

IRON, ZN, CU, PB AND CD CONTAMINATION IN THE COASTAL SECTION OF THE EVROS RIVER DELTA (NORTHERN AEGEAN SEA)

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Abstract

The degree of Fe, Zn, Cu, Pb and Cd contamination in the coastal section of the Evros River Delta, Northern Aegean Sea was assessed using water, sediment and the macroalga *Ulva rigida* analysis. Zinc, Cu and Pb levels in the water exceeded the European Environmental Quality Standards (EQSs) of waterborne contamination in estuaries and mainly Cu and Pb sediment contents the baseline levels in estuarine sediments. Metal levels in *U. rigida* indicate that the study area was rich mainly in bioavailable Cu and Fe.

Keywords: *Estuaries, Metals, Bio-accumulation, Algae.*

Introduction

One of the most important estuarine areas in Southern Europe, owing to its notable natural history and recreational interest, is that of Evros River, Northern Aegean Sea. Although the Evros Delta is protected as a wetland of international value according to the RAMSAR convention and despite the fact that considerable amounts of metals originated from human polluting activities enter Evros River over almost its entire catchment area, no information on metal contamination in the coastal section of the Evros Delta is essentially available. The use of bioindicators is the most employed method in the assessment of metal contamination in coastal environments; among the organisms most used is the green seaweed *Ulva rigida* C. Agardh ([1],[2] etc.). This study aims to assess the degree of Fe, Zn, Cu, Pb and Cd contamination in the coastal section of the Evros River Delta using *U. rigida*, and supplementary water and sediment, analysis.

Materials and Methods

Metal concentrations in water, surface sediments and *U. rigida* were measured seasonally in the coastal section of the Evros River Delta at four stations located at increasing distance from the estuary of the major branch of Evros River, using flame AAS or graphite furnace AAS with Deuterium background correction.

Results and Discussion

Mean Zn, Cu and Pb levels in the water (63.3, 9.8 and 31.5 $\mu\text{g l}^{-1}$, respectively) exceeded, whereas those of Fe and Cd (501 and 0.95 $\mu\text{g l}^{-1}$, respectively) did not, the European Environmental Quality Standards (EQSs) of waterborne contamination in estuaries ($<40 \mu\text{g l}^{-1}$, $<5.0 \mu\text{g l}^{-1}$, $<25 \mu\text{g l}^{-1}$, $<1.0 \text{mg l}^{-1}$ and $<5.0 \mu\text{g l}^{-1}$, respectively). A comparison of metal concentrations in surface sediments of the coastal section of the Evros Delta (Fe: 19270-31310 $\mu\text{g g}^{-1}$ DW; Zn: 68.7-247.0 $\mu\text{g g}^{-1}$ DW; Cu: 58.7-710.0 $\mu\text{g g}^{-1}$ DW; Pb: 66.0-219.4 $\mu\text{g g}^{-1}$ DW; Cd: 0.2-1.6 $\mu\text{g g}^{-1}$ DW) with those of several Greek estuaries ([3], [4], etc.) and baseline levels in estuarine sediments (Zn: $<100 \mu\text{g g}^{-1}$ DW; Cu: approx. 10 $\mu\text{g g}^{-1}$ DW; Pb: approx. 25 $\mu\text{g g}^{-1}$ DW; Cd: approx. 0.2 $\mu\text{g g}^{-1}$ DW) ([5]) reveals that the coastal area near the mouth of the major branch of Evros River shows some degree of contamination with Zn and Cd and overall the coastal section of the Evros Delta with Cu, Pb and Fe. Mean Fe and Cu levels in *U. rigida* at the study area (Fe: 2994 $\mu\text{g g}^{-1}$ DW; Cu: 22.4 $\mu\text{g g}^{-1}$ DW) are among the highest and mean Zn, Pb and Cd ones (Zn: 61.0 $\mu\text{g g}^{-1}$ DW; Pb: 6.1 $\mu\text{g g}^{-1}$ DW; Cd: 1.1 $\mu\text{g g}^{-1}$ DW) in the range of concentrations previously reported for the same species at other coastal areas (Fe: 73.58-4300 $\mu\text{g g}^{-1}$ DW; Zn: 6-594 $\mu\text{g g}^{-1}$ DW; Cu: 1.1-29 $\mu\text{g g}^{-1}$ DW; Pb: 0.51-29.8 $\mu\text{g g}^{-1}$ DW; Cd: 0.01-2.5 $\mu\text{g g}^{-1}$ DW;), some of which are recipients of domestic and industrial wastes (Thermaikos Gulf, central part of Venice lagoon) ([2], [6], [7], [8], [9], etc.). The above suggest a high bioavailability mainly of Fe and Cu in the coastal section of the Evros Delta.

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