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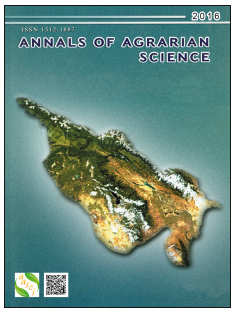

Distribution law and evaluation of chemical elements contents in soils below the detection limit

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Distribution law and evaluation of chemical elements contents in soils below the detection limit

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A B S T R A C T

There are samples in soils, where the content of any element falls below the limit of detection (for example, X-ray fluorescence analysis). To reveal a very low element content, we can achieve by regression analysis to obtain the dependence of its content from a common chemical analogue in profile. The most effective approach is the application of power regression equation, connecting low-Clarke lanthanides contents with high-Clarke lanthanides contents and low-Clarke bromine content with the high-Clarke halogen chlorine in soils.

There is a gradual transition from the normal distribution of high-Clarke lanthanides to lognormal distribution in low-Clarke lanthanides. The power regression approach allowed us to separate the regression relative error from the total metrological error. Estimation of the content of dispersed elements in the soil below the detection limit is limited by the magnitude of the regression relative error, and an estimation of the regression relative error is important for the construction of geochemical relationships of the elements.

Keywords: Llanthanides, Halogens, X-ray fluorescence method, Regression equations, Complete metrological errors, Relative regression errors.

Introduction

The chemical composition of soils is the basis of any serious soil analysis. Many agrochemical tasks are solved on the basis of these data: related with plant nutrition and soil contamination. However, when using this total chemical composition of soils, some questions have accumulated, which require resolution. One of the problems is connected with the study of micro- and nanoelements.

Occasionally there are samples in the soil profile, where the content of an element is reduced to below the limit detection of this analysis method. It is known, that by using the rapid and low-cost X-ray fluorescence (XRF) method, it is impossible to identify the element content below 3-4 mg/kg [1-3]. In recent years, this method was modified, using the so-called X-ray radiometric analysis (XRR) [4]. It is possible to expand the range of available trace elements, but detection limit is the same. There are similar limitations in other methods, for example, mass spectrometry with inductively coupled plasma. Arsenic is impossible to determine when the content < 1 mg/kg, Nb <0.1 mg/kg, molybdenum <0.05 mg / kg [5]. As a result, there are gaps in analytical