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Assessment of metal contamination of tiflet stream (Sidi Yahia Gharb city, Morocco)

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Abstract
Heavy metals are likely to cause micro nuisance even when they are released in very small quantities (developing toxicity through bioaccumulation). Moreover, small amounts are often offset by a volume effect due to the importance of water flows. The industry is responsible for almost all releases of heavy metals in water. Indeed, the water of rivers, streams, canals**,** seas has along been the "outlet" that allowed to evacuate wastes. This work focuses on the analysis and assessment of heavy metal contamination of raw sewage drained by four major collectors Tiflet river (Morocco) through Monitoring the spatio-temporal levels of some metal elements (Pb, Fe, Zn , Cd, Hg and Cr). Sampling was carried out twice a month over a period of three months(April, May and June) 2012. The Obtained results indicate the presence of contamination from metallic iron which exceeded the threshold of standards. Other metals trace elements exist in regular quantity, they could be classified in the order of abundance as follows: Fe> Zn> Pb> Cr> Hg> Cd, and the mean concentrations are respectively 10 mg/ l- 0.8mg /l -0.07 mg/l -0.037 mg/l -0.035 mg/l and 0.0038 mg/l.

Keywords*: sewage, heavy metals,* Tiflet stream, *Morocco.*

Introduction
Metal contamination in aquatic ecosystems is one of the aspects of pollution that threatens the environment. Its harmful effects could cause dangerous or critical situations sometimes affecting the ecological balance of these ecosystems. Heavy metals are not removed by biological means; this fact promotes their cumulative aspect in the various compartments of the ecosystem (water, fauna and flora). Most of wastewater is discharged directly into the sea or in the water boby often without treatment. Surface waters, which serve as the receiving environment for wastes issued from urban and industrial units located away from the coastline suffer from this practice. Moreover, the reuse of raw sewage poses serious risks to health and the environment due to their dependents in organic matter, pathogenic species and in particular heavy metals. Therefore, wastewater treatment is required prior to reuse or discharge into the receiving environment. For this purpose a spatio-temporal monitoring of the content of six metals elements; Fe, Zn, Cd, Cr, Pb and Hg in wastewater has been conducted in Tiflet stream, the mean concentrations are respectively 10 mg / l- 0.8mg /l -0.07 mg /l -0.037 mg /l -0.035 mg /l and 0.0038 mg /l.

2.Methods and Materials
The Study area of Sidi Yahia Gharb city is a municipality in the province of Kenitra city, which is far about 29 Km north east, which covers an area of 616 ha, and has about 31705 inhabitants (ONEP, 2005).
The study area marked by the oceanic influence, belonging to the bioclimatic sub-humid temperate winter, high humidity and low temperature fluctuations. Rainfall starts from October to April with, a monthly average lower to 5mm, June to September constitute the dry period.
For this study, we are interested in four main collectors of the city:

-Collector- A; drains upstream of the Tiflet steam;
-Collector- B; drains downstream of the Tiflet steam;
-Collector- C; drains the South of Sidi Yahia Gharb city (El Wahda neighborhood).
-Collector- D; drains the sewage plant ATRIR cork processing for export.

Table1: Statistics of the volumes of wastewater in Sidi Yahia Gharb city (ONEP, 2005)

Year	**2005**	**2010**	**2015**	**2020**	**2025**
Inhabitants.	**31895**	**32863**	**33861**	**34889**	**35948**
Total consumption m^3/j	**1786**	**1939**	**2099**	**2268**	**2337**
Industries	**72**	**74**	**76**	**79**	**81**
Global wastes m^3/j	**1424**	**1546**	**1674**	**1809**	**1864**
Global wastes l/s	**16,5**	**17,9**	**19,4**	**20,9**	**21,6**

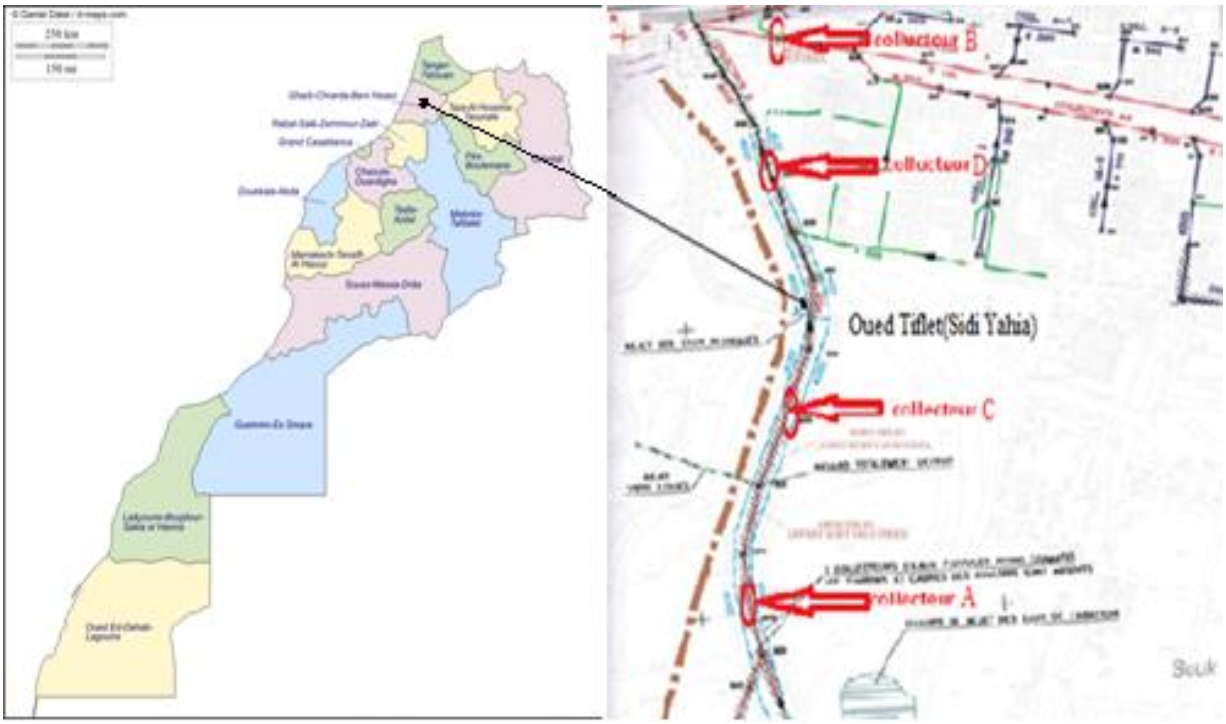

Figure 1: Location of sampling sites in Sidi Yahia city [10].

3. Results and discussion

Table2: Results of the analysis of heavy metals issued from Sidi Yahia wastewater (mg/l)

	Cd	Pb	Zn	Hg	Fe	Cr
uphill	0,0015	0,03	1	0,0015	5	0,02
domestic	0,003	0,06	5	0,03	4	0,04
support	0,002	0,05	3	0,05	6	0,03
industrial	0,009	0,14	25	0,06	25	0,06
min	0,0015	0,03	1	0,0015	4	0,02
max	0,009	0,14	25	0,06	25	0,06
moy±Ecat type	0,003±**0,003**	0,07±**0,04**	8,5±**11,12**	0,03±**0,02**	10±10,03	0,03±0,01

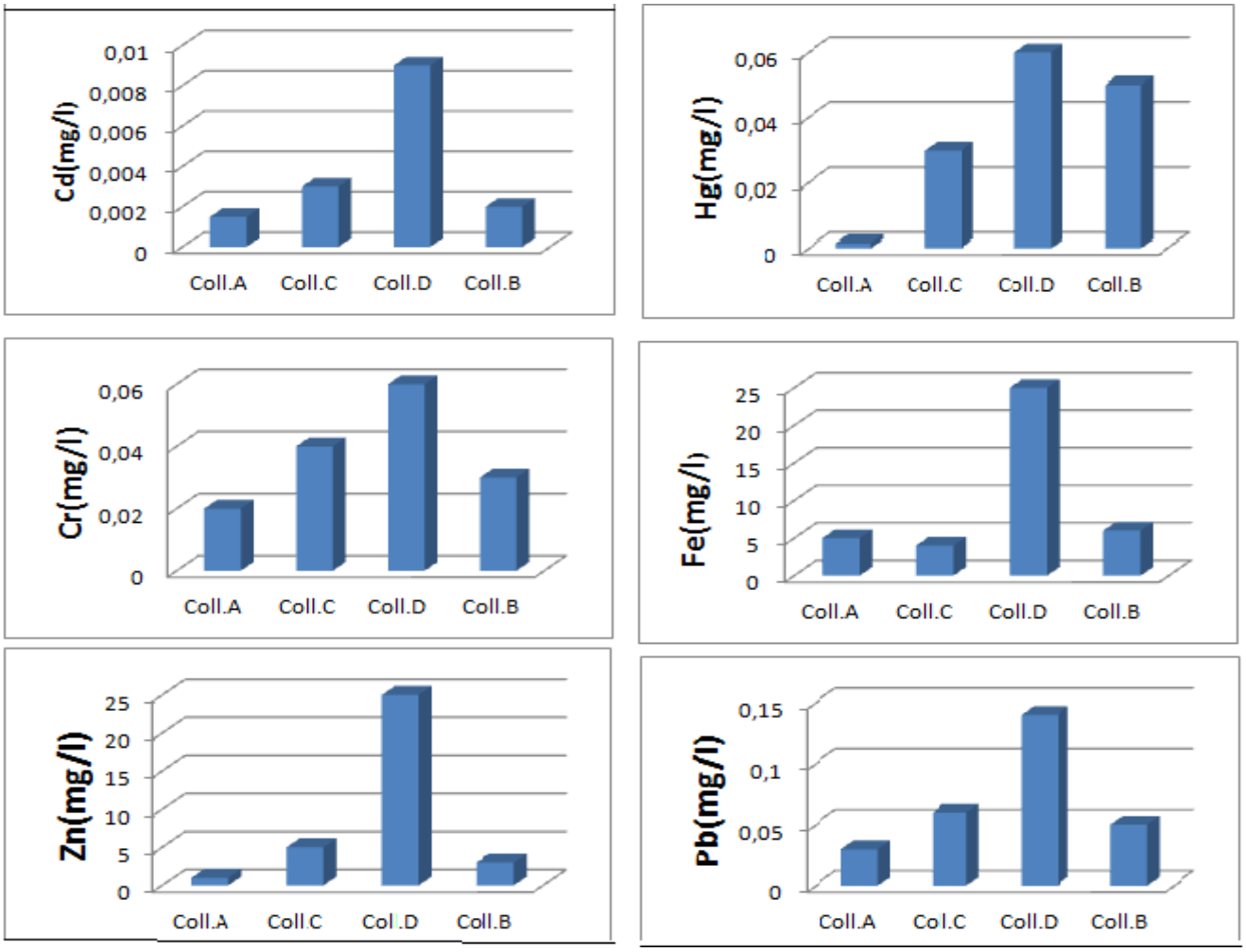

Figure 2: Spatial variation of the average level of heavy metals based on sampling stations in Sidi Yahia Gharb city**.**

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Waters analyzed, except Fe which exceeded the standards, other metallic trace elements exist in acceptable quantity. Our work is consistent with those of [3] conducted in France and **[1]** who monitored the pollution on 26 streams of some states in southern and northern Nigeria, on the Niger River delta [5], the cocoa zone of Ondo State in southwest Nigeria [8] and in the waters of Lagos [9]. These works showed that, with the exception of iron, the concentrations of most heavy metals in surface waters are generally below the global average of surface waters and international standards for drinking water. Indeed, in the absence of highly polluting industries directly connected to the sewerage system, the concentrations of heavy metals in domestic effluents are constant and are in form of traces, most of which is retained in the sludge. These trace elements immobilized in the surface of the ground, may cause problems in the metabolism of plants and animals and thus contaminate food chains. The studied heavy metals could be classified in order of abundance as follows: Fe> Zn> Pb> Cr> Hg> Cd. Iron fortification is due to the regional geological context. The same study showed that the soil in this region is more or less hydromorphic and the rock is constituted by (red sandy clay.), it is topped by a horizon of clay accumulation ferric. On the other hand, cultivated soils can contribute to Zn intake. Indeed, the fertilizer practices are responsible for this contribution. Nitrogen-based fertilizers can contain up to phosphate 83.3 mg Zn / kg of fertilizer [7]. In contrast, sampling sites located near residential areas, show no significant pollution by these metals. The absence, in almost all cases, of pre-treatment of industrial waste is largely responsible for the contamination of groundwater in the region of Sidi Yahia Gharb city, by heavy metals. Our results are consistent with those of [11] performed on Mohammedi groundwater [6]. They came to the conclusion that metal concentrations were not a threat to the habitat of

Lake Nakuru. Six years later, [4] studied the water, sediment, benthos and fish of the same Lake and indicated concentrations slightly increased compared to the values found in [6]; similarly, our results are similar to those of [12].

Conclusion

Industrial activity is mainly responsible for the degradation of Tiflet steam ecosystem. The presence of metal contaminants in untreated wastewater is dangerous to aquatic organisms and can greatly affect the balance of the ecosystem. However, if the recorded concentrations do not lead to immediate concerns, the may cause acute toxicity. It should be noted that the ecotoxicological risk is the cumulative nature of the heavy metals involved in the phenomena of bioaccumulation or biomagnification hence, the urgent need of a wastewater treatment plant in the town of Sidi Yahia and more specifically healthy in each industrial unit.

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