



Determination of bioavailable macro- and microelements from agricultural soil using different extractants

Tijana Milićević, Dubravka Relić, and Aleksandar Popović

Faculty of Chemistry, University of Belgrade, Serbia (tijana.milicevic231@gmail.com)

Translocation of elements from soil to plant has a major impact on the growing plants and on their quality in any agricultural field. In this study, soil samples were collected from agricultural area Radmilovac, Serbia during grapevine season in 2013. Bioavailable elements from soil to plant (grapevine) were isolated by five different extractants: $0.11 \text{ mol L}^{-1} \text{ CH}_3\text{COOH}$, $0.05 \text{ mol L}^{-1} \text{ Na-EDTA}$, $0.01 \text{ mol L}^{-1} \text{ CaCl}_2$, $1 \text{ mol L}^{-1} \text{ NH}_4\text{NO}_3$ and distilled water during 2 and 16 h. Concentrations of 22 bioavailable macroelements: Al, Ca, Fe, K, Mg, Mn, Na, P, S, Si and microelements: B, Be, Cd, Co, Cr, Cu, Mo, Ni, Pb, Sb, V, Zn were determined by ICP-OES. The best extractant for Al, B, Be, Mg, Mo, Si and Zn was CH_3COOH , Na-EDTA for Ca, Cd, Co, Cu, Fe, K, Mn, Ni, P, Pb, V, and distilled water for Na and S. Acetic acid has been proven to be an aggressive extractant and it can be used for isolation of higher concentrations of plant bioavailable elements from soil, rather than distilled water, CaCl_2 and NH_4NO_3 . The acidity of CH_3COOH enhances the extraction of bioavailable fraction of microelements from various substrates and destruction of carbonates as well. However, it can be concluded that there is no unique extractant for isolation of the most bioavailable fraction for all elements from the soil. It can be noticed that the most common concentrations of macroelements, K and Mn, are in correlation with concentrations of microelements, Cd, Co, Ni and Zn. This indicates that the most of their concentrations in soils are followed by microelements, whose concentrations are much lower than concentrations of macroelements. However, as these correlations are the most common, it can be concluded that the pairs of macro- and microelements (e.g. Mn-Cd, Mn-Co, Ni-Cd, Ni-Co, Ni-Mn, Zn-Cd, Zn-Co, Zn-Mn, Zn-Ni) have the same source in soil and can be isolated by the same extractant. It is interesting to note that the concentrations of Ca and Mg extracted from soil using CH_3COOH are in correlation and that neither of these macroelements is in correlation with the concentration of microelements isolated with the same extractant. The concentrations of Cu and S extracted from soil by distilled water during 16 h are in correlation. These elements could have entered only through the soil surface layer while grapevines were primarily treated by fungicide copper(II)-sulphate. In addition, the concentration of S is correlated with the concentrations of Mn, P and Na. It can be assumed that the correlation between these elements points to their origin from the pesticides used in agriculture production.