

„Biomass enrichment with micronutrients via biosorption as a utilization method of residues obtained after supercritical extraction”

Mateusz Samoraj, MSc

summary of doctoral thesis

The doctoral dissertation constitutes a proposal of new technology of micronutrient fertilizers via biosorption. The carrier of micronutrients was biomass. Possibility of use of byproducts such as fruit seeds residues after supercritical extraction with CO₂, for the production of fertilizers with micronutrients (Zn, Mn, Cu), was presented. In preliminary experiments, different types of biomass were tested in screening tests. After preliminary selection, based on *in vivo* and *in vitro* tests, materials with best characteristics were chosen.

On selected materials (blackcurrant, raspberry and strawberry seeds), research aimed at determination of micronutrients-binding mechanism (via potentiometric titration, XRF, ICP-OES, SEM-EDX) was conducted. New bench scale plant was designed and developed for production of new preparation for further vegetation tests. Bioavailability of micronutrients was assessed by *in vivo* (germination tests on garden cress, pot trials on white mustard and field trials on raspberries) and *in vitro* methods (extraction based tests). After the final selection of the best material, applicable batch of products was prepared in the pilot plant system for two-year field trials on maize. In experiments, about 10% higher yield and micronutrient content was obtained for edible parts of plants in comparison to commercial products. The study led to the formulation of a new product. Instruction of use was prepared. Preliminary economical analysis led to the estimation of production cost assessment.

Production of new preparations in pilot plant, and conducted field trials enabled to perform preliminary economical analysis and commercial potential evaluation before product launch. Technology Readiness Level (TRL) was rated at 5 and allowed to prepare technological offer for industry and interested companies.