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Application of ICP-AES technique for determination of zinc in plants and plant products

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Abstract

The global tendency of agriculture ecologization attaches particular importance to accurate and reliable determination of chemical elements that could act both as microelements and as heavy metals in plants and plant products for purposes of animal's feeding.

One of such elements is zinc. As a microelement it is necessary for the full growth and development of plants, by playing important role in synthesis of chlorophyll, auxins, and carbohydrates in the upper part of plants, by being the part of ferments, which regulate redox reactions in cell and by influencing on the processes of generation.

In the organism of farm animals zinc is necessary for timely puberty, normal development of generative organs, for proper functioning of organs of smell and taste, for immune response regulation and proper healing of wounds.

Both deficiency and excess of zinc in crop production are fraught with negative consequences for growth and development of plant and for growth and development of farm animals which are fed by these plants. When the content of zinc is exceeded the value of maximum allowable limit regulated by sanitary and veterinary regulations and rules, this element begins to act as a heavy metal.

Such a double manifestation of the properties of zinc makes necessarily a using of accurate, reliable and high-performance method of this element determination in plants and plant production.

Nowadays in Russia for zinc determination in plant raw materials and feeds, normative documents based on atomic-absorption measurement after classical dry or wet ashing are used.

However, modern international analytical practice and international standard materials based on it increasingly recommend the method of atomic emission spectrometry with inductively coupled plasma for solving problems of determining the content of microelements and heavy metals, including zinc.

This method has a number of fundamental advantages in comparison with the method of atomic absorption spectroscopy.

We conducted a study of the suitability of the integrated use of the method of atomic emission spectrometry with inductively coupled plasma and microwave mineralization of plant samples for the analysis of zinc content in plants and crop production.

As demonstrated by our study, the proposed approach is not only suitable for the stated purpose, but even allows to surpass the reproducibility of standardized methods based on atomic absorption spectroscopy, not least because of advantages of microwave mineralization of samples. These statements are confirmed by statistical evaluation of the experimental data.

From the work carried out, we conclude that the method of determining zinc in plants and crop production by atomic-emission spectrometry with inductively coupled plasma in combination with microwave mineralization can be recommended for use in the context of greening of agriculture and organic livestock.

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