

# HEAVY METAL LEVELS IN MACROALGAE FROM SINOP IN THE BLACK SEA

S. T. Çulha<sup>1</sup>, F. Koçbas<sup>2\*</sup>, A. Gündoğdu<sup>3</sup>, S. Topçuoğlu<sup>4</sup> and M. Çulha<sup>5</sup>

<sup>1</sup> Celal Bayar University, Faculty of Arts and Sciences, Department of Biology - fatma.1970@hotmail.com

<sup>2</sup> Department of Aquaculture, Faculty of Fisheries and Aquaculture, University of Sinop, 57000 Sinop, Turkey

<sup>3</sup> Department of Basic Science, Faculty of Fisheries and Aquaculture, University of Sinop, 57000 Sinop, Turkey

<sup>4</sup> Department of Biology, Faculty of Sciences, Istanbul University, Vezneciler, Istanbul, Turkey

<sup>5</sup> Hydrobiology Department, Fisheries Faculty, Çanakkale Onsekiz Mart University, Çanakkale, Turkey

## Abstract

Concentrations of Cd, Co, Cu, Fe, Ni, Pb and Zn were determined in marine algae. Certain macroalgae species were chosen among the green, brown and red algae species at Sinop stations in the Turkish coast of the Black Sea in 2009. The concentrations of the heavy metals Co, Cu and Zn in the present study are higher, but Fe, Ni and Pb are lower when compared with previous study in the same region.

**Keywords:** *Algae, Black Sea, Metals*

## INTRODUCTION

Sinop is located at the outermost point on the Turkish coast line of the Black Sea. The fishing potential of this region is important for production of fish meal and oil from fresh anchovy fish. The Black Sea has been subject to very high levels of pollution due to industrial activity, municipal wastewaters, agricultural chemicals, oil pollution and airborne particles. The macroalgae species are usually used to indicate heavy metal levels in both estuarine and coastal waters throughout the world. In benthic food webs, macroalgae are key links and they act as time-integrators of pollutants [1]. Sinop is the main station where our investigation on the heavy metal pollution of marine algae have been carried out since 1986, because it is route on the anchovy fish migration [2]. Some papers have been published concerning heavy metal concentrations measured in macroalgae species collected from the Sinop region [3],[4],[5],[6].

## MATERIALS AND METHODS

The aim of this study is: (1) to determine the concentration of Cd, Co, Cu, Fe, Ni, Pb and Zn in macroalgae samples collected from different stations of the Sinop region during 2009 and (2) to compare the present results with the similar studies have been carried out in the same region of the Black Sea. 6 sampling stations of macroalgae were established in Sinop region (Akliman, Pazaryeri, Karakum, Ormankampi, Yaykil, Gerze). The marine algae species were *Enteromorpha intestinalis*, *Enteromorpha linza*, *Ulva lactuca*, *Cladophora serices* (green algae), *Cystoseira barbata* (brown algae) and *Gelidium crinale*, *Ceramium rubrum*, *Corralina officinalis*, *Coralina ssp.* (red algae). About 500 g of the fresh weight were harvested at low tide. The samples were rinsed to remove sand and epiphytal materials (1) in the sea water and (2) then with top water and (3) distilled water. They then were dried at 85 °C and homogenized. All procedure of the method was similar to that previously described [5]. The concentration of the heavy metals were determined by ICP-MS.

## RESULTS

The heavy metal concentrations in marine algae are shown in Table 1. Errors will be calculated from counting statistics. The highest uptake in macroalgae species at the sampling sites were as follows: Cu and Ni in *G. crinale*, Fe and Pb in *E. intestinalis*, Zn in *C. sericea* and Co in *U. lactuca*. The heavy metals accumulated in different algal taxa were: in green algae, Fe, Pb and Zn; in brown algae Co; in red algae Cu and Ni. The Cd concentrations in tested macro algae samples were found to be below the lower limit detection (<0.01). The highest amounts of heavy metals in macro algae samples were found as: Co and Pb in Akliman; Cu and Ni in Yaykil and Fe and Zn in Karakum.

**Tab. 1. Average heavy metal concentrations (mg kg<sup>-1</sup> dry weight) in marine algae samples of all sampling stations**

Station and Species	Co	Cu	Fe	Ni	Pb	Zn
<b>Akliman</b>						
<i>C. barbata</i>	2.72	3.91	373	5.88	<0.01	10.97
<i>E. intestinalis</i>	1.83	3.17	421	4.00	<0.01	45.11
<i>Corallina ssp</i>	0.10	0.06	326	3.76	4.84	55.78
<i>U. lactuca</i>	0.75	3.61	567	4.70	<0.01	40.62
<i>E. linza</i>	2.34	4.05	944	8.38	<0.01	24.92
<b>Pazaryeri</b>						
<i>C. barbata</i>	1.02	5.33	81	0.95	<0.01	20.47
<i>U. lactuca</i>	1.01	5.25	117	2.78	<0.01	20.37
<b>Karakum</b>						
<i>C. barbata</i>	2.53	2.01	455	0.79	<0.01	0.08
<i>E. intestinalis</i>	1.54	6.21	1104	2.16	<0.01	0.19
<i>G. crinale</i>	<0.01	16.8	421	9.53	<0.01	0.28
<i>C. rubrum</i>	<0.01	2.65	691	0.28	<0.01	0.28
<b>Ormankampi</b>						
<i>C. barbata</i>	<0.01	4.42	184	9.26	<0.01	13.22
<i>E. intestinalis</i>	0.98	6.41	352	3.41	<0.01	12.87
<b>Yaykil</b>						
<i>C. barbata</i>	0.61	5.87	991	7.47	<0.01	16.84
<i>E. intestinalis</i>	0.03	7.44	1744	2.42	<0.01	21.61
<i>C. sericea</i>	2.09	2.09	1190	1.09	<0.01	63.11
<b>Gerze</b>						
<i>C. barbata</i>	0.99	6.03	272	2.17	<0.01	4.65
<i>U. lactuca</i>	0.06	8.30	223	3.70	<0.01	34.27
<i>C. officinalis</i>	<0.01	1.77	139	2.02	1.39	20.79

## CONCLUSION

In previous study, the heavy metal levels were investigated in *C. barbata* and *E. linza* collected from the Sinop during the period of 1998-2000 [6]. Our results showed that Co, Cu and Zn concentrations are higher, but Fe, Ni and Pb levels are lower than in the same macroalgae species collected from the Sinop in 2000. A comparison of the present results with data reported for similar macroalgae species from other Turkish marine environment, suggest that the heavy metal levels are not higher in the Sinop region than Bosphorus and Marmara Sea macroalgae.

## References

- 1 - Fowler, S.W., 1979. Use of marine algae as a reference material for pollutant monitoring and specimen banking. In: Luepke, N.P. (ed.). Monitoring Environmental Materials and Specimen Banking. Martinus Nijhoff, The Hague. Pp. 267-347.
- 2 - Topçuoğlu, S., Kirbasoğlu, Ç., Balkis, N., 2004. Heavy metal concentrations in marine algae from the Turkish Coast of the Black Sea, during 1979-2001. *J.Black Sea/Med.EnvIRON.*, 10, 21-44.
- 3 - Güven, K.C., Topçuoğlu, S., Kut, D., Erentürk, N., Saygi, N., Cevher, E., Güvener, B., Öztürk, B., 1992. Metal uptake by Black Sea algae. *Bot. Mar.*, 35, 337-340.
- 4 - Güven, K.C., Okus, E., Topçuoğlu, S., Esen, N., Küçükcezzar, R., Seddigh, E., Kut, D., 1998. Heavy metal concentrations in algae and sediments from the Black Sea coast of Turkey. *Toxicol. Environ. Chem.*, 67, 435-440.
- 5 - Topçuoğlu, S., Kirbasoğlu, Ç., Güngör, N., 2002. Heavy metals in organisms and sediments from Turkish coast of the Black Sea, 1997-1998. *Environ.Int.*, 27, 521-526.
- 6 - Topçuoğlu, S., Güven, K.C., Balkis, N., Kirbasoğlu, Ç., 2003. Heavy metal monitoring of marine algae from the Turkish coast of the Black Sea, 1998-2000. *Chem.*, 52, 1683-1688.