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Metallic Pollution of Aquatic Ecosystems: Water of Oum Er-Rbia River

Y. Asfers[1*], H. Taouil[1], S. Ibn Ahmed[1] and M. Chakit[2].
[1]*Laboratory of Matériaux, Electrochimie and Environnement, Université Ibn Tofail. Département de Chimie, B.P. 133, 14000 Kenitra, Maroc.*
[2]*Laboratory of Genetics, Neuroendocrinology and Biotechnology, Faculty of Sciences, Ibn Tofail University, Department of Biology, Kenitra, Morocco.*

ABSTRACT: *This study comes after a series of studies evaluating the quality of Oum Er-Rbia river, the choice of this ecosystem is determined by the socio economic importance of this river and the high pollutant caused by the agglomeration and industrial units distributed through the banks and tributaries. Their rejects in the water courses of Oum Er-Rbia can modify the quality of the water and prevent the development of socio economic activities. In our study we have focused to evaluate the contamination degree by toxic metals Zn, Co,Cr, Al by the mesure of their amount in different stations in two companions. The result show that the stations S4, S8 and S9 of Oum Er-Rbia river are contaminated by cobalt, then, in the S4, the manganese amount exceeds the Moroccan standard values in this metal intended for the irrigation. However, the measure of Cr, Zn and Al show that are favorable for the irrigation.*

I. INTRODUCTION

The pollution is a big problem that face the world. It means the presence of high quantities of chemical substances and bacteria which are very harmful for the environment, their adverse effects can be spread for a long time covered all the globe, this pollution affect water, gaze and soil [1-4]. Aquatic ecosystem is one of domains affected by pollution leading to his economic decrease. among these chemical substances we find heavy metals that characterized by his low solubility in the organisms and their accumulation in the trophic strains organic substances (in the opposite of organic pollutants) [5].Some studies interested by the evaluation of metallic pollution in the aquatic ecosystems [6-12] have shown that the use of wastewater in the irrigation produce the water with high account of organic substances and fertilized and flow in the soil which are adsorbed. This solution is absorbed by the plants or percolated in the under soil towards ground water which are deposed his pollutants, the consumption of this polluted water or agricultural products by organisms lead to a flow of this toxic elements in the trophic strains. H. TAOUIL and all [13] have detected the amounts of iron and Mn in the surface water of Guir basinTalssint eastern Morocco. They have shown that this water is not good for healthy and irrigation. Although, Azzawi and al. [14] are interested in the evaluation of the metal pollution of the river Fez and Sebou, they have found that a grave pollution highlighted at the Wadi Fez and they have detected a high concentration of the element Pb in Ouergha river [15], these authors have evaluated the metal pollution of wetlands in the Gharb region and have illustrated the effect of domestic wastewater that increase the concentration of some metal elements in the analyzed waters. So the basin of the OumEr-Rbia is the basin which concentrates the largest water demand of Morocco (4.25 billion cubic meters, or 35% of total water demand of Morocco) [16]. Then the peculiarity of this watershed will not remain without negative impacts on the water resources and the environment. The industry evolution, increasing and modernized agriculture (high use of fertilizers and over-farming) households; douars, towns, cities and increasingly populated constitute the key factors responsible for the degradation of freshwater quality and environment of the watershed of the Oum Er-Rbia. Indeed, a study of the quality of surface waters at the Oum Er-Rbia basin found that it is variable and depends on several factors including; climate, hydrology and location. Their results ensure that quality of water is generally good in the upstream basin and it degrades in downstream because of domestic and industrial waste [17]. Same study has shown that the section between downstream Kasba-Tadla rejection and rejection Dar Oulad Zidouh downstream on the river Oum Er-Rbia is particularly polluted by a combination of industrial and domestic waste. Another study has shown that the domestic sewage of the city Azemmour influences the physico-chemical quality of the estuary waters of the Oum Er-Rbia and causes qualitative and quantitative changes copepod stand estuary during an annual cycle [18].The objective of this study was to help complete the

data on the metal pollution in water intake stations located between the upstream and the downstream of the Oum Er-Rbia river.

II. MATERIALS AND METHODS

2-1. Site Description

The basin of the Oum Er-Rabia is one of the most important socio-economic centers of Morocco. It is one of the best equipped watersheds of the country. It includes 11 dams which the most important are Al Massira, Hassan 1st, and My Youssef Bin El Ouidane. The estuary of Oum Er-Rbia is located on the Atlantic coast 17 km north of the town of El Jadida. Azemmour occupies the left bank of the mouth of the Oued. The climate of the region is arid, hot winter. Water intakes have a double, marine and river. However, the increase in the consumption of water is not the only factor that influences on water, or human activity had a remarkable effect on water and its quality, polluting the very large quantities water, the pollution is caused by domestic, agricultural and industrial emissions that are routed into surface or groundwater without treatment.

2.2. Choice of sampling stations

The water Samples from the river waters were collected during a dry period (June of 2014). In order to characterize the metal quality of the Oum Er-Rbia river, the determination of average concentrations of heavy metals was conducted ineleven stations selected on its main flow, the main selection criteria were the possibilities sampling and the spatial distribution of stations in the river. These stations are rated as follows:

- So: control Station (Sources Oum Er-Rbia);
- S1 and S2: Stations located on the river, respectively before and after the dam "Daourat";
- S3 and S4: stations located near cultivated fields I and II respectively;
- S5: located on the river near cultivated fields I and II;
- S6: located in front of industrial unit "Unimer".
- S7: Station located on the river and allows a water sampling from the industrial unit 'Unimer ".
- S8: Direct Sampling of urban domestic wastewater of Azemmour
- S9: station allowing a water sampling of the urban domestic waste water of Azemmour
- S10: Station located on the river front and the station S11
- S11: adjacent Station (Oued + Beach).

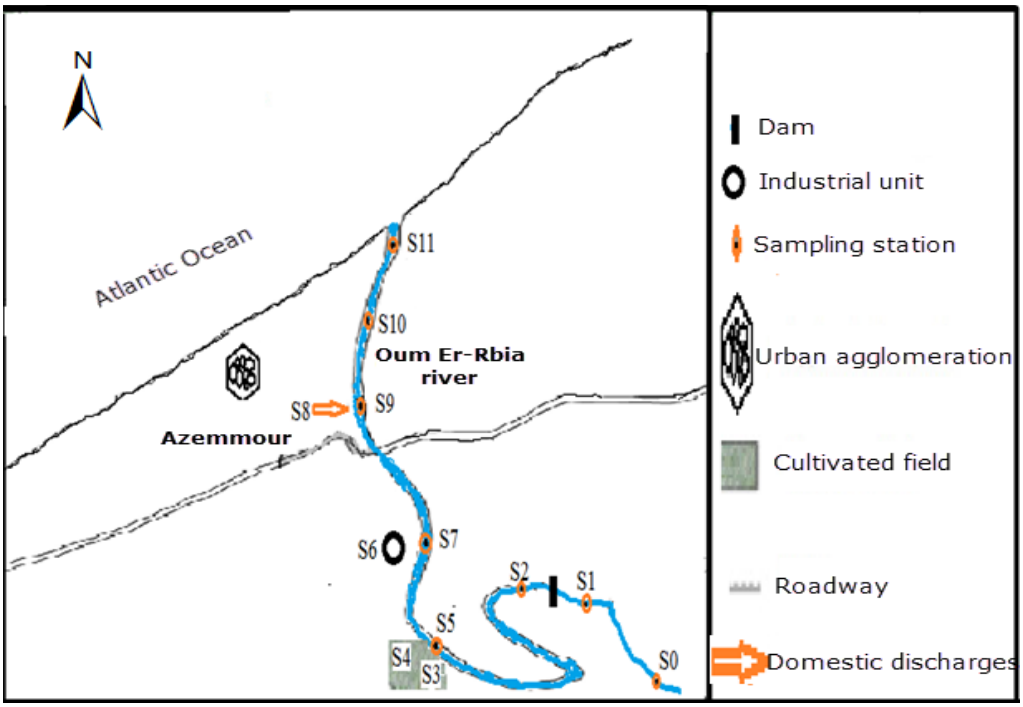

Figure 1: Geographical location of the sampling stations along Oum Er-Rabia River.

Analysis technics:

Water samples have stored in the polyethylene bottles. The water samples are stored in polyethylene bottles washed carefully with a slightly acidified solution and rinsed several times with distilled water [19]. For the determination of heavy metals, all water are treated in the field with ultrapure HNO_3.

III. RESULTS AND DISCUSSION

The evaluation of Cu concentration was conducted in the CNRST laboratory, the mains results are represented in the figures1 to 5.

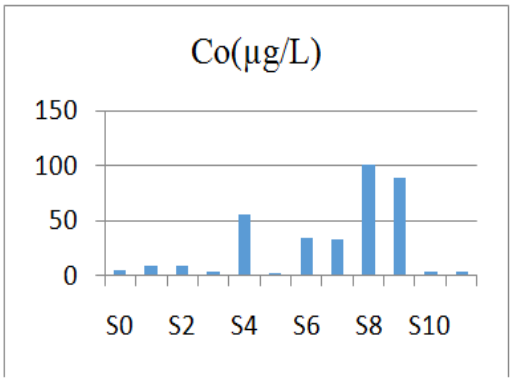

Fig 2: Average value of cobalt in different stations

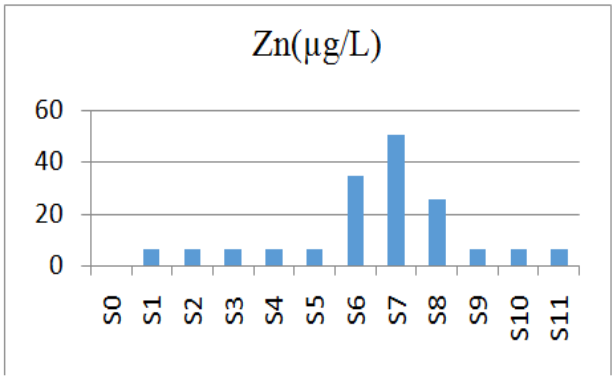

Fig 5: Average value of zinc in different stations

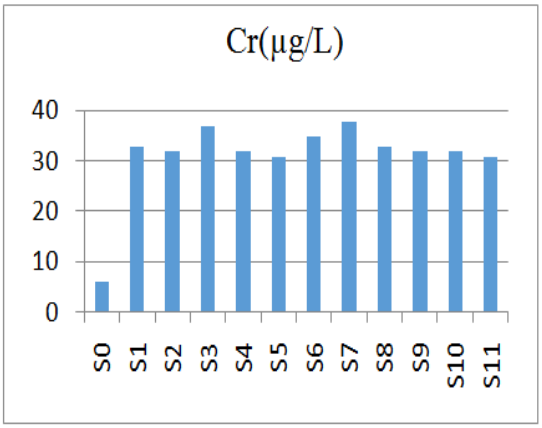

Fig 3: Average value of chromium in different station

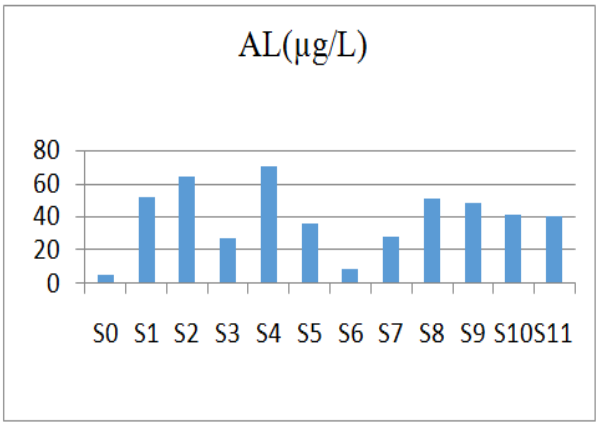

Fig 6: Average value of aluminum in different stations

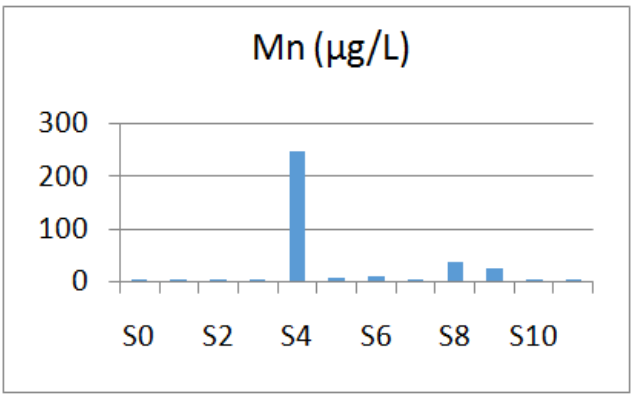

Fig 4: Average value of mmanganese in different stations

Cobalt

Cobalt is a gray metal, shiny and ferromagnetic. It does not react with water or with air at room temperature. Cobalt salts constitute complexes and are oxidants. In solution, the cobalt may exist in oxidation states + II, + III. The + II state (Co^{2+}) is considered the most stable in most environmental conditions. However, some organic complexing can stabilize the form + III, usually unstable and avoid its reduction [20]. The mean levels of cobalt are assayed between 4 g / L and 102 mg / L, we note that the station S0 has a content of 6 g / L. It also notes that the stations S8, S9 and S4 canoeing increased concentration in metal and station S4 is located on the side of cultures, it receives irrigation water from fields grown rich fertilizer, such as was observed by H. TAOUIL and collaborator in our different site [13]. At the opposite, the S9 station receives directly urban domestic waste, so this result can be explained by the heavy load of wastewater from the town, as well as water

stations S4, S8 and S9 are of poor quality for irrigation of agricultural land, their Co contents exceed the guideline value (50 g/L) standard Moroccan waters for irrigation.

Chromium

Chromium is generally present in natural waters at low levels ranging from 1 to 10 g / L [21]. The main inland water pollution surface sources of chromium are the surface treatment workshops, tanneries and textile industries. [22] Based on the work [23], chromium is also present in some fertilizers and pesticides. The results obtained subject of Figure 3, is observed that the concentrations of Cr in all stations are large enough and having reconciled values, they are between 31 to 38.1 mg / L except S0 station with its concentration is weak. The most important content is mainly observed at S 7 station, the station on the river suffered directly wastewater of industrial Unit-Uni Sea. Note that these levels found in metallic element chromium are adequations with standards of water for irrigation (100 mg / L).

Manganese

Manganese is a mineral element frequently encountered in different types of water, especially ground water. In the case of surface water, manganese can be found in accidental pollution or when the river receives water from a reservoir dam at the end of emptying. The test results clearly show that the average concentrations of Mn are almost weak in most stations are studying, this may be due to the precipitation phenomenon during the course flows along Oued. Furthermore all stations except Oued station S4, qualified favorable for irrigation because their contents do not reach the limit value set by Moroccan standards (200 µg / L). By cons it is noted that Mn is very abundant at the station S4 (254µg / L) are reminded that this station is a waste water intake station in cultivated fields, which explains its origin could be agricultural.

Zinc

He is involved in many physiological processes, it is essential to the life of a lot of body. It is very responded (mining areas) and used in deferent fields (metallurgy, printing - rubber - paint - alloy - Battery - agriculture and buildings). It is associated with clays, in organic matter .and the oxides (Co precipitation with iron and Mn), as the pH of the medium, Zn has great affinity with Co and Pb, and with iron oxides and Mn. At high concentrations, it becomes toxic to plants and animals and is a major contaminant for the aquatic and terrestrial [24]. From Figure 5, the average teneures in metal ranges from 6 to 51 g / L. There is significant content at the S7 station, the station on the river directly receives waste water from the industrial unit "Uni Sea." Remember that the station S8 is a fairly high content of this element that could be attributed to domestic waste. Then the heavy load of wastewater from the town Azemmour explains these results. In any case these levels are lower than those for irrigation presented by Moroccan standards (2mg /L).

Aluminum

Aluminum is the 3rd component of the earth's crust, it is close to the composition of the lithosphere after oxygen (42%) and silicon (28%). This is a very reactive metal, it does not occur in the free state in the environment. Aluminum has long been considered to have a safe to humans mainly because of its low intestinal absorption orally. Many studies show now that aluminum can be toxic to plants, animals and humans. That for determining the impact on health of human exposure to aluminum is still extremely difficult and source of much controversy in recent decades. Aluminum is quite significant levels in most of the stations studied. However, the maximum was observed at the station S4 rich in this element, it is recalled that this station is a decision wastewater or cultivated farming field is intense. So leaching Soil fertilized by irrigation water can be a source of pollution by this element. Same case was observed for the S5 station. As against the station S9 represents a level of 48µg / L the station receives direct domestic discharges, Common Azemmour. Then the heavy load of wastewater explains this result. The contents of S10 and S11 are remarkable, can be explained by the transport phenomena. Note that the water from these plants studied are of pretty good quality and can use in irrigation by Moroccan standards (5 g / L).

IV. CONCLUSION

This study illustrates the evolution of metal contamination of surface water of the river Om Er-Rbia and distribution of trace elements in the samples analyzed on the food chain of this river. The results indicate a fairly significant contamination by elements manganese and cobalt in some study sites, the source of contamination by these two elements may be natural or anthropogenic. Furthermore, all sampled stations have different levels of Cr, Zn, Al but. These contents are the standard and acceptable for irrigation (Moroccan standards). From this study, It is concluded that the surface water in river om Er-Rbia still having good quality for irrigation except a few sites which polluted by cobalt and manganese elements.

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