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Full Length Research Paper

Seasonal fluctuations of heavy metals from Kor River, Fars, Iran

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Seasonal fluctuations of heavy metals (Cadmium, Lead, Zinc, Nickel, Iron and Chromium) were studied in relation to water current, at three sampling stations from the bank of Kor River, from 15th March 2003 to 15th February 2004. The water and sediment samples were analyzed with the help of Atomic absorption methods (Perkins / Elmer Atomic absorption USA.). The data was statistically analyzed using ANOVA and coefficient correlation. The means of Zn, Ni. and Pb were increased significantly in water stations 2 and 3 when compared to the station 1 as control, while the means of Cd, Zn, Ni, Cr and Pb were equal in the sediment samples from stations 2 and 3, but the mentioned heavy metals were significantly increased in compared to control station. In addition, in raining seasons, high concentrations of the heavy metals at all stations, especially at station 2, were observed. The high concentration of the above heavy metals in the station 2 and 3 is possibly due to industrial pollutions and civil sewage where in raining season the high concentration of the heavy metals in all station particularly stations 2 and 3 is due to soil washing as well as water and sediment mixing due to heavy current of water at all the sampling stations. The mean of all elements were significantly increased ($p < 0.05$) in station 2 and 3 when compared to station 1.

Key word: Heavy metals, Kor river, water and sediment.

INTRODUCTION

The heavy metal pollution can be studied in different tissues (Sharma and Davis, 1980; Snarki and Olson, 1982; Nriagu and Pacyna, 1988; Webster and Canton, 1991; Rice, 1996; Demirak, 2005; Bustamante et al., 2003; Watanabe et al., 2003), soils and sediments (Ying Lu et al., 2007; Banat et al., 2005), and water fractions (Klavins et al., 2000; Howari et al., 2004). In those cases, it is very important to establish relationships between water and sediments concentrations, water and tissues, sediments and tissues and the three of them. Some authors have studied the relationships between tissues and the heavy metals (Bustamante et al., 2003; Watanabe et al., 2003). In this work, the main objective was to study the presence and comparing the concentration of the heavy metals like Cadmium, Lead, Zinc, Nickel, Iron and Chromium in sediments as well as current waters in different season and three station of Kor River. Kor River is approximately 280 km long and 35 to 40 m wide, which runs from North West toward south east of Fars province. The sewage of farming lands and industries as well as Marvdasht city and all villages surrounding the river are open to this river. This river finally is drained to Bakhtegan Lake which is nesting habitat and breeding home as well as winter habitat and resting area for many migratory and local birds. Numerous invertebrates and edible fishes especially carps are found in Kor River and Bakhtegan Lake which are captured and consume as food (Figure 1).

MATERIAL AND METHODS

The seasonal fluctuation of heavy metals were studied in relation to water current at three sampling sites, that is, Mahmmodabad St.1 (Site 1), next to Dorudzan damp, Pol Khan St.2 (Site 2), which is situated next to the industrial area and Marvdasht city, and Band Amir St.3 (Site 3), in which the sewage of farming lands and some villages surrounding the river are open just close to this site, The study was don for a period of one year “from 15th March 2003 to 15th February 2004”. The climate here is clearly marked by four distinct seasons; the spring (March to May), summer (June to

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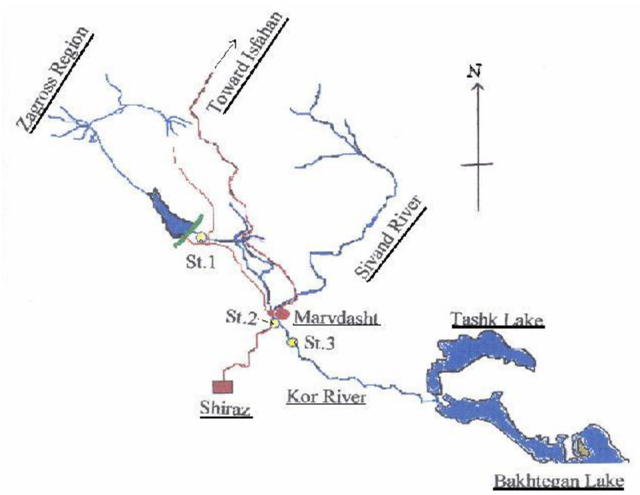

Figure 1. The Location of sampling sites.(St. = Sampling Station/Site).

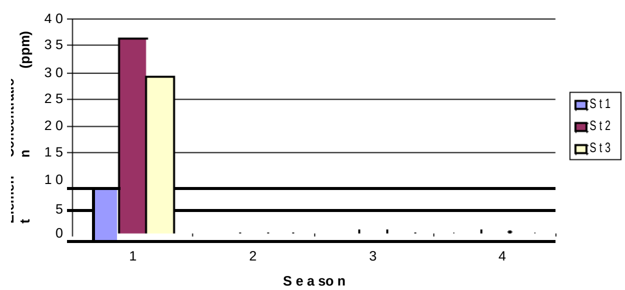

Figure 2. Concentration of cadmium in water of the three sampling stations (15th March 2003 to 15th February2004).

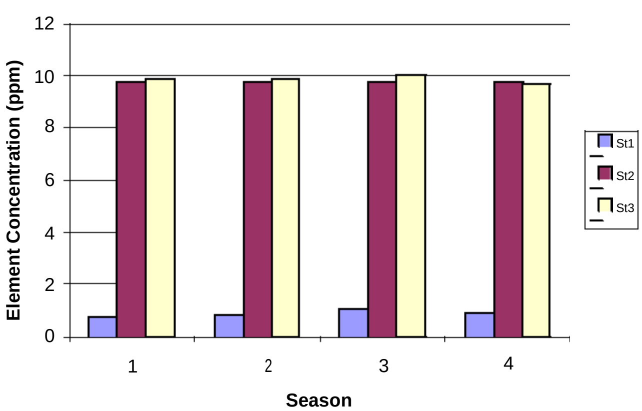

Figure 3. Concentration of cadmium in sediments of the three sampling stations (15th March 2003 to 15thFebruary 2004).

August) autumn (September to November) and winter (December to February). Samplings were done from water surface and the river sediments from 8 to 12 a.m. The surface water samples were collected from each sampling site with the help of polyethylene bottles and transferred to laboratory for the further analysis. The

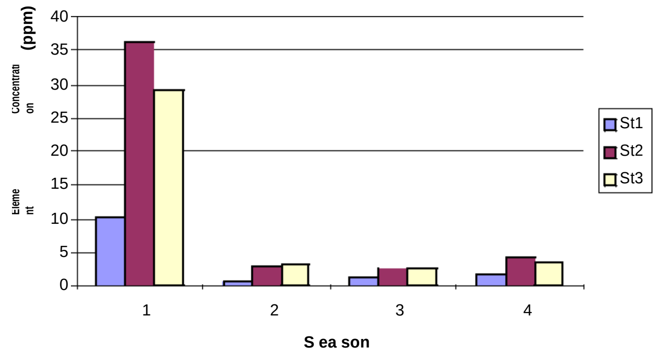

Figure 4. Concentration of lead in water of the three sampling stations (15th March 2003 to 15th February 2004).

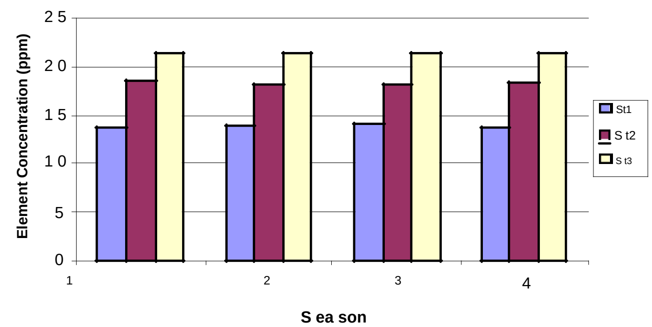

Figure 5. Concentration of lead in sediments of the three samplingstations (15th March 2003 to 15th February 2004).

sediments were collected with Eckmans dredge and transferred into polyethylene bags. The water and sediment samples were analyzed with the help of Atomic absorption methods (Perkins / Elmer Atomic absorption USA.). The required information about

seasonal water current fluctuation at various stations was collected from the meteorological section at Dorudzan station. The data was analyzed with the help of ANOVA for comparing means in 3 stations and coefficient correlation to correlate between the water current and elements concentration.

RESULTS

Mean seasonal fluctuations of Cd, Pb, Zn, Ni, Fe and Cr are present in the Figures 2 - 14. The water current fluctuation in three sampling stations during the year of study is shown in Figure 14.

DISCUSSION

The results were found as follow:

a.) Simultaneous comparison of the element concentration means from the three stations showed that, the mean of all elements were significantly increased ($p < 0.05$) in station 2 and 3 when compared to station 1.

b.) Correlation between the water current and total elements concentration presented in the water samples

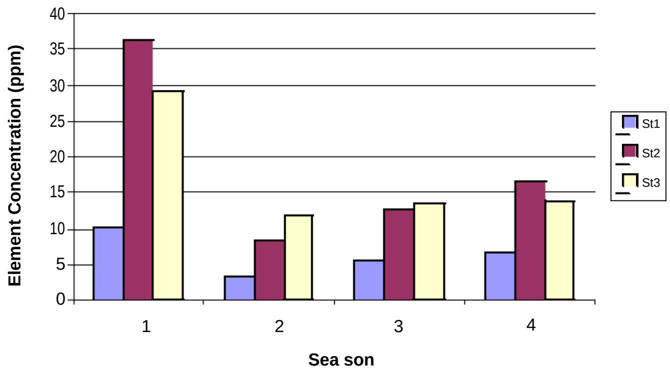

Figure 6. Concentration of zinc in water of the three sampling stations (15th March 2003 to 15th February 2004).

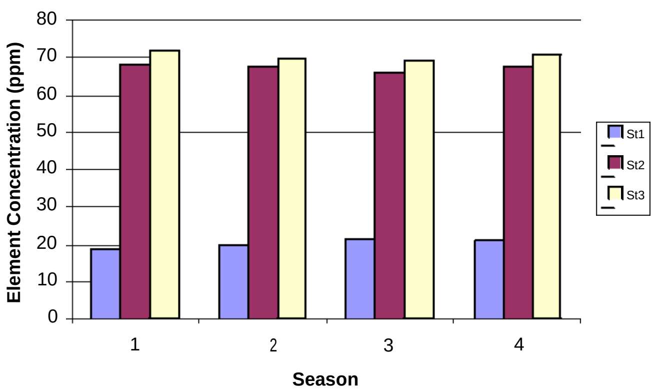

Figure 7. Concentration of zinc in sediments of the three samplingstations (15th March 2003 to 15th February 2004).

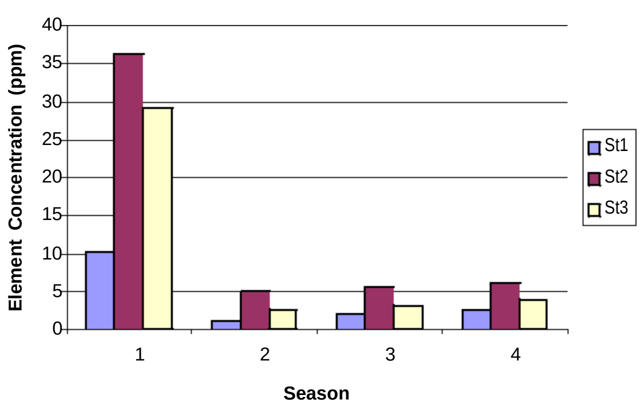

Figure 8. Concentration of nickel in water of the three samplingstations (15th March 2003 to 15th February 2004).

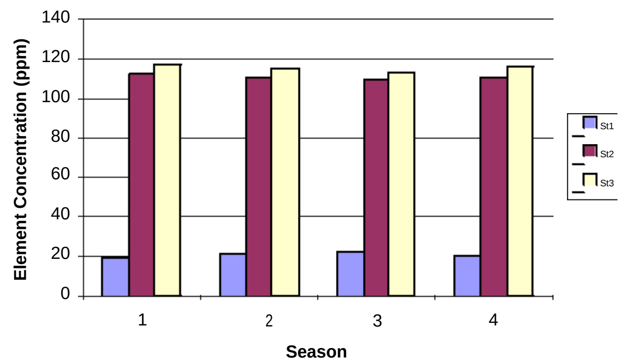

Figure 9. Concentration of nickel in sediments of the three sampling stations(15th March 2003 to 15th February 2004).

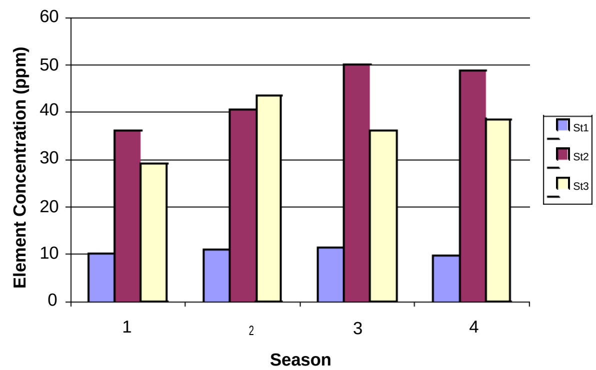

Figure 10. Concentration of iron in water of the three samplingstations (15th March 2003 to 15th February 2004).

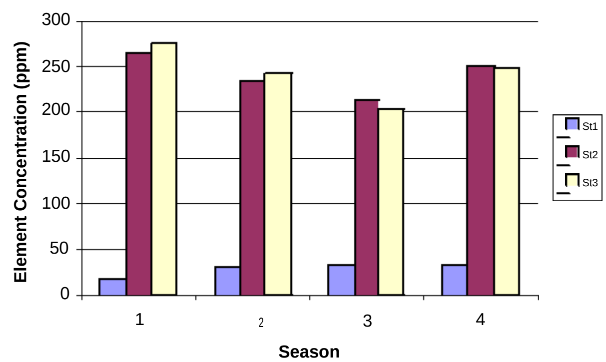

Figure 11. Concentration of iron in sediments of the three sampling stations (15th March 2003 to 15th February 2004).

showed that: ( ) at station 1, the correlation between water current and total elements concentration were significant ($p < 0.05$). ( ) at station 2, the correlation between water current and any elements concentration were not significant ($p > 0.05$). ( ) at station 3, the correlation between water current and lead concentration was significant ($p < 0.05$).

c.) Correlation between the water current and total element concentration present in sediment samples showed that: ( ) at station 1, the correlation between water current and the lead and iron concentrations were significant (p <

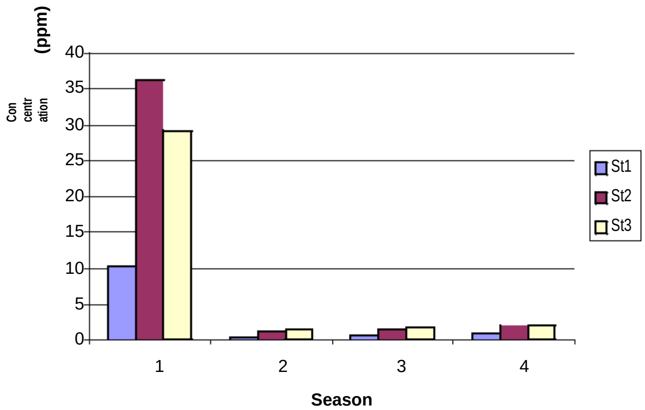

Figure 12. Concentration of chromium in water of the three sampling stations (15th March 2003 to 15th February 2004).

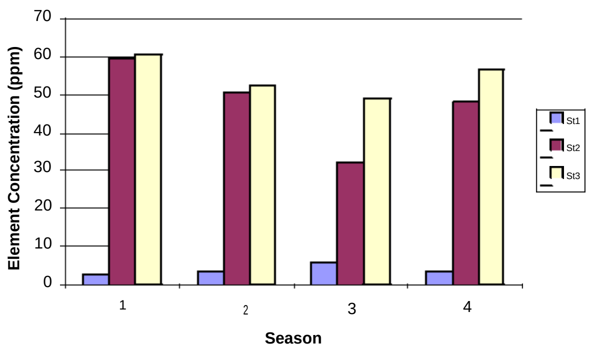

Figure 13. Concentration of chromium in sediments of the three sampling stations (15th March 2003 to 15th February 2004).

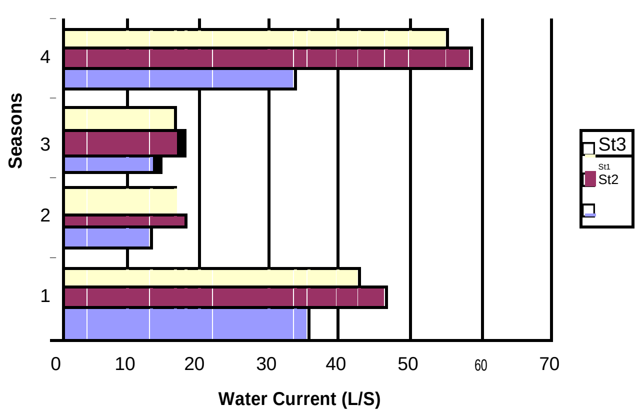

Figure 14. Water current in the three sampling stations (15thMarch2003 to 15th February 2004).

0.05). ( ) at station 2, the correlation between water current and the concentrations of lead,iron and cadmium are significant ($p < 0.05$), but the correlation of lead and iron with the water current was positive and water current with cadmium was negative. ( ) at station 3, the correlation between water current and lead concentration was not significant ($p > 0.05$), but significant with the other elements ($p < 0.05$).

Conclusion

As seen in Figures 2 to 13, the high concentration of the elements in the water and sediments at station 2 and 3 is possibly due to the heavy drainage of sewage from farming lands and industries as well as the hog-washed of Marvdasht city and all the surrounding villages. Of course, the soil itself may have some natural heavy metals as it is observed in the water and sediments at station 1, which is in agreement with Garbarino et al. (1995). In raining seasons (Figure 14), the high concentrations of heavy metals at all stations, especially at station 2, is possibly due to soil washes and sediment mixing because of very high water current in spring and winter (Figure 2 to 13).

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