Determination of soil micronutrients (Fe, Cu, Mn, B) extracted by Mehlich 3 using MP-AES

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The total concentration of micronutrients in soils is not a good predictor of its bioavailability and solubility. Therefore, during the decades several methods for the determination of plant availability and extractable fraction of micro- and macronutrients in soil were developed. Among several methods Mehlich 3 is the most appropriate due to its suitability for extracting soil micro- and macronutrients simultaneously. The AAS (atomic absorption spectroscopic) and ICP (inductively coupled plasma) methods are widely used for the analysis of microelements today. In 2011 the third method was added to this list with the appearance of the microwave plasma atomic emission spectrometer (MP-AES). This multielemental analytical equipment has a high potential in the soil analysis. Up to now there have been made some experiments for the use of MP-AES in soil and geological material analysis. But there is no information about the analysis of soil micronutrients extracted according to Mehlich 3 method and determined with the MP-AES. Due to the differences in atomization conditions the different emission and absorption lines are used in different instrumental methods. Therefore it is very important to choose the most suitable emission lines and the best atomization conditions. From the analytical viewpoint it is important to get coincidental results with other instrumental methods and from the agronomical point of view it is important to know the difference between AAS and ICP methods.

For the experiment 51 soil samples were used. The samples were collected from A horizons of agricultural lands. The pH range was from 4.7 to 7.5 and organic matter content from 1.4 to 7.8%. The content of Mehlich 3 extractable micronutrients was determined using ICP and MP instrumental methods. The micronutrient contents ranged as follows: Fe - from 170 to 470 mg kg-1, Mn – from 5 to 190 mg kg-1, Cu – from 0.3 to 4.5 mg kg-1, B - from 0.2 to 2.1 mg kg-1. The optimal instrumental settings for iron, manganese, copper, and boron analysis according to Mehlich 3, using MP-AES method, are reported. Detection limits and limits of quantification for the analysed elements are calculated. Comparison of the analysed micronutrients content is provided by ICP and MP. Also the influence of soil pH and organic matter content on the results of analysis was reported.