

Properties of bioactive preparations of cocoa bean with enhanced stability for enriching food

mgr inż. Milena Rogalska

Supervisor: prof. dr hab. inż. Dorota Żyżelewicz

Auxiliary supervisor: dr inż. Joanna Oracz

Abstract

The dissertation presents the results of a 4-year laboratory research carried out within the doctoral study project "New doctoral programme at the Faculty of Biotechnology and Food Sciences, Lodz University of Technology" No. POWR.03.02.00-00-I023/16 implemented under the Operational Programme Knowledge Education Development, funded by the National Centre for Research and Development. The results of the work were presented in 2 scientific articles, 2 chapters in a monograph and at scientific conferences.

In the theoretical part, the role of antioxidants in food was discussed, and phenolic compounds were characterised, with particular emphasis on flavonoids, which are the most abundant bioactive substances in cocoa beans. The bioactive properties and bioavailability of these compounds in the human gastrointestinal tract are also described. In addition, a literature review of encapsulation methods for bioactive materials was conducted and the techniques used in this thesis to encapsulate phenolic compounds were discussed.

The aim of the dissertation was to develop effective methods for the encapsulation of selected phenolic compounds from cocoa beans in both free and ACTICOA cocoa powder form and the extract obtained from it, the characterization of the functional properties and stability of the preparations obtained, and their application to selected food products obtained under laboratory conditions.

For encapsulation, the technique of obtaining inclusion complexes with cyclodextrins, liposome technology and the method of forming alginate-chitosan capsules were used. The encapsulation efficiency of cocoa bean phenolic substances was evaluated, and the characterization of the obtained preparations using scanning electron microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR) and laser diffraction techniques was carried out. The solubility, thermal and long-term stability of the selected phenolic compound and the resulting ACTICOA cocoa powder preparations were investigated. The composition of the phenolic compounds was evaluated using ultra-high performance liquid chromatography with spectrophotometric detection (UHPLC-DAD) and the antioxidant activity using various *in vitro* tests (Folin-Ciocalteu, DPPH, ABTS, FRAP) of the obtained preparations, and their changes after simulated digestion in the gastrointestinal tract were determined.

In the application part of the study, selected preparations, in free and encapsulated form using cyclodextrins and alginate-chitosan capsules, were introduced into food products (drinking yoghurt, agar jelly, confectionery corpus) obtained at the Institute of Food Technology and Analysis and the Institute of Fermentation Technology and Microbiology, Lodz University of Technology. A detailed characterization of the antioxidant properties of the enriched products was carried out.