

# HEAVY METAL CONCENTRATIONS IN MARINE ALGAE FROM THE TURKISH COAST OF THE BLACK SEA

K. Guven<sup>1</sup>, S. Topcuoglu<sup>2</sup>, N. Balkis<sup>1\*</sup>, H. Ergul<sup>3</sup>, A. Aksu<sup>1</sup>

<sup>1</sup> Institute of Marine Sciences and Management, University of Istanbul, Vefa, Istanbul, Turkey

<sup>2</sup> Turkish Marine Research Foundation, Beykoz, Istanbul, Turkey

<sup>3</sup> Kocaeli University Faculty of Art and Science Department of Biology, Izmit, Turkey - nbal@istanbul.edu.tr

## Abstract

Macroalgae samples were collected at different stations of the Turkish Black Sea coast in order to establish for concentration of Cu, Cd, Mn, Ni, Pb, Zn and Cr from 2001 to 2003. The levels of the heavy metals in seawater were also measured in 2003 to estimate the degree of accumulation of the each element by algae species. The patterns of heavy metal accumulation rates in decreasing order were Mn>Cu>Zn>Cr>Cd.

*Keywords : Algae, Metals, Black Sea.*

There have been made numerous studies on the heavy metal concentrations of the marine organism and sediment samples in the Black Sea marine environment, but limited information exists on the content of the heavy metals in seawater of the Black Sea. The papers were published on heavy metals content of macroalgae collected from Turkish Black Sea coasts between 1979 and 2000 [1-5]. Şile and Sinop are the main stations where our investigation on metal pollution of macroalgae have been carried out since 1979, because they are on the route of the water currents coming from the Danube river. The Black Sea coast is more than 4000 km long of which 1400 kilometers belongs of Turkey. The station of the Igneada is located near the Bulgaria border at the western part of the Black Sea. We selected one station from Yomra the eastern part of the Black Sea.

The aims of the present study were: (a) to determine the levels of Cu, Cd, Mn, Ni, Pb, Zn and Cr in seawater and algae species of the Igneada station in 2003 for examination of the concentration factors and (b) to determine the concentration the selected heavy metals in algae species at different stations of the Black Sea between 2001 and 2003.

Samples of algae collected from Igneada, Şile, Sinop and Yomra were green algae; *Chaetomorpha linum*, *Ulva rigida*, *Ulva lactuca*, *Enteromorpha linza*, brown algae; *Cystoseira barbata*, and red algae; *Pterocladia capillacea*, *Gelidium latifolium*, *Corallina granifera*, *Phyllophora nervosa*, *Corallina officinalis*, *Gracilaria verrucosa*. 500 g fresh weight sample was harvested at low tide and chose thalli as similar stage of each species. All procedures of the methods were similar to that previously described [2, 5].

Tab. 1. The concentration and concentration factor values in Igneada station during August 2003.

Cu	Cd	Mn	Pb	Zn	Cr
<b>The mean metal concentrations (<math>\mu\text{g l}^{-1}</math>) in seawater</b>					
1.74±0.1	0.31±0.08	1.6±0.4	<0.01	4.9±0.7	1.8±0.4
<b>The metal concentrations (<math>\mu\text{g g}^{-1}</math> dry weight) in algae</b>					
8.8±0.2 <sup>a</sup>	0.03±0.02	41.7±2	14±2	18±0.2	2.5±0.4
6.9±0.1 <sup>b</sup>	0.13±0.06	57.2±3	<0.02	8.3±0.1	2.5±0.3
<b>The concentration factors</b>					
506 <sup>a</sup>	96.8	25567	-	3693	1371
399 <sup>b</sup>	419.5	35070	-	1705	1349
<sup>a</sup> P.capillacea, <sup>b</sup> C.barbata					

The heavy metal concentrations determined in seawater are shown in Table 1. The Cu, Cd, Mn, Zn and Cr concentrations are higher than the range found in uncontaminated nearshore waters elsewhere in the world. In the present study, Cu, Mn, Zn and Cr concentrations are lower than were found in the same metals determined at northern Adriatic and north-western Black Sea. On the other hand, the concentration of Cd was higher in the Turkish Coast of the Black Sea. The concentration factors of the heavy metals are also given in Table 1. The patterns of heavy metal accumulation rates in decreasing order were Mn>Cu>Zn>Cr>Cd. The rate of the concentration factors may be useful to determine of the heavy metal

levels in seawater samples.

The highest accumulation of different metals in the tested algae species were, Cu and Mn in *C. officinalis*, Pb and Zn in *P. capillacea*, Cd in *G. latifolium*, Ni in *P. nervosa*, Cr in *E. linza*. In general, Cd, Zn and Cr decreased from 2001 to 2003, whereas, Cu, Mn and Ni levels increased in the same period. Regarding the areas, the highest amounts of Cd, Ni, Pb, Zn and Cr were found in Şile, while Cu and Mn in Yomra.

In our group studies, the heavy metal concentrations were determined in *C. barbata* and *U. lactuca* from Bosphorus during 1990-1991 [6] and Marmara Sea in 2000 [7]. In general, our results showed that the heavy metal concentrations in the Black Sea are lower than Bosphorus and Marmara Sea algae.

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