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EFFECT OF ULTRASOUND ON THE EXTRACTION AND CHARACTERISATION OF BIOACTIVES FROM PLANTS

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Extracts from Beta Vulgaris cv. beet greens using conventional and ultrasound treatment were obtained. Amount of betacyanins, betaxanthins, polyphenols and antocians in the extracts obtained with different extraction methods was investigated. It was found that the extraction using ultrasound result

in improving of content of bioactive compounds and antioxidant activity in plant extracts.

Были получены экстракты из свекольной ботвыBetaVulgariscv. с использованием обычной и ультразвуковой обработки. Было исследовано количество бетацианинов, бетаксантинов, полифенолов и антоцианов в экстрактах, полученных различными методами экстракции. Было установлено, что экстракция с использованием ультразвука приводит к увеличению содержания биологически активных соединений и антиоксидантной активности в растительных экстрактах.

Sugar production leads to the formation of significant quantities of by-products such as beet pulp, sludge cake, lime, molasses and beet green which can be successfully applied for extraction of valuable essential components. In turn, the extracts can be widely used in different areas of industrial production, in particular in the food industry. Methods such as cold pressing, heating reflux, soxhlet and solvent extraction have been widely used to extract bioactive components from natural products [2, 3, 5, 8]. However, disadvantages including safety hazards, high energy input, low product quality, environment risk and toxicological effects were always found during extraction [2, 3, 1]. Therefore, improving the extraction methods in bioactives production is necessary and will be an advantage in food and pharmaceutical industry. Recently, novel extraction methods such as accelerated solvent, ultrasound-assisted, microwave-assisted, supercritical fluid and enzyme-assisted extraction have been developed [4, 6, 7]. Amongst them, ultrasound assisted extraction has been confirmed as a more economic, environmentally friendly and efficient techniques due to significant acceleration the transition process active substances from raw material to the medium. It is known that the effect of extraction methods of plant cells and tissues can result in significant changes in content of bioactive compounds such as antioxidants, polyphenols. For instance, changes in betacyanin/betaxanthins ratios and concentrations of betacyanins have been reported in various plant extracts depending on the extraction method [6, 7].

In the study reported here, extracts were obtained from 0.5 g of crushed beet green using different extraction conditions. The final extract was free from any unpleasant smell and possessed time-stable colour patterns. A graphical representation of the results on the effect of extraction method and different solvent on the content of betaxanthins, betacyanins, polyphenols and antocians in the extracts is presented in Figure 1.

On the basis of the obtained data, a direct correlation between the amount of biologically active compounds and method of extraction as well as the type of extractant is depicted. The most complete recoveries were observed in samples obtained using ethyl alcohol and alkali. It should be noted that ultrasonic treatment

can increase the amount of betaxanthins, betacyanins, polyphenols and antocians up to 45% in the final extract.

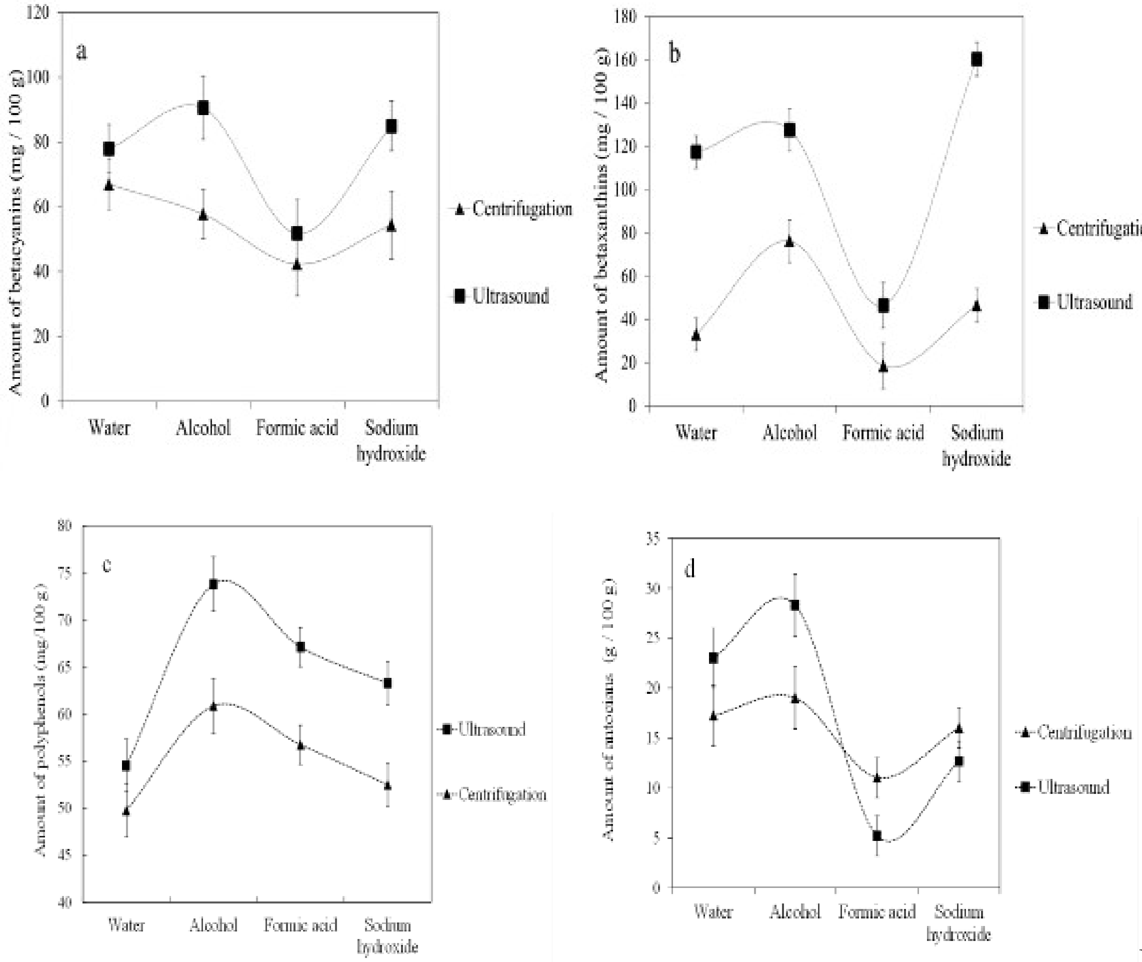

Figure 1 – Amount of **(a)** betacyanins, mg/100 g, **(b)**betaxanthins, mg/100 g, **(c)** polyphenols, mg/100 g, **(d)**antocians, g/100 g in the extracts obtained using centrifugation or ultrasound treatment depending on solvent

Analyses of betacyanins content (Figure 1a) in the extracts showed that there were substantial differences in the amount of their concentrations depending on the type of treatment (centrifugation or ultrasound) and solvent. Hence, the least amount of betacyanins (42.3±10.5 mg/100 g) was obtained with centrifugation and using a formic acid as a solvent. The maximum content of betacyanins (90.5±7.5 mg/100 g) was found in the ultrasound assisted extraction with alcohol. The maximum amount of betaxanthins (Figure 1b), polyphenols (Figure 1c) and antocians(Figure 1d) was obtained utilizing ultrasound and alcohol with revealing values of 127.6±9.8 mg/100 g, 60.9±2.9 mg/100 g and 28.3±3.1 g/100 g, respectively. These values were 1.5 times higher to those obtained with the same solvent (alcohol) and centrifugation, which sows the significance of ultrasound assisted extraction procedure.

Experimental data also reveal that the extraction performed using alcohol and ultrasonication resulted in increased antioxidant activity as compared to the centrifugation and other solvents (data not shown). Presumably, this difference in antioxidant activity can be explained by a greater degree of extraction resulting in increasing amount of antioxidants. Hence, it was confirmed that under the influence of ultrasonic vibrations there is a more rapid and active destruction of intracellular tissues of plant material, which leads to an intensification of the extraction process and increasing the content of biologically active compounds in solution.

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