Sprouts enriched with microelements: application of hydrogel fertilizers with controlled release of micronutrients

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Introduction:

In recent years, consumer preferences have increasingly focused on healthy food, which is mainly based on vegetables and fruits. A special role in nutrition play seed sprouts, which are obtained from very early stages of plant growth. Taste, high content of bioactive substances and microelements increasingly persuades consumers to supplement their diet with these young plants (Kyriacou *et al.*, 2016). Also, germination is a very fast and inexpensive process, which lasts up to three weeks and provides a large yield.

The sprouts have a much higher nutritional value than seeds, due to the content of processed protein, which has a high content of polyunsaturated fatty acids and vitamins or microelements. Moreover, during germination, proteins break down into oligopeptides and free amino acids, which support biochemical processes in the human body (Benincasa *et al.*, 2015). The nutritional value of the sprouts is influenced by many factors, including light, ambient temperature, but also the substrate from which the nutrients are taken (Blicharska *et al.*, 2014). Hsu *et al.* (2008) presented the effect of fertilization of buckwheat sprouts with water containing nutrients (Cu, Zn and Fe) on antioxidant activity. The content of provided elements in buckwheat sprouts significantly increased, moreover, the ethanol extract from buckwheat sprouts showed high activity of iron ion chelation and higher activity of DPPH radical interception.

The aim of this work was to enrich ground cucumber sprouts with microelements (Mn, Zn, Cu) using hydrogel fertilizers based on sodium alginate with immobilized waste biomass.

Methods:

Hydrogel beads composed of sodium alginate (2.5%) and biomass (5%) were prepared. The structures were enriched with Mn^{2+}, Zn^{2+} and Cu^{2+} ions by the sorption process. Cucumber seeds (5x10) were placed on cotton wool lined Petri dish, then 5 tests were prepared: test "0" (without fertilizer), control test (with beads without micronutrients) and tests fertilized with beads enriched with Mn^{2+}, Zn^{2+} and Cu^{2+} respectively (Fig. 1). After 10 days, samples were taken, mineralized and the content of microelements was analyzed.

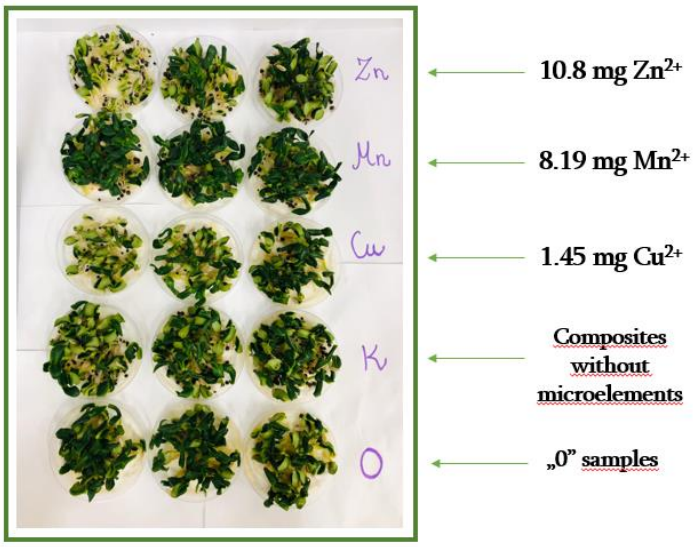

Fig. 1. *Germination tests*

Results:

Fig. 2 shows the content of microelements in cucumber sprouts. The nutrient content of samples fertilized with hydrogel composites increased significantly. The content of Mn^{2+} in sprouts increased over 30 times, while the content of Zn^{2+} increased about 20 times in comparison with the zero sample. The concentration of microelements has also slightly increased in samples fertilized with non-enriched composites, due to the presence of nutrient-rich waste biomass.

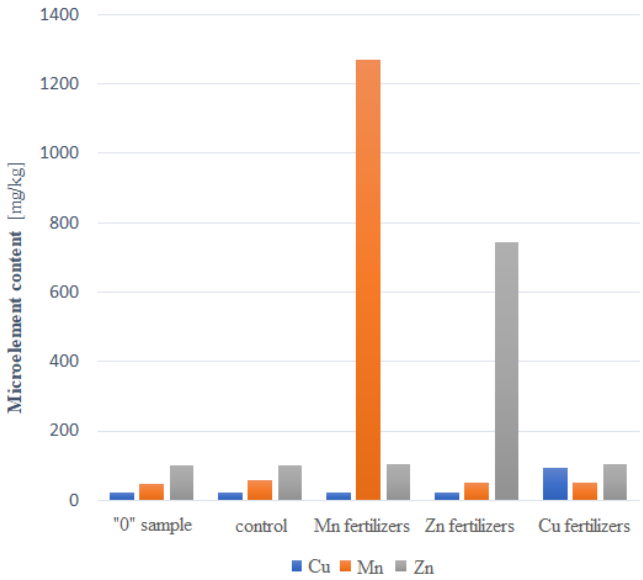

Fig. 2. *Content of microelements Mn^{2+}, Zn^{2+} and Cu^{2+} in enriched cucumber sprouts*

Conclusion:

Prepared microelements hydrogel fertilizers significantly increased the nutrient content in cucumber sprouts. Micronutrient-rich sprouts can be a supplement to the diet and represent potential as a functional food.

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