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Chemistry and Environmental Protection Division

7. simpozijum

Hemija i zaštita životne sredine

sa međunarodnim učešćem

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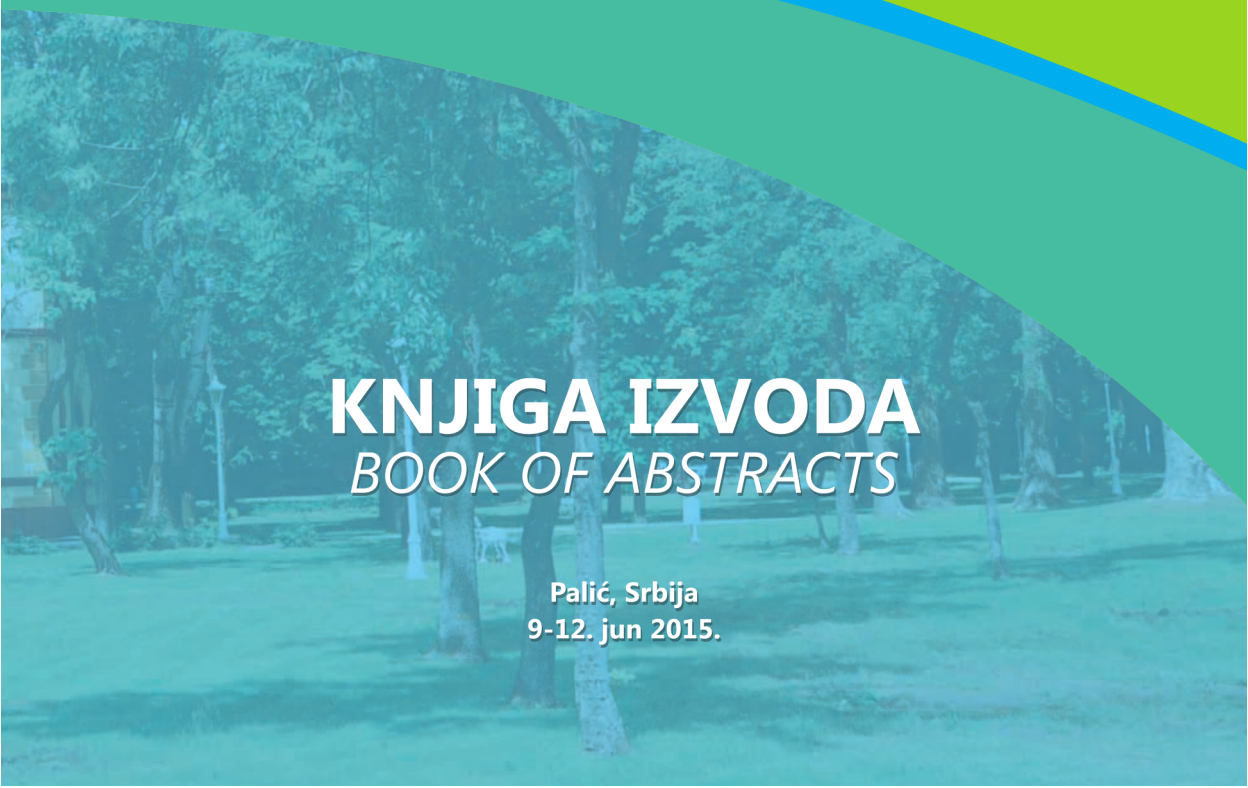

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Fitostabilizacioni potencijal *Festuca rubra* L. na deponiji pepela termoelektrane "Nikola Tesla –A" u Obrenovcu (Srbija)

The potential of *Festuca rubra* L. for phytostabilization of fly ash deposits at the thermoelectric power plant 'Nikola Tesla –A' in Obrenovac (Serbia)

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Fly ash (FA), a coal combustion residue (CCR) generated from thermal power plants, has been recognized as an environmental and human health hazard all over the world. Phytostabilization is remediation technology in which plants reduce mobility and availabilty of toxic pollutants i.e. immobilize them in the substrate or roots [1]. This study examined the potential of sown plant species, *Festuca rubra* L. (red fescue) for phytostabilization of fly ash deposits at the thermoelectric power plant 'Nikola Tesla-A' in Obrenovac (Serbia). Field studies were carried out on the passive FA lagoons: L3 – the lagoons 3 years old and L2 – the lagoons 11 years old.

The total content of As, B, Cu, Mo and Se in the fly ash and plant material (roots and leaves) was determined through the preparation of samples by using wet digestion in a microwave oven (CEM, MDS-39 2000). Measuring the concentration of elements was conducted on the ICP-OES (Spectro Genesis). Bioconcentration factor (BCF) was calculated as: BCF = element in roots / element in substrate. Translocation factor (TF) was calculated as: TF = element in leaves / element in roots. BCF and TF can be used to assess a plant's potential for phytoremediation [2].

The total As, B, Cu, Mo and Se content in the fly ash at L3 and L2 sites was found to be toxic for soils (Table 1) [3]. The accumulation of As, B, Cu, Mo and Se in roots and leaves of *F. rubra* at fly ash sites (L3-L2) ranged from 7.83-8.21 to 6.58-6.48 μg/g, 10.33-8.56 to 62.47-32.52 μg/g, 9.58-8.78 to 4.83-3.28 μg/g, 1.08-1.55 to 1.98-3.03 μg/g and 4.43-5.43 to 2.60-2.35 μg/g, respectively (Fig. 1). Sown species *F. rubra* at both FA sites is characterized by lower ability of translocation of As, Cu (BCF<1, TF<1) and Se (BCF>1, TF<1) from roots to leaves, whereas B and Mo are efficiently transported from roots to leaves (BCF<1, TF>1) (Fig.1). It means that As, Cu and Se are largely retained in roots, pointing to that *F. rubra* is an excluder plant. Similar results were found in *Saccharum munja* L. at the FA lagoons in India [4]. According to [2] excluders prevent or limit the translocation of toxic elements from roots to leaves. Thus, a greater content of As, Cu and Se in roots of *F. rubra* than in leaves can be explained by their stronger binding capacity to the root cell walls and reduced synthesis of specific transportes which can facilitate their flow within the leaves [5]. However, *F. rubra* has potential to transfer B and Mo to the leaves, and that may be related to the activation of the BOR1 and BOR4 as well as MOT1 and MOT2 transporters which operate in the condition of toxic B and Mo concentration in soils [6].

Study revealed that *F. rubra* acts as a good excluder of toxic concentrations of As, Cu and Se on fly ash deposits. Furthermore, this grass species is perennial nature, has an extensive root system, grows fast and tolerates drought, alkaline pH, high salinity and nutrient–poor soil, which makes it suitable plant species for phytostabilization of FA deposits.

Table 1. The total concentrations of elements in fly ash at L3 and L2 sites.

Parameters	L3	L2	Limit [3]
As_{Tot} (μg/g)	18.65 (3.036)	11.66 (0.588)	4.4 – 9.3
B_{Tot} (μg/g)	57.80 (1.950)	47.06 (3.484)	22.0 – 45.0
Cu_{Tot} (μg/g)	62.19 (2.836)	44.07 (1.632)	13.0 – 24.0
Mo_{Tot} (μg/g)	1.74 (0.189)	2.64 (0.039)	0.7-1.50
Se_{Tot} (μg/g)	3.52 (0.544)	2.42 (1.03)	0.25-0.38

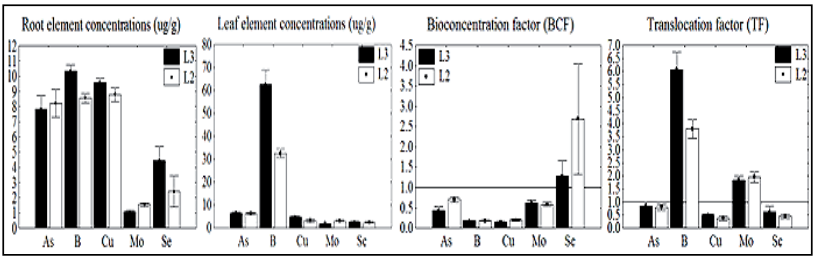

Figure 1. The concentrations of As, B, Cu, Mo and Se in roots and leaves, BCF and TF of *F. rubra* growing at L3 and L2 fly ash sites.

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