ABSTRACT

Current dietary trends and consumer awareness focus on the relationship between the consumed food, a natural diet and its impact on health and disease prevention. Therefore, growing health risks related to inadequate nutrition increase the pressure to develop innovative and functional products based on plant raw materials with proven health-promoting effects. In this context, sea buckthorn (*Hippophaë rhamnoides* L.) berries fit in the strategy of searching for natural agents that may help prevent non-communicable diseases. However, their sensory qualities and the complexity of their hydrophilic-lipid phase pose a challenge not only for consumers but also for the food industry.

The aim of the study was to determine the health-promoting profile of sea buckthorn berries and to develop a technology for the production of functional and tasteful products with targeted health-promoting properties based on sea buckthorn fruits. This objective was implemented in four research steps: (1) analysis of the biologically active fraction of sea buckthorn; (2) optimization of the malolactic fermentation of juices based on sea buckthorn fruits; (3) development of recipes and optimization of technology for obtaining functional products with sea buckthorn fruit juice; (4) analysis of physicochemical properties and health-promoting potential of microcapsules obtained from sea buckthorn fruit juice.

The results obtained in the first step demonstrated a unique composition of lipophilic and hydrophilic bioactive compounds of sea buckthorn berries that significantly modulate anti-diabetic, anti-obesity, anti-aging, anti-inflammatory, and antioxidant activities. The diversity of the anatomical parts of sea buckthorn (skin, pulp, seeds, endocarp, shoots, and leaves) was determined in terms of their content of phenolic compounds, triterpenes, and mineral nutrients. Analysis of juices, a commercially common form of processing sea buckthorn fruits, confirmed their anti-diabetic and anti-obesity properties. It also indicated the potential to increase the functionality of juices in reducing neurodegenerative changes due to their content of phytoprostanes, phytofurans, tocopherols, tocotrienols, and amino acids.

Further, the potential of sea buckthorn fruits was considered in the technological aspect related to the design of foods with targeted health-promoting properties. The dynamics of changes in the content of organic acids, sugars, phenolic compounds, and antioxidant activity during malolactic fermentation of sea buckthorn fruit juice and mixed sea buckthorn-apple juice was determined. Selected strains of *Lactobacillus plantarum* and *L. plantarum* subsp. *argentoratensis* were characterized by high metabolic activity. They promoted accumulation of flavonols and increased the antioxidant activity of the juices. Malolactic fermentation was therefore considered a promising method of biological deacidification of sea buckthorn fruit-based juices.

The designed smoothie products, containing high proportion of sea buckthorn fruit juice (25% and 50%), achieved both high health-promoting potential and consumer acceptance. Novel product formulations should be considered as dietary supplements with potential antioxidant, anti-aging, and anti-diabetic properties. Mixing sea buckthorn fruit juice with other fruits and vegetables, commonly available for processing industry in Poland, improved the taste, color, and aroma of the final products.

Studies on the optimization of microencapsulation of sea buckthorn fruit juice identified maltodextrin as a coating agent more valuable than inulin due to a higher content of phenolic compounds, greater antioxidant activity, lower non-enzymatic browning, and HMF accumulation in the microcapsules. This paper presents the

effects of polysaccharide carriers and drying method type on the stability of selected chemical compounds and antioxidant activity of sea buckthorn fruit juice after drying and storage.

The study confirmed that sea buckthorn is a valuable raw material for the production of both functional and palatable products. It corroborated a high potential of sea buckthorn berries as a food component rich in bioactive compounds with antioxidant, antidiabetic, anti-obesity, anti-inflammatory, and anti-aging properties.

Key words: sea buckthorn, anatomical parts, juices, smoothies, malolactic fermentation, microcapsules, bioactive compounds, antioxidant, anti-aging, anti-diabetic, anti-obesity, anti-inflammatory