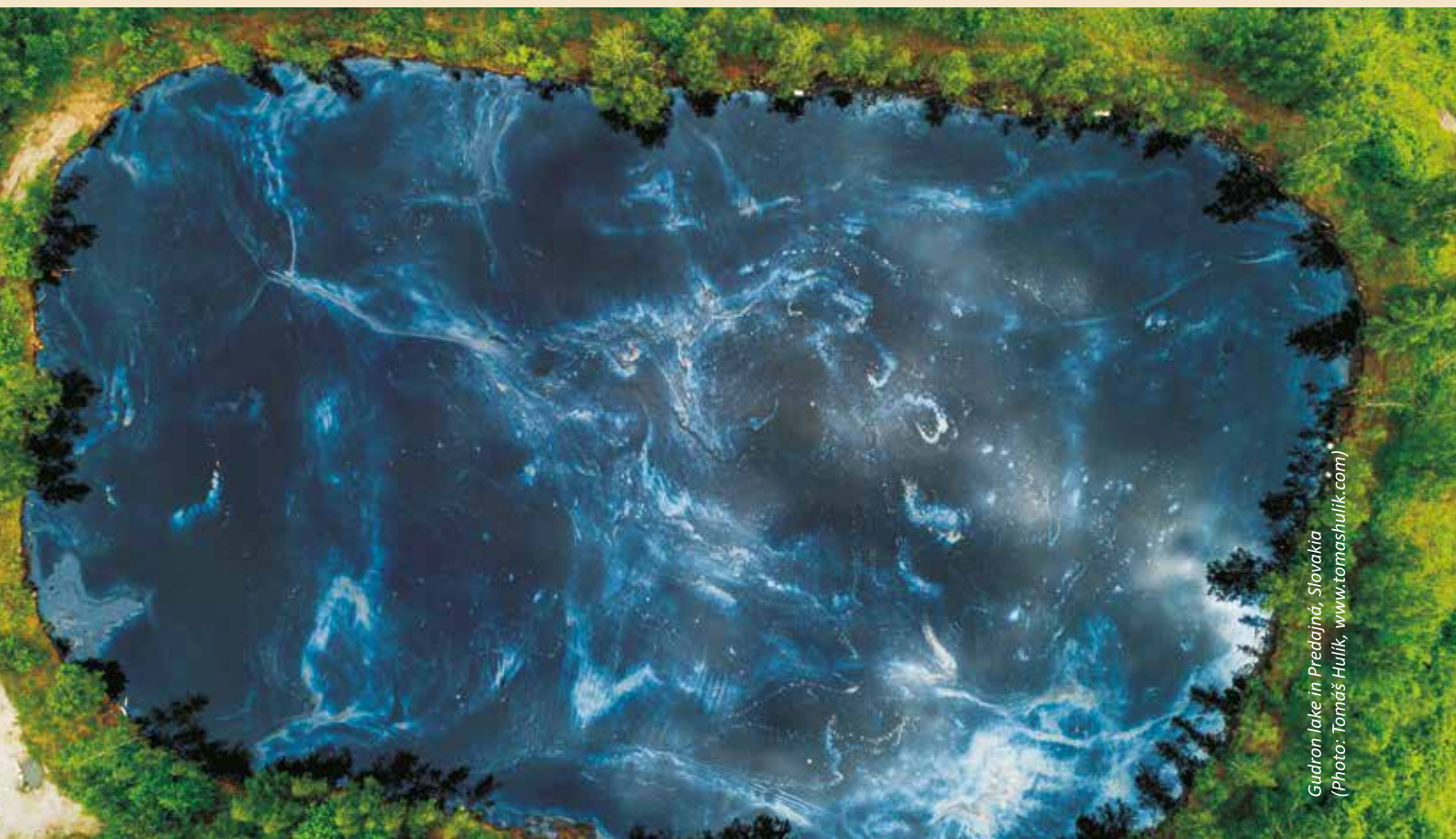


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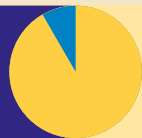
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SENEC | SLOVAK REPUBLIC | 12 – 14 OCTOBER 2022



*Gudron lake in Predajná, Slovakia
(Photo: Tomáš Hulík, www.tomashulik.com)*

CONFERENCE PROCEEDINGS





This publication has been prepared by the Slovak Environment Agency to support the International Conference CONTAMINATED SITES 2022, Senec, Slovak Republic, 12 – 14 October 2022. The conference was organised by the Slovak Environment Agency in the close cooperation with the Ministry of Environment of the Slovak Republic.

PUBLISHED BY:

Slovak Environment Agency (SEA)
Tajovského 28
975 90 Banská Bystrica
SLOVAKIA
Tel.: + 421 48 4374 164
www.sazp.sk
<https://contaminated-sites2020.sazp.sk/>

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The publication has not been proofread.

All images © Authors of the articles and SEA archive

Cover photos: Tomáš Hulík – www.tomashulik.com (1), Envigeo a. s. + Terradron (3), Archive of the SEA (4)

ISBN: 978-80-8213-084-6



Document completed in September 2022.

DISCLAIMER:

The information and views set out in this publication are those of the authors and do not necessarily represent the official views of the Ministry of Environment of the Slovak Republic and the Slovak Environment Agency as well.

ACKNOWLEDGEMENT:

The editors of this document would like to thank all authors of papers for their contribution.

THIS DOCUMENT SHOULD BE CITED AS:

Slovak Environment Agency. International Conference Contaminated sites 2022. Conference Proceedings. Banská Bystrica, October 2022. ISBN: 978-80-8213-084-6.

Available on the Internet: <http://contaminated-sites2020.sazp.sk/>

*The activity has been implemented within the national project
Information and providing advice on improving the quality of the environment in Slovakia.*

The project is co-financed by the Cohesion Fund of the EU under the Operational programme Quality of Environment.

TRACE ELEMENTS CONTENT IN SOILS AND INDIGENOUS MEDICINAL HERBS IN THE AREA OF HIGHLY DEVELOPED INDUSTRIAL ACTIVITY

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KEYWORDS

Extensive environmental pollution, industry, medicinal species, power plants, wild habitats

ABSTRACT

In rich flora of Serbia thrives a wide variety of indigenous medicinal species whose effectiveness is associated with their active constituents. One of the major quality problem is their high trace elements content that can be associated to extensive environmental pollution of their wild habitats, particularly when characterized by highly developed industrial activities. Aim of the study (Project TR 37006, year 2017; Project 451-03-68/2022-14/200011, year 2022) was to determine the trace elements contents in medicinal plants and in soils of their wild habitats.



Fig. 1 Republic of Serbia, near Belgrade: Nikola Tesla Thermal Power Plants d.o.o. Obrenovac: Tent A (a) and Tent B (b); industrial-petrochemical complex HIP-Petrohemija a.d. Pančevo (c)

Nikola Tesla Thermal Power Plants d. o. o. Obrenovac (TENT A and TENT B) are very diverse in terms of relief and geological background of the primary vegetation and climate. The production complex of HIP -

Petrohemija in Pančevo was built on approximately flat soil, raised on chernozem, with signs of glaying on the loess. The flora of Pančevo consists of wild and cultivated plants. The studied soil types, under all plant species sampled, were Calcic Gleysol (Obrenovac) and Humogley (Pančevo) [IUSS Working Group WRB, 2015]. The samples of plants are collected in the area of highly developed industrial and industrial-petrochemical activities: Obrenovac (*Cichorium intybus* L., *Plantago major* L., *Symphytum officinale* L., *Taraxacum officinale* F. H. Wigg) and Pančevo (*Matricaria chamomilla* L., *Melissa officinalis* L., *Mentha piperita* L., *Foeniculum vulgare* Mill). Soil and plant analyses were done according to ICP-OES methodology (Soltanpour et al., 1996).

Tab. 1 shows total levels of trace elements in the soil samples under studied plants from both Obrenovac and Pančevo. It corresponded to the usual levels in agricultural soils and were below the maximum permissible concentrations – MPC (OGRS, 2019).

Tab. 1 Total contents of trace elements in soils from Obrenovac and Pančevo under studied plants

Trace elements	Total forms of trace elements (mg kg ⁻¹) in soil under studied plant species							
	<i>C. intybus</i>	<i>P. major</i>	<i>S. officinale</i>	<i>T. officinale</i>	<i>M. chamomilla</i>	<i>M. officinalis</i>	<i>M. piperita</i>	<i>F. vulgare</i>
Cd	0.56	0.57	0.55	0.48	0.71	0.69	0.63	0.70
Co	19.11	15.75	16.96	19.37	0.90	0.43	0.75	0.73
Cr	78.71	82.11	84.61	81.21	0.72	0.45	0.53	0.76
Cu	92.05	91.35	89.98	93.81	16.48	14.26	16.85	15.42
Fe	29920	31345	30160	34491	31560	22457	34103	24300
M	724.67	428.67	481.00	749.33	254.70	137.13	196.33	262.50
Ni	36.37	29.25	31.86	41.86	27.64	14.66	23.24	23.72
Pb	21.81	20.68	19.93	14.16	13.76	13.88	15.20	12.36
Zn	94.38	111.55	111.75	91.37	7.98	10.14	6.08	5.73
As	8.60	3.46	3.80	9.86	1.18	0.85	1.16	1.03

Fig. 1 shows the normal and toxic concentrations of trace elements (mg kg⁻¹) and As (µg kg⁻¹) in the plants aerial parts collected from the area of Obrenovac and Pančevo.

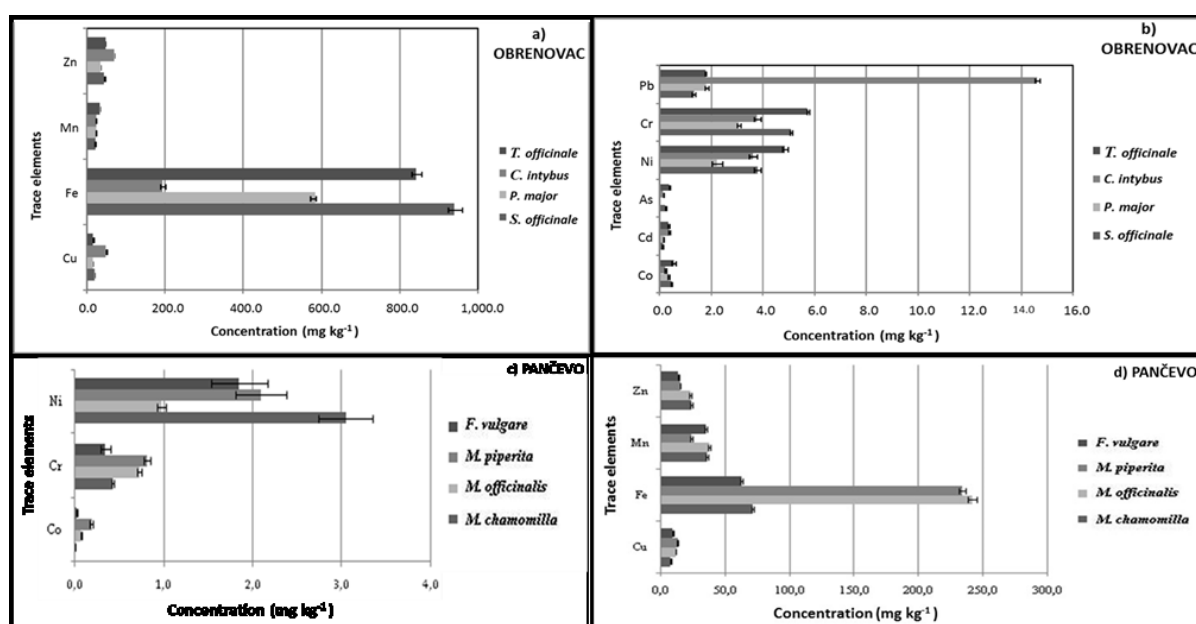


Fig. 1 Trace elements content in plants collected from the area of Obrenovac (a, b) and Pančevo (c, d)

During the year 2017, the contents of Pb, As, Cd, Co, Mn, Ni and Zn in the herbs samples from Obrenovac were below MPC; Cr was toxic in all samples, Cu was toxic in *C. intybus* and *S. officinale*, and Fe was toxic in *T. officinale*, *P. major* and *S. officinale*. The contents of trace elements in herbs from Pančevo were below MPC (Kastori et al., 1997), suggesting that they are with normal contents of trace elements suitable for further usage. It could be concluded that the herbs from Obrenovac growing site are, generally, not appropriate for further use.

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