2022-03

Potential of Brassica Napus for Phytoextraction of Heavy Metals from Soil and Sediment

Đukanović N., Beljin J., Zeremski T., Tričković J., Rončević S., Stojanov N., Maletić S.

EuChemS

2nd European Sample Preparation e-Conference
1st Green and Sustainable Analytical Chemistry e-Conference
Joint online events | 14 - 16 March, 2022

Potential of Brassica Napus for Phytoextraction of Heavy Metals from Soil and Sediment

GSAC
PP11

N. Djukanovic[1], J. Beljin[1], T. Zeremski[2], J. Trickovic[1], S. Roncevic[1], N. Stojanov[2], S. Maletic[1]
(1) Department of Chemistry, Biochemistry and Environmental Protection, Faculty of Sciences, University of Novi Sad, Trg Dositeja Obradovica 3, Novi Sad, 21000, Serbia, nina.djukanovic@dh.uns.ac.rs
(2) Institute of Field and Vegetable Crops, Maksima Gorkog 30, Novi Sad, 21000, Serbia

Keywords: *Brassica napus, Heavy metals, Phytoextraction, Sediment, Soil*

It is well known that non-hyperaccumulating *Brassica* species have potential for heavy metal accumulation and can tolerate high concentrations of heavy metals in their shoots [1]. The objective of pot trials was to assess if rapeseed (Brassica napus) as energy crop, has potential to be used for phytoextraction of heavy metals from soil. Pot experiments were performed in open air under natural weather conditions, in large plastic pots (height 30 cm/diameter 36 cm), filled with 20 kg of sediment (polluted and unpolluted sediment which has properties similar to sediment used in pot experiments).
Three days after sowing, soil in pots with rapeseed was treated with commercial PGPR products:Trifender Pro and Panorama Bio Plus. Three weeks after rapeseed plants emerged, Bio Echo product was applied foliar. Six weeks after sowing each pot was fertilized with ammonium nitrate fertilizer. Pots were irrigated manually by adding 2.5 L of water every second or third day after plants emerging. Ten weeks after sowing harvest was performed.
Soil samples were collected from each pot at the beginning of pot experiment and after the harvest. Plants were sampled only at the end of the pot experiment. Samples of soil and rapeseed plants (roots and aboveground parts) were prepared in laboratory and tested on content of heavy metals.
Based on the content of the selected metal(oid)s at the beginning and end of the experiment, according to national sediment legislation, sediment is considered as highly contaminated (Cu and Cr exceeded remediation values, and Zn, Cd, Cr and Pb exceed target value). The content of the metal in the contaminated sediment has not changed significantly during the experiment (Figure 1.). Based on the results obtained by BCR extractions [2], most of the present metal(oid)s are in non-available fraction (reducible and oxidizable). In general, available fraction of all metals in control sediment is higher than in contaminated sediment.
The below ground biomass of rapeseed in the contaminated sediment is marginally lower compering to the control soil. However, above ground rapeseed biomass is significantly higher for all rapeseed treatment in contaminated sediment compared to the control soil. The treatment with addition PGPR Trifender has the best performance from the all-rapeseed treatment in the respect of obtained biomass. Bioaccumulation factor (BAF) of the below ground biomass has significantly higher for all investigated metal(oid)s except in the case of Cd. The translocation factor (TF) was <1 which indicate that the main mechanism of the metal(oid) removal is phytostabilisation and not phytoextraction [3]. The low TF can be attributed also to the short growing season in pot experiments (3 month).

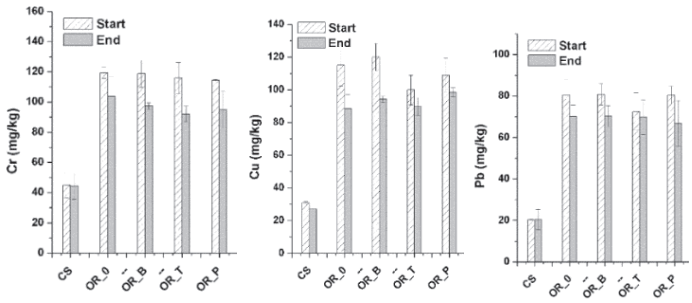

Figure 1. Metals concentration in the soil during the pot experiment.

Acknowledgements
This study has funded by the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No. 101006912-Phy2Climate.

References
[1] R. Angelova, R.I. Ivanova, J.M. Todorov, K.I. Ivanov, Potential of rapeseed (brassica napus l.) for phytoremediation of soils contaminated with heavy metals, J. Environ. Prot. Ecol. 18 (2017) 468-478.
[2] M. Arin, T. Kazi, M. Jamali, N. Jalbani, H. Afridi, J. Baig, Speciation of heavy metals in sediment by conventional, ultrasound and microwave assisted single extraction methods: A comparison with modified sequential extraction procedure, J. Hazard. Mater. 154 (2008) 998-1006.
[3] A.J.M. Baker, Accumulators and excluders-strategies in the response of plants to heavy metals, J. Plant Nutr. 3 (1981) 643-654.