



Comparison of ICP-OES and MP-AES in determining soil nutrients by Mehlich3 method

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Accurate, routine testing of nutrients in soil samples is critical to understanding soil potential fertility. There are different factors which must be taken into account selecting the best analytical technique for soil laboratory analysis. Several techniques can provide adequate detection range for same analytical subject. In similar cases the choice of technique will depend on factors such as sample throughput, required infrastructure, ease of use, used chemicals and need for gas supply and operating costs.

Mehlich 3 extraction method is widely used for the determination of the plant available nutrient elements contents in agricultural soils. For determination of Ca, K, and Mg from soil extract depending of laboratory ICP and AAS techniques are used, also flame photometry for K in some laboratories. For the determination of extracted P is used ICP or Vis spectrometry.

The excellent sensitivity and wide working range for all extracted elements make ICP a nearly ideal method, so long as the sample throughput is big enough to justify the initial capital outlay. Other advantage of ICP techniques is the multiplex character (simultaneous acquisition of all wavelengths). Depending on element the detection limits are in range 0.1 – 1000 $\mu\text{g/L}$.

For smaller laboratories with low sample throughput requirements the use of AAS is more common. Flame AAS is a fast, relatively cheap and easy technique for analysis of elements. The disadvantages of the method is single element analysis and use of flammable gas, like C_2H_2 and oxidation gas N_2O for some elements. Detection limits of elements for AAS lays from 1 to 1000 $\mu\text{g/L}$.

MP-AES offers a unique alternative to both, AAS and ICP-OES techniques with its detection power, speed of analysis. MP-AES is quite new, simple and relatively inexpensive multielemental technique, which is use self-sustained atmospheric pressure microwave plasma (MP) using nitrogen gas generated by nitrogen generator. Therefore not needs for argon and flammable (C_2H_2) gases, cylinder handling and the running costs of equipment are low. Detection limits of elements for MP-AES lays between the AAS and ICP ones.

The objective of this study was to compare the results of soil analysis using two multielemental analytical methods - ICP-OES and MP-AES. In the experiment, different soil types with various texture, content of organic matter and pH were used. For the study soil samples of Albelvisols, Leptosols, Cambisols, Regosols and Histosols were used. The plant available nutrients were estimated by Mehlich 3 extraction. The ICP-OES analysis were provided in the Estonian Agricultural Research Centre and MP-AES analysis in department of Soil Science and Agrochemistry at Estonian University of Life Sciences. The detection limits and limits of quantification of Ca, K, Mg and P in extracts are calculated and reported.