



Separation and determination of Si, Al and Fe speciation forms from soils by solid-liquid extraction and extraction in aqueous PEG-based two-phase systems

D. BULGARIU (1,3) , L. BULGARIU (2), C. Rusu (1)

(1) "Al. I. Cuza" University, Faculty of Geography and Geology, Iași, Romania, (2) Technical University "Gh. Asachi" from Iași, faculty of Chemical Engineering and Environmental Protection, Iași, Romania, (3) Romanian Academies, Filial from Iași, Collective of Geography

Iron, aluminium and silica are major elements in any type of soil. Their contents and occurrence forms varied in relative large limits, but always these are directly correlated with the pedogenesis and the "condition" of some type of soil. The equilibriums of inter-phases distribution and speciation of Fe, Al and Si in soils, are extremely sensitive to relative low variations of physic-chemical conditions and conditioned the distribution of all others chemical elements from soil.

The field literature contains a rich material about the applications of extraction solid-liquid systems (SPE) to the separation of speciation forms of Fe, Al and Si from soils. In case of these methods utilization, the mobility, speciation forms and association way of Fe, Al and Si with mineral and organic components of soils are estimated in function of selectivity and extraction degree in some extractants. In comparison with SPE, the separation of Fe, Al and Si from soils in aqueous two-phase systems (ABS) is relative little studied. Ours studies have show that by combination of SPE with ABS can be realized selective separations of Fe, Al and Si speciation forms from soils, which make possible a more precise analysis of these.

In this paper are presented the results about the applicability and the limits of SPE-ABS extraction procedure to separation and determination of Fe, Al and Si speciation

forms from soils, in function of extractant type, work technique and physic-chemical characteristics of soils samples. The estimation accuracy of speciation form association way for these three elements with mineral and organic components of soils was also followed in this study.

The experiments were done using 3 types of soils: andosol, technosol and antrosol. The traditional separation procedure include the extraction with: (i) 0.3 M ammonia citrate + soium bicarbonate + sodium dithionite, pH 7.3 (Tokashiki and Wada, 1975), (ii) 0.2 M $\text{Na}_2\text{P}_2\text{O}_7$, pH 10 (McKeague et al., 1971), (iii) 0.2 M $\text{NH}_4\text{HC}_2\text{O}_4$, pH 3.0 (Fey and LeRoux, 1976), (iv) 0.5 N NaOH (Wada and Greenland, 1970), (v) 8.0 N HCl and 0.5 N NaOH (Kitagawa, 1977). The work procedures and the results interpretation are those mentioned in literature. For the SPE-ABS application we have used the same extractants, and the work conditions were maintained almost constant. The extractants solutions have been prepared by mixing 10 mL of 20 % [w/w] PEG solution with average molecular mass 1550 with 40 mL of 20.5 % [w/w] Na_2SO_4 solution.

From each soil sample was separated, by iso-dynamic magnetic method, more mineral fractions. Both, raw soil samples and each from separated mineral fractions have been used for the extraction by SPE procedure and by SPE-ABS, respectively. In each case was estimated the selectivity and the extraction degree of Fe, Al and Si, and was follow the kinetics of extraction processes.

The estimation of the type of Fe, Al and Si extractible forms and the association way of these with mineral and organic soil components was done using the experimental results obtained both by solid and liquid phase analysis. X-ray diffraction, IR and Raman spectrometry and microscopic studies of each separated mineral fractions and raw soils samples, before and after extraction, were the methods used for solid phase analysis. The liquid phase analysis was done by determining the contents of Fe, Al and Si from obtained extracts, by atomic absorption spectrometry and UV-VIS spectrophotometry.

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