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Determination of Heavy Metal Levels in Aquatic Plants Collected from Hoyran Lake in Isparta, Turkey

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Ten species of plant samples were collected from Egirdir Lake in Turkey. Nine trace metals (Cu, Cd, Pb, Zn, Mn, Fe, Cr, Ni and Co) in the samples were determined using flame atomic absorption spectrometry after microwave digestion. The relative standard deviations for all measured metal concentrations were lower than 10 %. Recovery values were nearly quantitative (≥ 95 %). The metal concentrations in samples were found to be 11.8-1.23, 1.22-0.78, 17.2-2.37, 36.5-7.38, 177.4-13.7, 377.8-103.6, 12.0-2.04, 11.4-2.76 and 7.48-2.22 μg/g for copper, cadmium, lead, zinc, manganese, iron, chromium, nickel and cobalt, respectively.

Key Words: Heavy metal levels, Aquatic plants, Hoyran Lake.

INTRODUCTION

Egridir Lake takes place in either the borders of Isparta province and Lakes region and it is one of the most important lakes of both. It is the 4th biggest lake in Turkey with 517 kilometre square surface area. Lake separated into two sections. Little one that placed at north side section called as Hoyran Lake, the section placed at south called Egirdir Lake. Each two sections connected with Hoyran throat. Several types of water plants are commonly grown Hoyran Lake.

Heavy metal pollution is a serious environmental problem all over the world in recent years. Lead, iron, copper, manganese, zinc, *etc.* were chosen as representative trace metals whose levels in the environment represent a reliable index of environmental pollution. Metals like iron, copper, zinc and manganese are essential metals since they play an important role in biological systems, whereas lead and cadmium are non-essential metals as they do not have any biological function are toxic even in traces[1-3].

Traffic is one of the sources of emission of trace metals such as Pb, Ni, Cu, Fe, Mn, Zn. High density traffic is pollutant for soil, plant and environment. Some plants could absorb trace metals more than others because of their properties such

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as pubescence-glabrous, erect-lean of stem, branching form, narrow large of leaf, flower form *etc*. Some plants can be used as a biomonitor for the determination of trace element levels[4-12].

In present study, the levels of trace metals in aquatic plant samples were determined by flame AAS after microwave digestion methods and is reported here.

EXPERIMENTAL

A total ten species of plant samples were used in this study. The samples were collected in Hoyran Lake, Turkey during in 2007. The samples were dried at 105 ºC for 24 h. Dried samples were homogenized using agate homogenizer and stored in pre-cleaned polyethylene bottles until analysis.

A Perkin-Elmer AAnalyst 700 AAS with deuterium background corrector was used in this study for the elemental analysis. All reagents were of analytical reagent grade unless otherwise stated. De-ionized water (18.2 MΩ cm) from a Milli-Q system (Millipore, Bedford, MA, USA) was used to prepare all aqueous solutions. All mineral acids and oxidants (HNO_3 and H_2O_2) used were of the highest quality grade (Suprapure, Merck, Darmstadt, Germany). All the used plastic and glassware were cleaned by soaking with the contact overnight in a 5 % (w/v) HNO_3 solution and rinsed with distilled water prior to use.

Samples (1.0 g) was digested with 4 mL of HNO_3 (65 %), 2 mL of H_2O_2 (30 %) in microwave digestion system for 31 min and diluted to 10 mL with deionized water. A blank digest was carried out in the same way (digestion conditions for microwave system were applied as 2 min for 250 W, 2 min for 0 W, 6 min for 250 W, 5 min for 400 W, 8 min for 550 W, vent: 8 min, respectively). This procedure was preferred because of more accurate with respect to both time and recovery values. The recovery values were nearly quantitative (> 95 %) for above digestion method.

RESULTS AND DISCUSSION

Trace metal concentrations were determined on dry weight as µg/g. The concentration levels of the elements measured in the samples are given in Table-1. The metal concentrations in samples were found to be 11.8-1.23, 1.22-0.78, 17.2-2.37, 36.5-7.38, 177.4-13.7, 377.8-103.6, 12.0-2.04, 11.4-2.76 and 7.48-2.22 µg/g for copper, cadmium, lead, zinc, manganese, iron, chromium, nickel and cobalt, respectively. The high metal accumulation levels in the species were found in *Polygonum salicifolium* Brouss. ex Willd. for Cu, Zn, *Ranunculus trichophyllus* Chaix for Cd, Mn, Cr, *Nasturtium officinale* R. Br. for Pb, *Polygonum hydropiper* L. for Fe, Ni, Co. Among all the samples, iron concentrations were found higher than other metal concentrations.

The lowest and highest iron concentrations were found to be 103.6 µg/g in *Nymphaea alba* L. and 377.8 µg/g in *Polygonum hydropiper* L. respectively.

TABLE-1
HEAVY METAL LEVELS IN SOME PLANT SAMPLES (μg/g)

Plant species	Cu	Cd	Pb	Zn	Mn
Polygonum lapathifolium L.	11.1±1.0	0.78±0.06	4.02±0.41	34.3±3.1	85.5±7.9
Polygonum hydropiper L.	10.0±1.0	0.86±0.08	5.67±0.55	28.2±2.5	118.0±10.9
Polygonum salicifolium Brouss. ex Willd.	11.8±1.1	1.13±0.11	2.37±0.22	36.5±3.5	177.4±17.3
Nymphaea alba L.	1.23±0.12	0.86±0.08	2.37±0.23	8.11±0.78	13.7±1.2
Pteriidium aquilinum (L.) Kuhn	7.03±0.70	0.95±0.09	BDL	21.8±2.0	64.4±5.9
Hippuris vulgaris L.	2.49±0.22	1.04±0.10	5.66±0.55	11.5±1.1	60.9±5.8
Myriophyllum verticillatum L.	2.24±0.20	1.13±0.12	5.66±0.50	7.38±0.71	82.2±7.8
Nasturtium officinale R. Br.	3.76±0.35	0.78±0.08	17.2±1.6	8.42±0.83	44.9±4.4
Ranunculus trichophyllus Chaix	3.51±0.35	1.22±0.12	5.66±0.55	24.8±2.1	168.0±18.8
Rorippa amphibia (L.) Bess.	2.24±0.23	0.95±0.09	8.97±0.90	14.3±1.2	55.8±5.5
Plant species	**Fe**	**Cr**	**Ni**	**Co**	
Polygonum lapathifolium L.	349.9±28.5	4.79±0.48	4.05±0.41	6.07±0.61	
Polygonum hydropiper L.	377.8±31.7	5.34±0.52	11.40±1.1	7.48±0.73	
Polygonum salicifolium Brouss. ex Willd.	272.2±26.3	3.13±0.29	5.34±0.52	6.07±0.61	
Nymphaea alba L.	103.6±10.3	2.04±0.20	1.89±0.17	5.03±0.50	
Pteriidium aquilinum (L.) Kuhn	283.1±25.4	4.24±0.41	6.21±0.59	5.02±0.50	
Hippuris vulgaris L.	286.2±27.2	8.08±0.79	4.91±0.47	5.02±0.49	
Myriophyllum verticillatum L.	254.6±23.5	10.8±1.0	7.07±0.71	2.22±0.22	
Nasturtium officinale R. Br.	240.7±23.8	7.00±0.65	7.95±0.77	5.73±0.55	
Ranunculus trichophyllus Chaix	307.2±29.9	12.0±1.1	5.79±0.56	2.22±0.21	
Rorippa amphibia (L.) Bess.	182.6±17.3	5.34±0.53	2.76±0.27	3.27±0.33	

BDL = Blow detection limit.

Manganese contents of *Nymphaea alba* L. (13.7 μg/g) and *Ranunculus trichophyllus* Chaix (168.0 μg/g). Manganese is the second high concentration values after iron in samples. Samecka-Cymerman *et al.*[13] found iron and manganese contents as 610-3940 mg/kg and 19-2121 mg/kg in aquatic plants. There are different among for copper contents. *Polygonum salicifolium* Brouss. ex Willd. and *Rorippa amphibia* (L.) Bess. had high and low copper levels. Copper levels in present study is lower than literature values[13]. Ajasa *et al.*[14] reported iron and copper content as 35-241 μg/g and 2.96-24.4 μg/g in the some plants.

Zinc contents of the plant samples were between 7.38 and 36.5 μg/g. *Polygonum salicifolium* Brouss. ex Willd. had considerably higher zinc content (36.5 μg/g) than others.

The highest cadmium, chromium, nickel, lead and cobalt concentrations were found in *Ranunculus trichophyllus* Chaix (1.22 μg/g), *Ranunculus trichophyllus* Chaix (12.0 μg/g), *Polygonum hydropiper* L. (11.4 μg/g), *Nasturtium officinale* R. Br. (17.2 μg/g) and *Polygonum hydropiper* L. (7.48 μg/g), respectively. The highest cadmium and lead concentrations reported by Liu *et al.*[15] as 36.25 and 148.48 mg/kg.

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