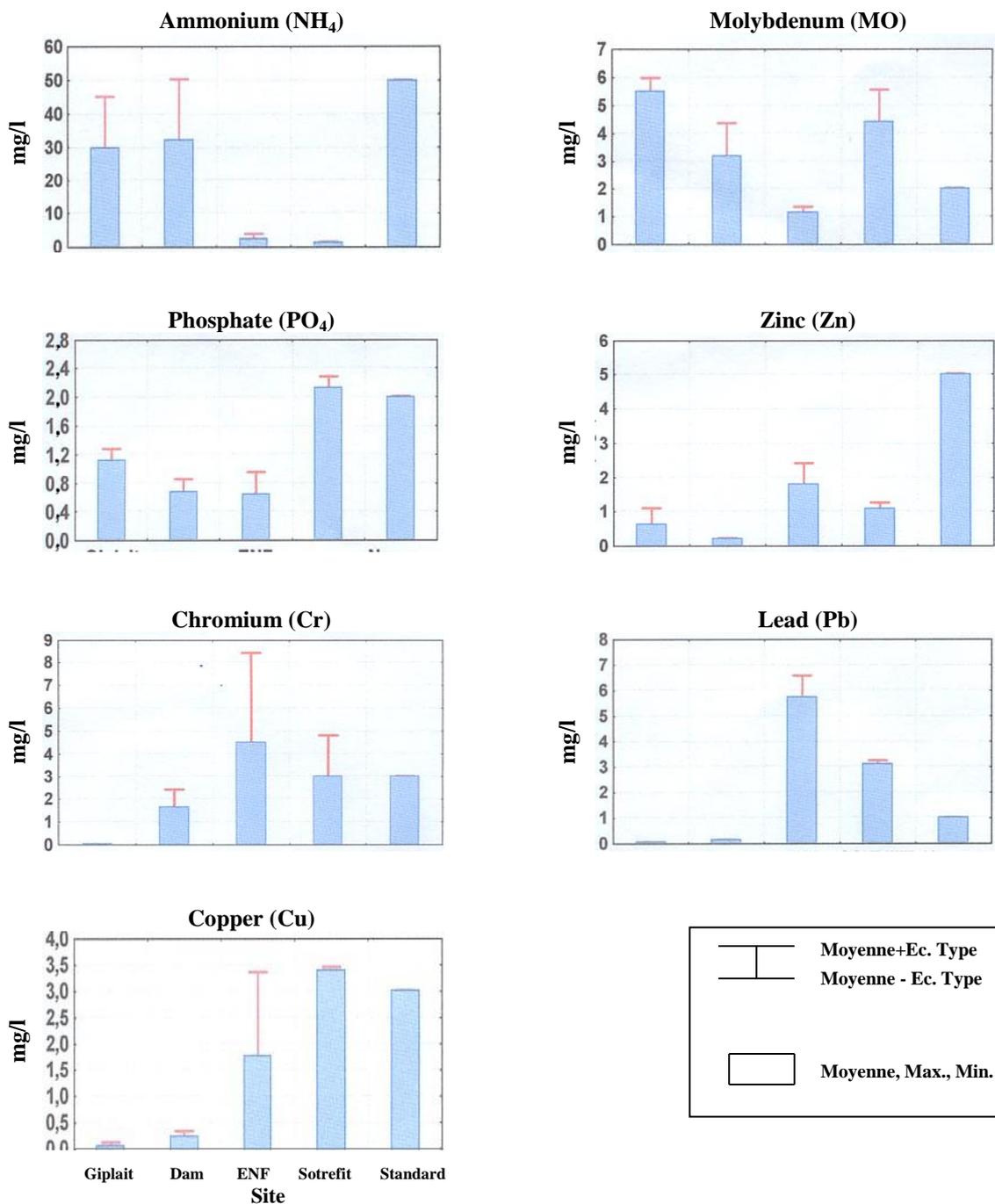
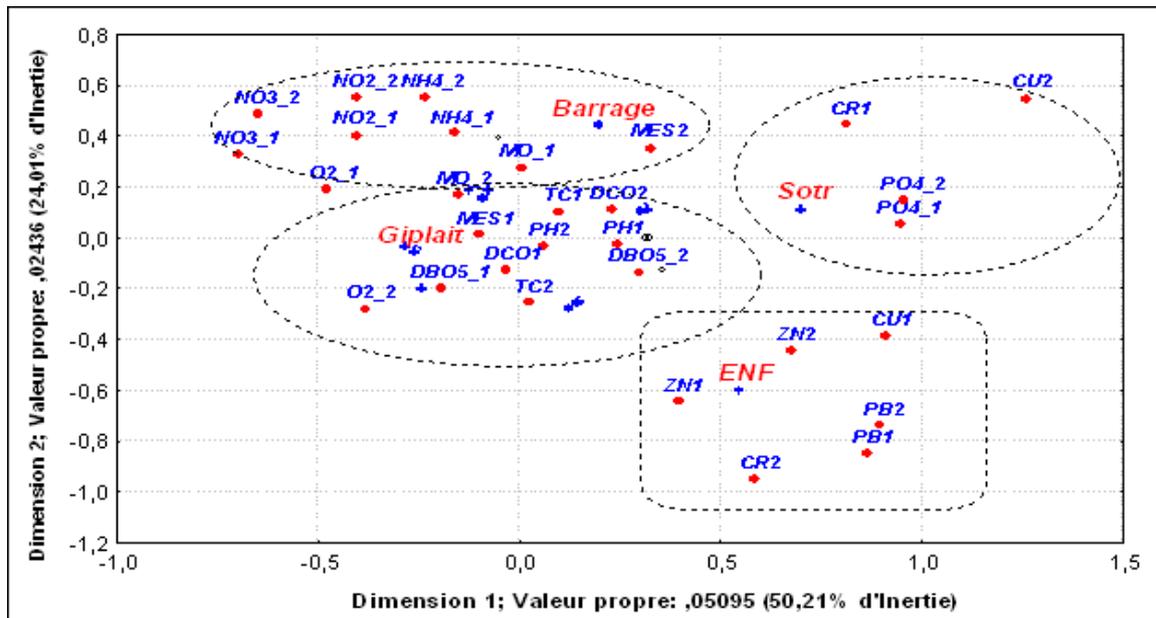


Fig. (2): Results of the physicochemical analysis of samples (Giplait, ENF, Sotrefit, Bakhadda dam)



Cont. Fig. (2): Results of the physicochemical analysis of samples (Giplait, ENF, Sotrefit, Bakhadda dam)



**Legend:**

TC1: Temperature measured in summer 2005.  
 O2-1: Oxygen dissolved in summer 2005.  
 NI1 Nickel in summer 2005.

TC2: Temperature measured in winter 2005.  
 O2-2: Oxygen dissolved in winter 2005.  
 NI2: Nickel in winter 2005.

Fig. (3): Factorial analyses sites correspondences/parameters of hydrous pollution

**Positive side:** The examination of axis 1 on the positive side makes it possible to define the association of the site of the “Sotrefit Company” which holds a strong concentration of Phosphates during the two periods of sampling, chromium (in winter) and of copper (in summer). Indeed, phosphorus is one of the leading causes of vegetable proliferation out of fresh water. For that, it is urgent to act by reducing the phosphate concentration in order to limit the development of vegetable plankton on the surface of these rejections. Phosphorus is naturally present in water at concentrations of some hundredths of milligrams per liter, which are enough with the development of harmonious semi-watery vegetation. Its excess, in its directly usable form by plants, comes primarily from industrial wastes and animal herd’s rejects<sup>[4]</sup>.

**The axis NO<sub>2</sub> (24% of the total inertia of the cloud):** On this axis, we can say that the site of Bakhadda (receiving dam) is associated with strong nitrate concentrations, nitrites, ammonium, organic matter and suspended matter. Now, it is to be noted that this dame is really polluted because of these various nitrogen shapes which are likely to be transformed into nitrosamines (real carcinogenic source). Indeed, nitrogen can be present in water in its various forms: Nitrate (NO<sub>3</sub><sup>-</sup>), nitrite (NO<sub>2</sub><sup>-</sup>), ammonium (NH<sub>4</sub><sup>+</sup>) and organic nitrogen. In addition to its intrinsic toxicity, the ammoniacal nitrogen is transformed into nitrite, then nitrate by consuming oxygen from the process of nitrification. It thus contributes also to situations of anoxia of the aquatic environments<sup>[9]</sup>

## CONCLUSION:

The obtained results from this research revealed a certain number of anomalies, in particular in the management of waste of the various industrial wastes. For this purpose, we announce a certain number of indicator parameters of pollution under catchments area of "Oued Mina" and in the principal production facilities of Tiaret area. Indeed, rejections from "Giplait" have a high concentration in COD, BOD5 and out of suspended matter because of the strong proportion of the whey rejections

On the level of the "Sotrefit Company", we have recorded a high concentration of phosphates which can also be at the origin of particularly acute problems of pollution.

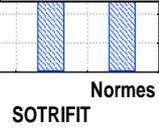
On the level of the receiving dame, we have noted a strong concentration of organic matter and nitrates. So, any fall of the dissolved oxygen content can then be interpreted like a biological sign of growth, in the presence of an important rate of the organic matter. The consumption of the organic matter (essential nutritive source for bacterial proliferation) is accompanied by an increase in water bacterial density. On the other hand, pollution by nitrates can expose drinking water users to serious problems; so, this situation requires a regular monitoring of Bakhadda's dame water quality, which is currently used for the drinkable water provision of the city concerned.

Finally one of the factors accentuating pollution is the dryness, generating so a low flow of feeding rivers of the dame, almost exclusively charged by water of rejections. It would be judicious to work on local standards of surface water and rejections for the whole of the catchments area of the dame. This would make

possible to respect the qualitative aims, specific to surface water feeding this concerned dame.

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## تلوث المياه بوادي مينا بمدينة تيارت الجزائر

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لا شك أن قضايا المياه وتلوثها وإدارتها تشغل الرأي العام العالمي، ومن هنا أتت أهمية هذا البحث والذي يتعلق بتقييم تلوث الماء بالنفايات السائلة الصناعية الرئيسية من وحدات الإنتاج من المجمع الصناعي لمدينة تيارت بالجزائر، والتي يتم التخلص منها في وادي مينا الذي يتم تصفية مياهه ليصبح صالحاً للشرب. وقد تم تحليل البيانات التي يتم أخذ عيناتها في فصلي الصيف والشتاء.

وقد دلت نتائج البحث إلى التالي :

- على مستوى **Giplait** : زيادة في الارتباط **BOD5** خلال فترتي أخذ ووقف تنفيذ معدل النمو.
- على مستوى **Sotrefit** : ارتفاع تركيز الفوسفات، خلال الفترتين الصيفية والشتوية، فضلاً عن ارتفاع نسب الكروم في فصل الشتاء، وارتفاع نسب النحاس في موسم الصيف.
- على مستوى من **ENF** : ارتفاع مستوى المعادن الثقيلة في المخلفات السائلة التي تصل إلى السد، ووجود المواد العضوية التي تتسبب في تلوث مياه هذا السد الذي يستخدم حالياً لتوفير مياه صالحة للشرب لمنطقة تيارت.

ورغم اكتساب مدينة تيارت السمعة بأنها منطقة غير ملوثة، إلا أن هذه الدراسة لا تؤيد ذلك. مما يدعونا إلى العمل على تقليل وصول هذه الملوثات أو منعها تماماً حتى تعود هذه المدينة إلى ما كانت عليه سابقاً.