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BOOK OF ABSTRACTS

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Comparison of ICP-MS, ICP-OES, INAA, and WDXRF Techniques in Measuring Elements in Coniferous Needles Samples

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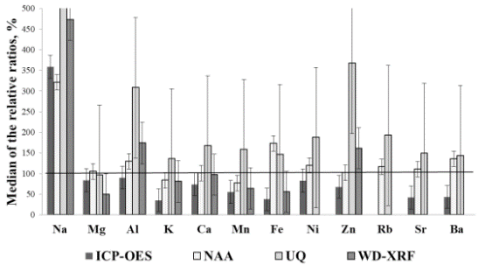

Fig. 1. Median of relative ratios.

The elemental composition of plant matrices has been conventionally determined by spectrometric techniques such as Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES), and Inductively Coupled Plasma Mass Spectrometry (ICP-MS) [1]. Wet mineralization (digestion) of samples requires time, equipment, and usage of aggressive and toxic chemicals which are the main drawbacks of those routinely used techniques [2].

The need for suitable analytical methods for direct and multi-elemental analysis of plant samples has been increased in recent years [3]. Instrumental Neutron Activation Analysis (INAA) is one of the techniques for direct analysis which has been previously applied in environmental studies, nevertheless it is not a commonly used technique for plant samples.

X-ray fluorescence (XRF) is another technique with the possibility of performing multi-element analysis directly on solid samples with numerous advantages.

Although non-destructive techniques (INAA and XRF) are widely accepted in various fields of screening tests regarding the analytical approach, their performance needs to be evaluated in plant sample analysis. The main aim of this research was to assess how reliable non-destructive techniques are in detecting elements in conifer needles regarding routinely used spectrometric techniques.

A total of 49 plant samples of four conifer species (*Pinus nigra*, *Abies alba*, *Taxus baccata*, and *Larix decidua*) were measured using two routinely used (ICP-MS and ICP-OES) and two non-destructive instrumental techniques (WD-XRF and INAA). A quality control program included NIST pine needles certified reference material (1575a) analysis using all examined techniques.

The techniques were compared by examination of relative ratio (element concentration measured using investigated analytical techniques divided by concentration determined by ICP-MS (figure 1)) and by correlation. Precision of all examined techniques was additionally investigated.

This study confirmed that non-destructive spectroscopic techniques can be successfully applied on plant samples since sample preparation for these techniques is fast and in good accordance with the principles of green chemistry. Investigated standardless XRF method can also produce well-correlated results, compared to other techniques based on calibration standards. Obtained results suggest that the high accuracy of the analysis can be ensured by additional analytical and quality control steps (the use of internal standards, standard addition, *etc.*).

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