Title: Heavy metal uptake by plant parts of willow species: A meta-analysis

Authors: Dávid Tőzsér, Tibor Magura, Edina Simon

PII: S0304-3894(17)30324-2
DOI: http://dx.doi.org/doi:10.1016/j.jhazmat.2017.03.068
Reference: HAZMAT 18547

To appear in: *Journal of Hazardous Materials*

Received date: 3-11-2016
Revised date: 13-3-2017
Accepted date: 15-3-2017

Please cite this article as: Dávid Tőzsér, Tibor Magura, Edina Simon, Heavy metal uptake by plant parts of willow species: A meta-analysis, Journal of Hazardous Materialshttp://dx.doi.org/10.1016/j.jhazmat.2017.03.068

Heavy metal uptake by plant parts of willow species: a meta-analysis

Dávid Tőzsér[a], Tibor Magura[a] and Edina Simon[a*]

[a]Department of Ecology, University of Debrecen, Egyetem sq. 1, H-4032 Debrecen, Hungary

Corresponding author: E. Simon, E-mail: edina.simon@gmail.com

Highlights

- We hypothesized that Cd, Pb and Zn can be accumulated in all plant organs
- We evaluated published data on Cd, Pb, and Zn accumulation in different plant parts
- Roots of willows have great potential for remediating Pb-contaminated soils
- The accumulated amount of Pb in willows is independent of exposure time
- Accumulation of Cd in leaves and twigs, and Zn in twigs are intensive for 3 years

Abstract

Previous studies on phytoremediation reported contradictory or inconsistent results on the Cd, Pb, and Zn accumulation in and among plant parts of willow (*Salix*) species. We hypothesized that metals could accumulate in all plant organs in different concentrations and the metal accumulation in tissues would be increased with exposure time. Furthermore, we analysed the effect of soil pH on metal accumulation, and the correlation between metals. We evaluated published information on Cd, Pb, and Zn accumulation in root, stem, twig, and leaf of willow species using meta-analysis. Results showed that all parts of willow species accumulated significantly more Cd, Pb, and Zn in contaminated soils than in uncontaminated soils. However, the metal accumulation was significantly different among plant parts. We concluded that willow species were proven to be prosperous accumulators of Cd (twigs and leaves), Pb (roots and twigs) and Zn (twigs). We found that Cd accumulation rate in stems is higher in soils with lower pH. Significant positive correlation was found between the accumulations of Cd and Zn in stems. Accumulation rates of Cd (both in leaves and twigs) and Zn (in twigs) were increased significantly with exposure time and the accumulation was successful for at least 3 years.

Keywords: Meta-analysis, Phytoremediation, *Salix*, Contamination, Accumulation

1. Introduction

Global environmental problems are among the main challenges of the 21st century [1]. Frequent irresponsible and inadequate land use (e.g. managing former and current industrial and mining sites) or demands claimed by population growth (e.g. food supply, urbanization) cause soil pollution, which is one of the most urgent worldwide problems to eliminate [2-5].

Cleaning up contaminated sites with traditional remediation methods places a huge financial strain on stakeholders [6-7]. During the last few decades, researchers found that