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NATURAL DYES FROM POKEWEED BERRIES: EXTRACTION PROCEDURES AND STABILITY

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Natural dyes extracted from berries of pokeweed (*Phytolacca americana*) were used as colorants in food and textile industries because of their nontoxic and ecofriendly characteristics, as nutraceuticals with antioxidant properties and sensitizers for dye-sensitized solar cells. Chemical structure of natural dyes from pokeweed berries belong to the betalains class, namely to betacyanins that provide the red-violet color and betaxanthins with yellow-orange color. Complexity of betalains extraction consist in poor stability of natural dyes and depends on various factors (temperature, pH, and concentration of dye, water activity, light and UV radiation, metal chelators, mordant and pretreatment of raw materials). The purpose of this work was to describe the different approaches to optimize the extraction technique for obtaining the natural dyes from pokeweed berries in stable form based on previous researches. The cheapest methods of dyes obtaining is extraction using different solvent systems (water-alcoholic, weak acid solutions, buffer solutions, etc.) by liquid-solid extraction in ratio 5:1. Our studies were shown that water extracts from pokeweed berries contained 5.5 times more betalain colorants when compared to ethyl alcohol (95%) extracts. While it is necessary to take into account that colorants from pokeweed maintain the stability in limits of pH from 3.0 to 7.0. The optimal pH for maximum stability of betalains is 5-6. To enhance the betalain extraction yields, the different methods of pretreatment were proposed, such as pulsed electric fields, gamma irradiation, and low-direct current electric fields, ultrasonic or microwave assisted extractions. Their advantages consist in processing at low temperatures due to the high sensitivity of betalains to heat, which decompose at temperatures above 50ºC. However, in our studies it was determined that the concentration of natural dyes in pokeweed berries did not change during the year of storage at a temperature of -12-16ºC. Encapsulation of extracted betalains with polysaccharides (pectin, guar gum) as the wall material led to increased stability and longer shelf life of natural dyes. Based on the described approaches and our data, the developed technological procedure for obtaining and stabilizing of natural dyes from pokeweed berries will be proposed for patenting as a food colorant.

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