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COMPARISON OF ICP-OES AND GFAAS TECHNIQUES FOR DETERMINATION MINERAL CONTENT IN WHEAT AND WHEAT PRODUCTS MATRIX

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In modern society, it has become necessary that every food product possess nutritional label. One part of the nutritional value of food is micronutrients, especially minerals. They can be determined by different analytical techniques such as inductively coupled flame atomic absorption spectroscopy (FAAS), graphite furnace atomic absorption spectrometry (GFAAS), plasma-optical emission spectroscopy (ICP-OES) and inductively coupled plasma-mass-spectrometry (ICP-MS). These techniques differ according to the number of elements that can be determined, the levels of determination, the number of samples that can be determined and the sample volume. Wheat contain substantial share of minerals iron (Fe) and Zinc (Zn). A lot of human population especially woman and children's in poor countries suffers from deficient of these micronutrients. Therefore is necessary to measure their content in wheat and wheat products such as different kinds of bread that are staple food. Therefore, the aim of the study was to determine Fe and Zn in wheat grain and milling streams by GFAAS and ICP-OES to compare them.

Three old wheat cultivars Rumska crvenka (DOI: 10.18730/ZAHP), Crnozrna (DOI: 10.18730/ZAFXX) and Stara Banatka (DOI: 10.18730/ZAG0*) was first milled in a Bühler pneumatic laboratory mill MLU 202 (Uzwil, Switzerland). The eight milling streams were obtained six flours and two by-products. Fe and Zn content of twenty seven samples (24 samples of milling streams and 3 of wheat grain) was determined by GFAAS and ICP-OES techniques.

The results of the study showed that the correlations between GFAAS and ICP-OES techniques for determination of Fe and Zn were positive and statistically significant. The higher correlation ($r=0.9447$) was gained for determination of Zn content, whereas for Fe content was a little bit lower ($r=0.9358$). Furthermore, analysis of variance (ANOVA) showed statistical differentiation among the results of mineral content in milling streams determined by two techniques. The values of both minerals determined by GFAAS in the milling streams of grain endosperm were lower than the values obtained by the ICP-OES technique, while in the milling streams from the outer parts of the grain they were higher. From results it can be concluded that is better to use GFAAS technique for determination of minerals if necessary to evaluate nutritive value of wheat and wheat products.

Key words: *minerals, analytical techniques, wheat and wheat products*

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POREĐENJE ICP-OES I GFAAS TEHNIKA ZA ODREĐIVANJE SADRŽAJA MINERALA U MATRIKSIMA PŠENICE I PROIZVODA OD PŠENICE

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U savremenom društvu postalo je neophodno da svaki prehrambeni proizvod ima nutritivnu oznaku. Jedan deo nutritivne vrednosti hrane čine mikronutrijenti, a pogotovo minerali. Oni se mogu odrediti različitim analitičkim tehnikama kao što je induktivno spregnuta plamena atomska apsorpciona spektroskopija (FAAS), atomska apsorpciona spektrometrija sa razaranjem uzorka u grafitnoj peći (GFAAS), plazma-optička emisijska spektroskopija (ICP-OES) i induktivno spregnuta plazma-masena spektrometrija (ICP-MS). Ove tehnike se razlikuju prema broju elemenata koje mogu odrediti, koncentraciji uzorka i broju uzoraka koji se mogu odrediti kao i zapremini uzorka koja je potrebna za analizu. Pšenica sadrži značajan udeo minerala gvožđa (Fe) i cinka (Zn). Veliki broj ljudi, posebno žena i dece u siromašnim zemljama, pati od nedostatka ovih mikronutrijenata. Zbog toga je neophodno odrediti sadržaj ovih minerala u pšenici i pšeničnim proizvodima kao što su različite vrste hleba koji su osnovna hrana. Stoga je cilj studije bio da se pomoću GFAAS i ICP-OES odredi sadržaj Fe i Zn u zrnu pšenice i proizvodima mlevenja kako bi se mogli uporediti rezultati dobijeni pomoću ove dve tehnike.

Tri stare sorte pšenice Rumska crvenka (DOI: 10.18730/ZAEHP), Crnozrna (DOI: 10.18730/ZAFXX) i Stara Banatka (DOI: 10.18730/ZAG0*) prvo su samlevene na Bühler-vom pneumatskom laboratorijskom mlinu MLU 202 (Uzwil, Switzerland). Dobijeno je osam pasaža od čega 6 frakcija brašna i dve frakcije nusproizvoda. Sadržaj Fe i Zn u dvadeset sedam uzoraka (24 uzorka pasaža i 3 zrna pšenice) određen je pomoću GFAAS i ICP-OES tehnike.

Rezultati studije su pokazali da su korelacije između GFAAS i ICP-OES tehnika za određivanje Fe i Zn pozitivne i statistički značajne. Veća korelacija ($r=0,9447$) dobijena je za određivanje sadržaja Zn, dok je za sadržaj Fe nešto niža ($r=0,9358$). Pored toga, analiza varijanse (ANOVA) pokazala je statističku diferencijaciju između rezultata sadržaja minerala u mlevenim tokovima utvrđenim dvema tehnikama. Vrednosti oba minerala utvrđene GFAAS u mlevenim tokovima endosperma zrna bile su niže od vrednosti dobijenih ICP-OES tehnikom, dok su u mlevenim tokovima iz spoljašnjih delova zrna bile veće.

Iz rezultata se može zaključiti da je bolje koristiti GFAAS tehniku za određivanje minerala ako je potrebno za procenu nutritivne vrednosti pšenice i pšeničnih proizvoda.

Ključne reči: *minerali, analitičke tehnike, pšenica i proizvodi od pšenice*

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