EVALUATING METALLIC POLLUTION CAUSED BY IRON, COPPER, LEAD AND CADMIUM OF OUM ER-RABIA RIVER WATER

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(**Received on Date: 19th October 2015** **Date of Acceptance : 7th January 2016**)

ABSTRACT

Spatial variations in water contents of trace metals (Cu, Pb, Cd, Fe) were studied at the Oumer-Rabia. The results showed that only the waters of the river'slead were exceeded the production limit for drinking water (10mg /l)(Moroccan standards) value. And cadmium levels found in most of the plants studied are above the limit of surface value and the maximum value of drinking water(3µg / l), established by Moroccan standards. But these levels remain below the mandatory value favorable to irrigation water.

Keywords:Water, Trace Metals, Evaluatin, Oumer-Rabia

No:of Figures : 6 **No: of References:28**

Introduction

Pollution of surface water becomes more worrisome especially during periods of low water levels, where the dilution effect would be minimal or absent due to low flow rates which then allows good conditions of dilution and assimilative. Thus the pollution of rivers by chemicals present negative impacts multifaceted, affecting various areas. And among these chemicals likely to be the cause of the deterioration of the water quality, are the heavy metals. Some have high toxicity. Indeed pollution by heavy metals is a current problem that concerns all regions anxious to maintain their water assets to a high degree of quality. [2] They differ from other chemical pollutants, their low biodegradability and their high bioaccumulate along the food chain. This may cause significant environmental damage[2]. They differ from other chemical pollutants, their low biodegradability and their high bioaccumulate along the food chain. This may cause significant environmental damage [3]. Ainsi K. Mint Mouhamed Salime et al ont été évalués la qualité de l'eau de la rive droite du fleuve Sénégal [4]. It is further that metal contamination of aquatic ecosystems has attracted the attention of several researchers in Morocco [5-7].Thus Azzaoui et al. [8] were interested in assessing pollution métalliqe: Copper, Lead, Iron and Manganese in the watershed sebou. Thus F.Afri-Mehennaoui et al [9] evaluated the level of contamination by trace metals (SEM), sediments and wadis Rhumel Sakiet Roum, in the industrial zone in Constantine (Algeria). Moreover H.Taouil et al [10] were interested in evaluating metal contamination: Lead, Cadmium, Copper and Nickel in the watershed Guir: Case of wadi water Tislit Talssint--eastern Morocco. It is the authors have shown that waters of this river are a rather deteriorated quality with some heterogeneity in their metal concentration. On our part, we are interested in the study of metal contamination of the waters of the Oum Er-Rabia, Morocco.

Materials and methods

Study area

The basinof the OumEr-Rabia (Figure 1)constitute an importantsocio-economic centers of Morocco. It is one of the best equipped watersheds in the country. It includes 11 dams, 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 (33 ° 16'N 8 ° 20'W) at 17 km north of the town of El Jadida. Azemmour occupies the left bank of the mouth of the Wadi. The climate of the region is arid, hot winter. Water intakes have a double, marine and river. However, in addition to the 11 dams upstream and to the construction of a dam 14 km from the mouth, freshwater intakes remain low and are limited to seepage through the dike, to discharges domestic and in exceptional circumstances, for the release of dams.Therefore, this estuary is largely dominated by marine dynamics. However, from 1996, the hydrology of this medium was strongly influenced by fluvial

deposits due to large volumes of fresh water transported by the heavy rainfall experienced by the region, or by continuous releases of dams (Figures 1 and 2). To achieve the objective of this study, eleven stations were sampled during a year.

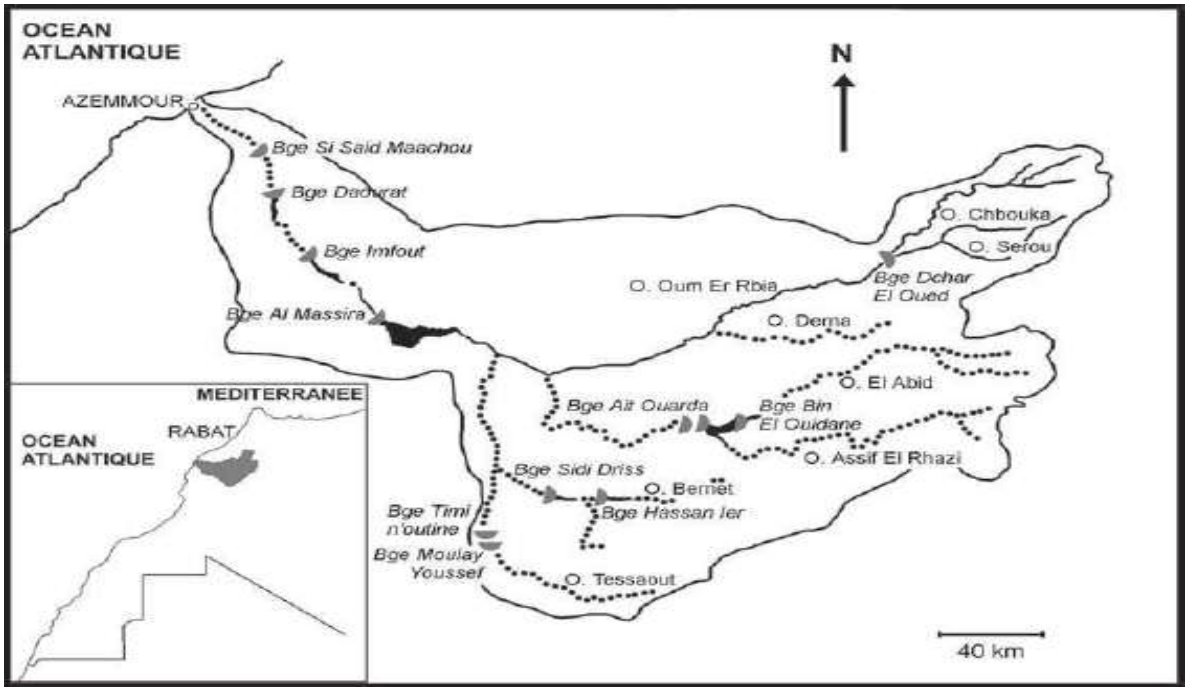

Figure 1 : Bassin d'Oum Er-Rabia

Choice of stations

River's water samples were collected during two campaigns during a dry period (June of 2014). In order to determine the average concentrations of heavy metals and to characterize the metal quality of the Oum Er-Rabia, eleven stations were selected on the main axis of flow, their choices are a compromise between the possibilities sampling and the need to account for the spatial organization of the river. These resorts are noted as follows:

So: Control Station (Sources Oum Er-Rabia);S1 and S2: Stations located on the river and located before and after the Dam 'Daourat ";S3 and S4: Direct Sampling of wastewater cultivated fields I and II respectively;S5: resort on Oum er-Rabia near cultivated fields I and II;S6: Direct Sampling wastewater of industrial unit "Unimer".;S7: Station located on the river and in front of the wastewater industrial unit "Unimer".;S8: Direct Sampling of urban domestic sewage Azemmour;S9: Resort on Oum er-Rabia and facing the urban domestic sewage Azemmour;S10: Station located on the river and before the station S11;S11: adjassante Station (Oued + Beach).

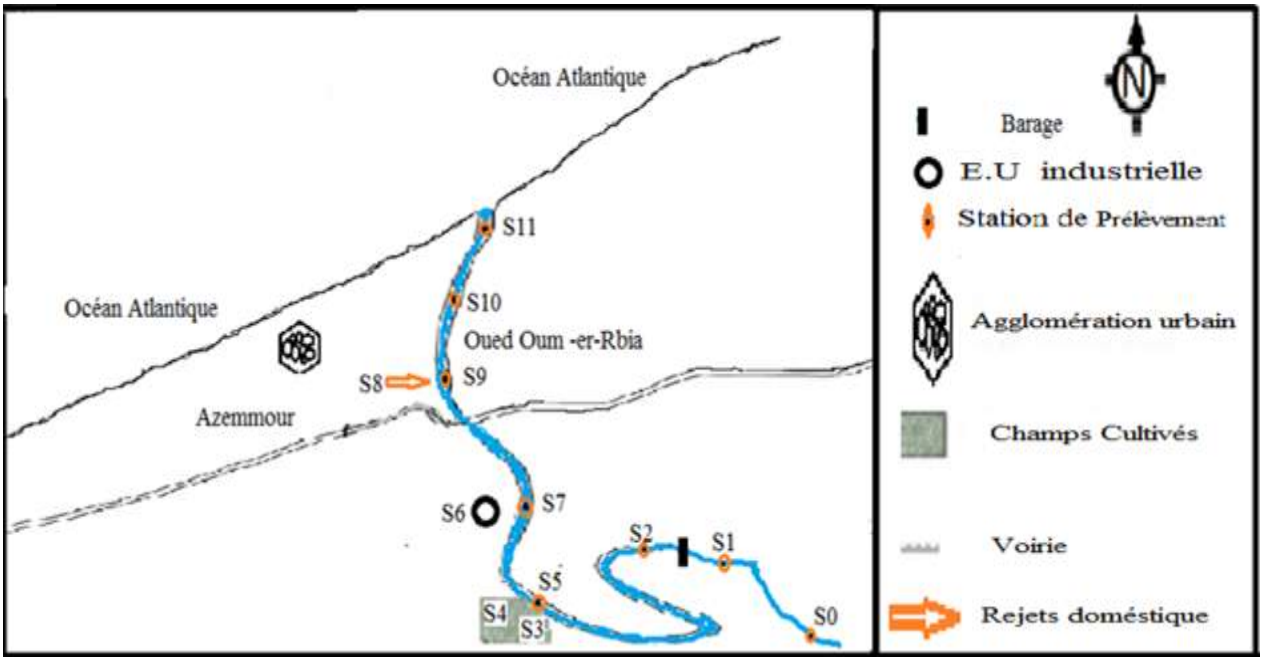

Figure 2: Geographical localization of the sampling stations wadi waters Oum Er-Rabia.

Technics of analysis:

Water samples werecollected in polyethylene bottles whichhad been carefully washed before the sampling compaign by a slightly acidified solution, then by a distilled water [11]. In order to measure the metallic concentration, water sampleswere treated in the field with ultrapure HNO3.

Results and discussion

The concentrations of Pb, Cd, Cu, Fe, were determined using ICP-MS (Inductively Coupled Plasma Mass Spectrometry) in the laboratory of National Centre for Scientific and Technical Research (CNRST) -Morocco.

The copper:

Copper is an essential element for organisms and toxic in high levels. It is widely used in various fields (electricity, metallurgy, textiles, photography, agriculture, fungicides, tanneries, piping). In nature, copper is found either in the metallic state in the native copper (Cu), or the state of monovalent ion (Cu +) in cuprite, chalcopyrite and bornite for example, or to bivalent state (Cu 2+) in malachite and azurite. The alteration of primary minerals releases this element that co-precipitates with oxides, clays, carbonates, sulfides, and organic matter. Thus copper is an essential trace element widely distributed in nature [12.13]. It is helpful to human metabolism and enters the structure of certain enzymes. Its failure causes foodborne anemia in children. Copper daily needs are in the order of 2.5 mg / kg for adults and 0.5 mg / kg body weight in children. The main source of input is provided by the diet. The mean levels of copper in the waters of the Oum er-Rabia are characterized by a maximum at the station S10 (780µg / L) (Figure 3), this allows to highlight the importance of discharges wastewater from the rural town of Azemmour in copper intake, so the source of pollution by this element could be anthropogenic. The work [14] showed that the origin of the metal contamination by this element

could be anthropogenic and natural. Thus copper concentrations in the studied waters exceeds the average grade of soft natural water estimated at 1.8 mg / l [15-16] and are well above the average of the waters of the Seine (1.7 mg / l cu) [17], however the concentration of the metal does not reach the potability standard (2mg / l). Moreover Moroccan standards instead the waters of the wadi in this element in the excellent class (<20 mg / l).

Lead

Lead, heavy metals, has the largest ionic radius (1.75 Å). It is not essential for organizations and its presence at high levels is toxic. Lead is known to interfere with the production of hemoglobin and change the composition of blood. It also acts on the central nervous system and causes lead poisoning. It mainly comes from the fuel, batteries and paint. In nature it is found in galena. This element can be associated to sulfates and carbonates but also to clays and organic matter depending on the pH. This element has many affinities with Cd and Zn. Thus, lead is one of the most dangerous toxic metals to aquatic organisms. Indeed, soluble lead compounds are more toxic to fish than the insoluble compounds [18]. For a lead level of 0.5 mg / l in the mining rivers in Wales, there has been complete disappearance of all fish species within a few years. [19] Thus the results show that lead levels in this important study all stations except the control station S0. However the maximum levels was recorded at the station S5 (52 g / l) (figure 4) rich in this element, this is due to the amount used in fertilizer, because the crop field is developed at the station S5, indeed studies on fertilizers in Canada have shown that these products contain up to 3.5 mg / kg Pb (nitrogen-phosphate fertilizer) [20].The results can be explained by the high burden of spilling waste water in front of the S7 stations, S8, S9. Thus, the source of pollution by this element at these stations could be anthropogenic. Furthermore, the significant concentration at the station S11 (44 g/l) away from urban and agricultural disruption, so the contribution of lead in soil enrichment is likely subsequently the source of pollution by this element at S11 may be natural. A previous study [14] have showed that the origin of the lead contamination could be anthropogenic and natural. However the waters of the river in question are conducive to irrigation (levels <5 mg / l) but exceed the limit value of production of drinking water (10 mg / l) (Moroccan standards).

Cadmium:

Cadmium, nonessential toxic metal, is used as a colorant and is frequently found in the alloys and the batteries. It is very harmful and its compounds in large doses can cause cancer. It has serious toxic effects in humans. Acute intoxication by cadmium can occur pulmonary or digestive tract [21, 22, 23] Indeed pulmonary: in case of massive inhalation, the subject suffers from nausea, dizziness and headache associated with drought mouth and intense thirst. And through the digestive tract: show signs of gastroenteritis after a lag time from 15 minutes to 5 hours. From Figure 3 we see that the average levels of this metal oscillate from 4 to 13µg / l (Figure 5), there is a particularly high

content at the S5 station (13 mg / l) rich in this element, therefore the source of pollution by this element could be agricultural. Remember that this station next to cultivated fields of the wadi in question, so the leaching of soil fertilized by irrigation waters can also be a source of cadmium intake. Indeed, the metal Fertilizer analyzes revealed levels up to 6.3 mg / kg of cadmium in fertilizers mainly phosphate and potash. [24] Similar studies performed on 24 types of fertilizers have shown that levels of cadmium in these fertilizers range from 0.8 g / g 48 g / g [25]. Except S5 station (13 g / l) and S10 (11µg / l), the levels found in most of the stations studied are above the limit value of surface water (3µg / l) and the maximum permissible drinking water (3µg / l), established by Moroccan standards [26]. But these levels remain lower than the imperative value favorable waters for irrigation (10 ug / l) (Moroccan standards).

Iron

Iron is the most abundant metal in the earth's crust where it represents about 5%. Therefore, it can be released naturally, mainly part of the igneous rocks and sulphide ores and sedimentary rocks. In addition, increased use of iron in many industrial processes can be a major source of pollution of waterways. The main industries are mining and mineral processing, chemical industry, metallurgy, textile, canning and the production of titanium oxide [27]. Thus the results obtained (Figure 6) show that the maximum concentration reached 236µg / l at the station S10, the high concentration found can be explained by the regional geological context. In fact, leaching of soils of the region may be responsible for this iron fortification, thereafter, the natural origin is likely. In most of the stations,the iron levels exceeded the natural value of fresh water (<30 mg / l) [28]. Nevertheless, in all stations, iron contents are less than the limit value of water intended for the production of drinking water (300 mg / l) (Moroccan standards) however, in all the studied sources, the dosage levels are lower than the imperative value favorable for irrigation water (5 mg / l) (Moroccan standards). According to the grid of surface water and Moroccan standards, these waters are attributed to the excellent class (levels <500 mg / l).

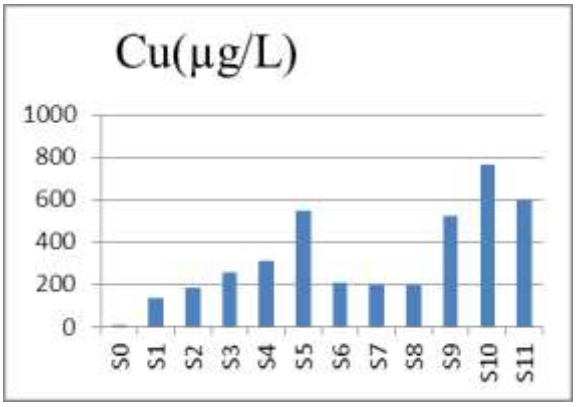

Fig1:average value of leadin différent stations different stations

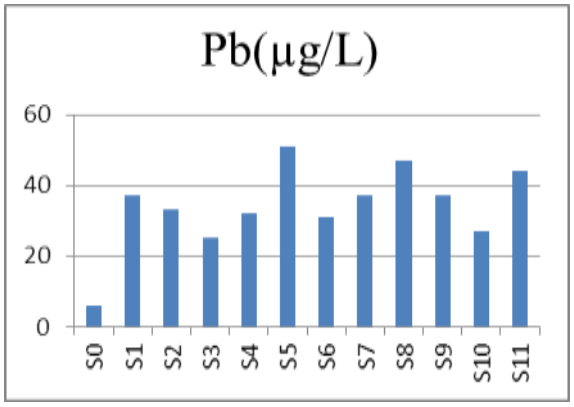

*Fig 4:*average content of copper in

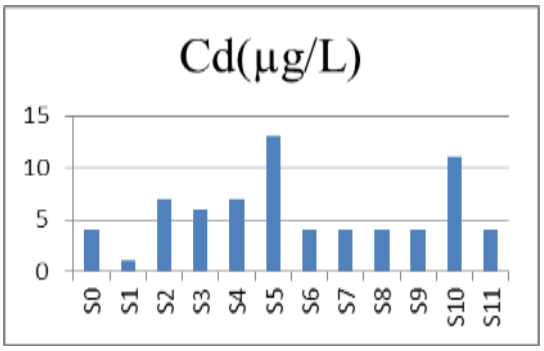

Fig 5:average level of cadmium in different stations

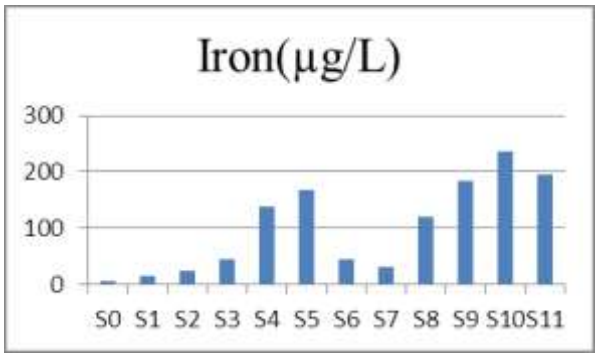

Fig 6:the mean content of iron in the different stations

Conclusion

This study constitute an assessment of the metal quality of Oum er-Rabia. It is interesting to note that the analysis results show that the average levels of copper and iron in the studied waters are characterized by a maximum at the station S10, and the concentrations found in all studied stations remain below Moroccan potability standard. By cons lead levels exceed the limit value of production of drinking water (Moroccan standards). Thus the levels of cadmium found in most of the studied stations exceed the limit value of surface waters and the permissible maximum value of clean water (3µg / l), established by Moroccan standards. But these levels remain qualify the waters of the river favorable for irrigation.

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