

„Formulations based on supercritical algal extract”

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the summary of doctoral dissertation

The doctoral dissertation proposes formulations containing algal extracts obtained by supercritical CO₂ (SC-CO₂) extraction, as follows: water-borne emulsion of biostimulant for foliar application, and both cream and two-in-one peeling with face mask for facial skin care. Formulations were assessed in instrumental and application tests which followed preliminary experiments to select a group of interest. Further examination included biostimulants based on SC-CO₂ extract from Baltic macroalgae and *Spirulina platensis* and, in some cases, enriched with micronutrients (B, Cu, Fe, Mn, Mo, Zn). Among cosmetics, cream containing both SC-CO₂ and water extract from *S. platensis* and peeling containing SC-CO₂ extract from the microalga and Baltic sand were chosen. Levels of contaminants (biostimulant) and impurities (cream and peeling), as well as microbiological quality for cosmetic products were verified to remain within the limits set by applicable European Union and national regulations and standards. Formulation also underwent analysis of the basic physicochemical properties and short-term stability assessment.

Germination tests proved beneficial biostimulant influence on the initial growth phase of garden cress and common wheat. The effect was observed for radish growing at the presence of abiotic stress agent, as well. Under field conditions, biostimulants showed activity towards wheat grains development and, depending on vegetation season, yield, and affected oilseed rape yield. Application of biostimulants containing SC-CO₂ algal extract provided similar results to plant treatment with commercial products.

There were two types of qualitative assessment on cosmetic products – performed by the author of doctoral dissertation and by independent participants. Product characteristics received high estimate and so did some of the skin caring effects. One considered cream to suit daily skin care routine. However, compared with control emulsion lacking of SC-CO₂ microalgal extract, it was not clearly justified for the activity against skin problems such as ageing symptoms and imperfections. Peeling was more positively reviewed meeting the expectations of skin cleansing and caring. Allergy patch tests on 96 participants proved safety of both cream and peeling containing SC-CO₂ microalgal extract.

The solution presented in the doctoral dissertation attempted to follow the trends of extracting active compounds of industrial value from biologically-originated materials using solvent-free

techniques. The obtained results suggest that the solution might be applied to valorise regional waste materials – Baltic macroalgae, and enhance commercial potential of the common raw material for the food industry – *Spirulina platensis*.