European Geosciences Union
General Assembly 2018
Vienna | Austria | 8–13 April 2018
EGU.eu

Potential toxicity assessment of anthropogenic pressure by heavy metals in semi-enclosed artificial lagoon ecosystems in the Gulf of Aqaba, Red Sea

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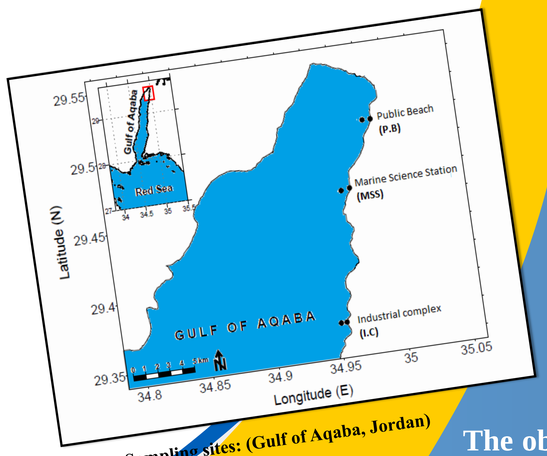
Introduction

Several environmental hazards are due to the spreading of high levels of potentially harmful substances (PHS) such as oil, plastic and heavy metals in marine ecosystems. Marine related activities such as manufacturing, constructions and industry may lead to elevated levels of PHS, increasing the potential environmental risk worldwide.

Anthropogenic pressures are able to increase heavy metal concentrations to higher levels than the background baselines and become harmful to the aquatic environment and its living organisms. However, most of the insoluble portion of the wastes in the aquatic ecosystems settle on the bottom in close association with sediment particles, keep suspended or enter with the food chain. PHS can be transported as either dissolve species in water or in association with suspended sediments and are subsequently deposited and in some cases trapped by the sediment particles.

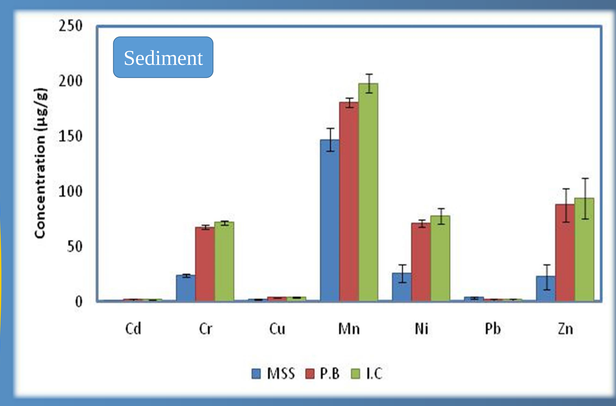
The aims of this study were i) to determine the levels of heavy metals (Cd, Cr, Cu, Ni, Mn, Pb, and Zn) from different sites of the Gulf of Aqaba that were subjected to loads of stress as a result of anthropogenic pressure. ii) to determine the ability of *Ulva lactuca* to accumulate heavy metals from the surrounding environment. The Algae *U. lactuca* selected for their widespread distribution and sensitivity to environmental changes.

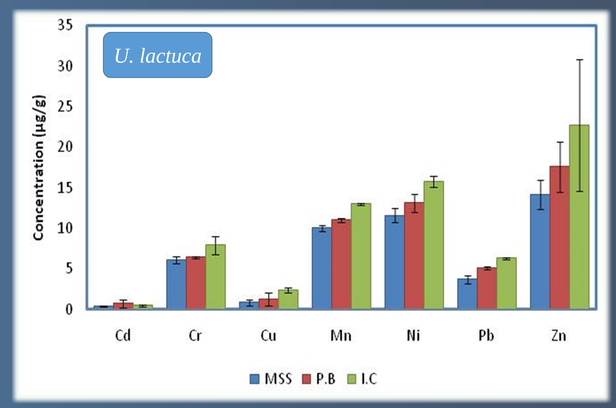


Sampling sites: (Gulf of Aqaba, Jordan)

Sampling sites at the Gulf of Aqaba, Jordan

The average concentrations of studied heavy metals in sediments and algae are shown in below





Our results indicated that detectable amounts of Cd, Cr, Cu, Ni, Mn, Pb, and Zn were identified in *U. lactuca* at all sampled sites and the total concentrations of most of the investigated metals in the sediment samples were significantly higher (ANOVA $p < 0.05$) than those of control. The high level of metals in algae reflects the high bioavailability of metals and the capacity of the algae to accumulate metals. This capacity depends on a variety of factors, the two most relevant ones being the bioavailability of metals in the surrounding water and the uptake capacity of the algae. Significant positive correlation between heavy metals in *U. lactuca* and sediment were reported especially for Cr, Cu, Ni and Mn (Spearman rank order correlation; $p<0.01$).

The obtained PHS contents indicate that different anthropogenic pressure demonstrate various degree of PHS pollution and the higher values at site I.C of the studied zone can be attributed to the discharge influence of anthropogenic impact due to various industrial and urban wastes which present at variable composition, entering the Gulf of Aqaba.

Our findings of PHS levels in sediments and *U. lactuca* indicate that the *U. lactuca* appear rather highly tolerant towards environmental pressure since their metabolic equilibrium is not altered by increased metal uptake. Therefore, the above mentioned native marine algal species growing on stressed ecosystem may have the potential for restoration and reclamation of anthropogenic stressed marine ecosystems. Our results are comparable with those reported in other studies marine environments.

References

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