

## Utilization of *Salix Alba* L. and *Alnus Glutinosa* L. as Biomonitor for Heavy Metal Pollution in Gumushane

Duygu Ozdes<sup>1</sup>, Celal Duran<sup>2</sup>, Ozgun Kalkisim<sup>3\*</sup>, Yener Top<sup>4</sup>

<sup>1</sup>Gumushane University, Gumushane Vocational School, Gumushane, Turkey

<sup>2</sup>Karadeniz Technical University, Faculty of Sciences, Department of Chemistry, Trabzon, Turkey

<sup>3</sup>Gumushane University, Gumushane Vocational School, Gumushane, Turkey

<sup>4</sup>Gumushane University, Gumushane Vocational School, Gumushane, Turkey

\*okalkisim5@hotmail.com

### Abstract

This study was carried out to investigate the usage of willow (*Salix alba* L.) and alder (*Alnus glutinosa* L.) leaves as biomonitor in heavy metal pollution and to determine the levels of heavy metals such as Pb, Cd, Ni, Al, As, Cu, Fe, Cr, Hg, Zn, Co and Mn, quantitatively in Gümüşhane province by utilizing these biomonitor plants. For this purpose the willow and alder samples were collected from 45 and 20 different localities from the mining area, industrial zone and highway area where the heavy metal pollution may be at high levels. In addition, the samples were collected for each plant species from the control points where the contamination is minimal. Prior to heavy metal analysis leaf samples were digested in a closed vessel microwave system using appropriate solvent mixtures. Then the samples were diluted to the appropriate volume and analysed for heavy metals by inductively coupled plasma-mass spectrometry (ICP-MS). The highest heavy metal levels in willow and alder leaves taken from the mining area were obtained for Zn ( $414 \mu\text{g g}^{-1}$ ) and Al ( $433 \mu\text{g g}^{-1}$ ) analysis, respectively and the lowest values were obtained for As ( $0.19 \mu\text{g g}^{-1}$ ) and Co ( $0.1 \mu\text{g g}^{-1}$ ), respectively. The highest values of all of the willow and alder leaves taken from the highway area were obtained in Al analyses and found to be  $383$  and  $243 \mu\text{g g}^{-1}$ , respectively and the lowest values were obtained in Cr-As ( $0.4 \mu\text{g g}^{-1}$ ) and As ( $0.2 \mu\text{g g}^{-1}$ ) analysis, respectively. The highest heavy metal levels in willow and alder leaves taken from the industrial zone were obtained for Al ( $508.4 \mu\text{g g}^{-1}$ ) and Mn ( $510 \mu\text{g g}^{-1}$ ) analysis, respectively and the lowest values were obtained for As ( $0.3 \mu\text{g g}^{-1}$ ) and Co ( $0.1 \mu\text{g g}^{-1}$ ), respectively.

From the obtained data it is seen that, despite the measures taken, the heavy metal pollution in Gümüşhane province is not a vital danger for human and environmental health but it is at the risk level in many regions.

**Keywords:** Gumushane, Willow, Alder, Heavy metal, Biomonitor