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Evaluation of the bioaccumulation of metals tracks at Donax trunculus In the Moroccan Mediterranean Coast (In Cap de l'eau)

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ABSTRACT

Monitoring of coastal contamination by metals, using bivalve filter-feeding shellfish, is a common practice in many programs of pollution monitoring around the world. This work aims to evaluate the degree of contamination of the Mediterranean marine ecosystem through the study of spatiotemporal level of trace metals in Donax trunculus to assess the health risk faced by top predators, including humans, consumer marine products. Harvesting Donax trunculus was conducted at the Moroccan Mediterranean, two in shallow sandy areas, located in Cape water. The interpretation of the results showed the impact of pollution on seawater by environmental inputs of marine fisheries resources of the Mediterranean. Analysis of variance showed significant levels of iron and lead in the three stations, reflecting a seasonal pattern of metal bioaccumulation, and the concentrations of most metals which increases significantly in winter.

Keywords: heavy metals, Bioaccumulation, Donax trunculus, Méditerranée,

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INTRODUCTION

Through recent research finding has been demonstrated on the more and more degradation of the quality of our aquatic ecosystems, which appears to be caused by a massive and uncontrolled pollution, as much natural organic matter as by the industrial synthesis. This pollution seems to affect all compartments of the ecosystem [5].

In this study we aimed to quantify the bioaccumulation of trace metals in a bivalve mollusc that was widely commercial [17], it's Donax trunculus (Linné, 1758) in the Mediterranean coast of Morocco at two sampling sites from beach Saïdia to beach Cape water, the detected elements are naturally present in our environment, but because of the contributions due to high rate activities of humans have been added and are persistent. The choice of living and inert substrates is justified by their ability to bind and accumulate many toxic organic and inorganic, and can provide a very useful tool for estimating the pollution level of the hydro system. [19]

The detection of a substance in water, sediment or in species requires the determination of its concentration, and the identification of the source of pollution and the route of dissemination in the aquatic environment, in fact the toxicity of a product is the speed of onset of lesions and their severity is generally based on the absorbed amount and the dose distribution in time [23]. However the existence of a threshold value determines the permissible limits recommended for the security of an organization and to judge the quality of the surrounding medium.

Presentation of study areas

Morocco is a crossroad between Europe and Africa, and between the Mediterranean and the Atlantic Ocean. The Mediterranean part belongs to the Alboran Sea [22] with a temperature of sea water that reaches highs 24 to 25 ° c in summer and minimum values in winter from 14 to 15 ° C, measured with a pH around 7.82, and conductivity of about 54.7 microseconds / cm with a salinity that varies between 37 and 38 g / l. [6, 15]

The coastal plain consists of two horizons: [11]

Deposit silty clay, formed by rock weathering residues of Ouled Mansour and alluvium of Moulouya.

Sea-sand horizon Flandrian

Station «Cap de l'eau: Cap water» «N°35,13704 / W°002,40525», from the left bank of the mouth of Oued Moulouya to the beach of Ras Kebdana, is a sandy area of 4 km sheltered by cliffs Akemkoum el Baz, and the port of Cape Town Water.

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MATERIALS AND METHODS

Sampling was conducted in the sediment at the sandy sea, and from sea water at mid depth without risk of interference with the layers above and below, without any disruption due to nature or humans, [1] then the water was set to the action of adsorption and elution in the presence of nitric acid 2,5 N [23]**.** Containers after being rinsed with sea water filled to the brim and sealed on site. About forty adult individuals, (mean size about 3cm), are hand-harvested and sorted on site, cleaned and stored in polyethylene bottles, previously washed, and containing water of the sampling. After a purge period of up to 36 hours, the soft parts were separated from the shells, and were washed with distilled water and then drained. [7] After that, they were homogenised using a stainless steel knife mill and then lyophilized. The 100 mg of dry sediment taken was mineralized at 120 ° C for 4 h in the presence of 4 mL of hydrofluoric acid and 2 mL of a mixture hydrochloric acid and nitric acid (by volume). And a quantity of 0.5 g of dry powder of Donax trunculus was mineralized at 120 ° C for 4 h with 4 mL of nitric acid. [20] Sample analysis was performed by atomic emission spectrometry (ICP-AES) following the methods [2] in the laboratory of UATRS CNRST in Rabat.

RESULTS

Trace metals (including Pb, Cr, Cd, and Ni) are present at high levels in the sediment (superficial layer of sand from the beach), mainly lead and nickel, but are circulating at low levels in seawater.

Table 1: Levels of the 5 trace metals in sea water and sediment from the beach in "Cap de l'eau"

Samlpes	Cd	Cr	Ni	Pb
Water (mg/l)	1.093	0.198	0.298	2.087
Sediment (mg/kg)	1.883	10.294	37.534	20.336

In our study, analysis of variance shows significant coefficients for all metals, reflecting a seasonal pattern of metal bioaccumulation. Thus, the concentrations of most metals increase significantly in winter and fall in summer, especially for Lead and Arsenic stability in **(Figure 1)**

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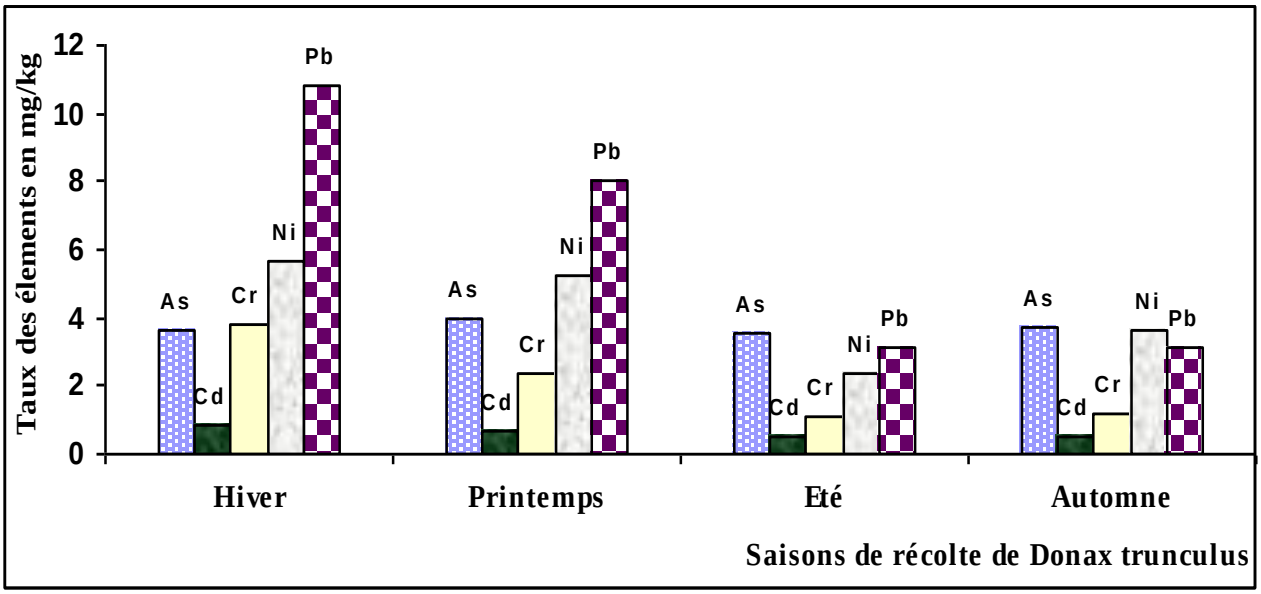

Figure 1: Levels of metals during the four seasons in Donax at Cap de l'eau

As for the observed spatial variations in metal contamination in Donax trunculus, [16] there is an evidence of a largest widespread contamination at the Saïdia resort, particularly for iron, and Cape water for other elements.

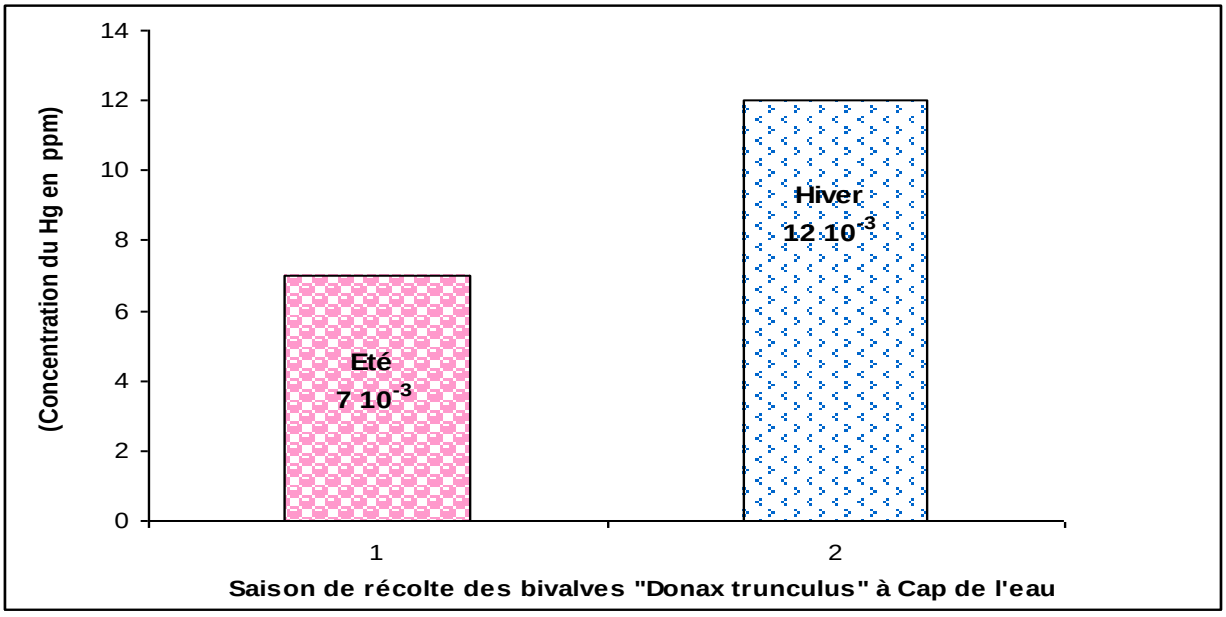

Figure 2 : Levels of mercury during the two seasons in Donax at Cap de l'eau

Mercury levels detected in the pulpit of Donax trunculus show a slight difference in summer (0.007 mg / kg) and increases in winter (0.012 mg / kg) but remains below the European standard.

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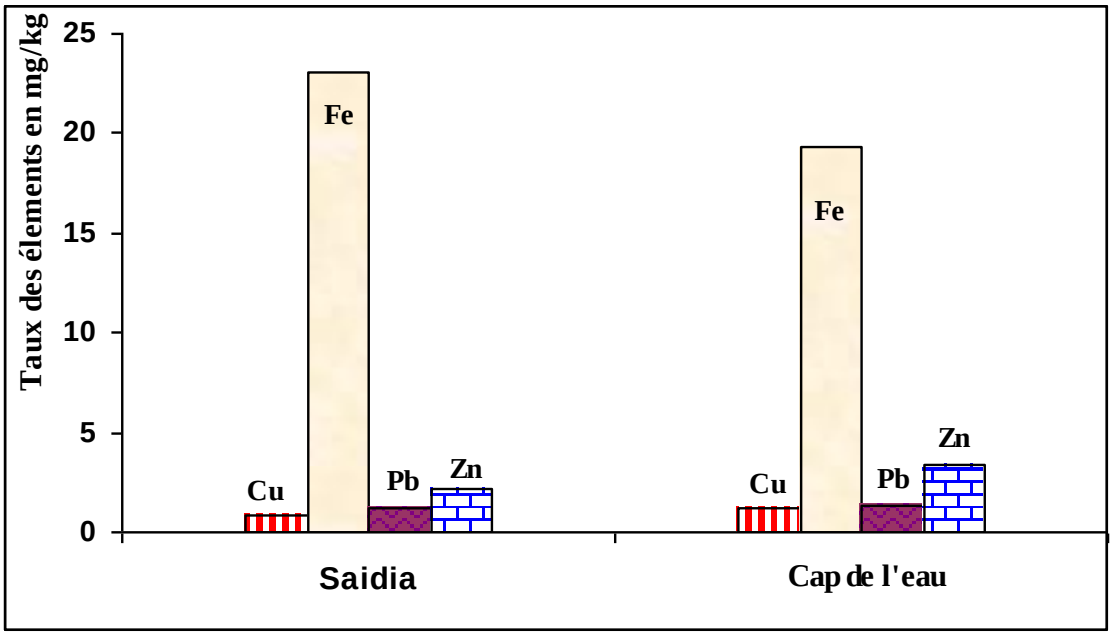

Figure 3 : Contents of elements at Donax trunculus on Course of the water and Saidia

DISCUSSIONS

Filter-feeding shellfish are likely to strongly focus metallic elements in trace amounts in the marine environment, the bioaccumulation is obtained direct transfer by water, or to desorption of metal components mounted on the inert particles or live in suspended in water that they feed. [12] At both study sites, the high recorded concentrations of iron are comparable with previous studies conducted in the same area. [4, 8, 14] The highest degree of contamination during the four seasons for Donax trunculus corresponds with lead levels above the standards of the EEC 2001/2002, which limits the levels in shellfish in fresh weight (Pb: 1.5 mg / kg ; Cd: 1 mg / kg and 0.5 mg Hg / kg) during the winter, the movements of currents in water seem to have an effect, too. The momentum seems to have a tidal influence on the quality and management of the pollution load passing through the mouth before being discharged to sea level. However, it turns out that the Mediterranean coast is subject to numerous permanent urban and industrial discharges, nearby port of Ras Kebdana. It should also be noted that the majority of industrial units that cease operations during summer time and which may be related to primary productivity and annual growth of the species [10], plus those due to agricultural activity practiced on the banks of Oued Moulouya, with the modernization of this activity and its intensification were usually accompanied by misuse and irrational nitrogen fertilizer in excess of actual needs in culture [18].

Growth and development of bivalves depend on the intensity of material storage reserve that fluctuates seasonally for mainly physiological reasons. The bioaccumulation phenomenon particularly in the digestive gland, [21] is maximum and minimum before reproduction after spawning when reserves were depleted during gametogenesis.

Moreover, the development of fisheries, the establishment of industries and the exodus to the cities along the coast lead to over fishing and impaired quality of the marine environment and result in pollution of marine ecosystems, where the consumption of contaminated bivalve raises toxicological concerns possible harm to public health. [20]

As the effluents from factories, such as solid particles contribute to the alteration of the aquatic ecosystem and can cause aquatic animals from mechanical epithelia. [9]

Contaminations of marine environments by heavy metals is one of the major problems in environmental toxicology, and make almost no reaction to the subject of biological or chemical degradation, [13] they can therefore accumulate in marine food chains.

Whatever their origin, their route to the sea and the chemical form in which they are rejected, heavy metals are subjected upon entry into the marine environment, a set of physicochemical processes that fall in the water and sediments, and their adsorption on living matter, and several factors may control the concentration of heavy metals in seawater [3]**:**

- Adsorption of suspended particles (ferrous sulphate, hydrated ferric oxide, hydrous manganese dioxide, apatite and Limon suspended organic matter).
- Precipitation of insoluble compounds containing ions usually present in sea water
- Precipitation of sulfide in environmental conditions very simplistic.
- Biological processes leading to the removal of varying intensity by microorganisms

CONCLUSION

Winter is often accompanied by a nutrient intake that could lead to a wealth of phytoplankton may be contaminated by metals released by sediments and those from industrial discharges. Faced with this scourge requires the need for regular monitoring of the quality of edible products, and a power emergency measure up to the formal prohibition of the sale and consumption of these products collected in the estuary.

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