ULTRASOUND-ASSISTED EXTRACTION OF POLYPHENOLS FROM CHOKEBERRY POMACE

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Introduction

A considerable amount of by-products and waste remains after agro-food production. Even though they are considered waste, fruit by-products remain rich in nutrients and bioactive compounds, such as proteins, unsaturated fatty acids, minerals, dietary fiber, and various antioxidant compounds. This allows fruit by-products to be used in designing foods with functional properties, enhancing nutritional and health-promoting values of foods, as well as improving the technological and sensory characteristics of food products. One of the targets of the UN Sustainable Development Goals is to accomplish zero-hunger by 2030 through the promotion and implementation of sustainable production and a circular economy. One way to achieve this is through the utilization of by-products that would otherwise be wasted but are considered a sustainable answer to the food waste problem. Chokeberry pomace of (*Aronia melanocarpa*) is a by-product of juice production, that is a rich, underutilized source of phenolic compounds, which are well known for their significant antioxidative and anti-inflammatory properties. Thus, it represents a good baseline for the preparation of various extract and further various functional additives as well as upcycled foods.

Generally, during juice pressing from chokeberry fruits, approximately 13% of the total polyphenols are transferred to the juice, thus these facts suggest that chokeberry pomace can be further used to prepare various extracts.

Materials and methods

Ultrasonic-assisted extraction with **ethanol:water ratio**
40:60
60:40
80:20

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Spectrophotometric analysis: total polyphenols, proanthocyanidins, antioxidant activity
HPLC analysis: individual polyphenols

Results

Table 1 Polyphenols, proanthocyanidins and antioxidant activity of ethanol/water extracts of chokeberry pomace

	etanol:water ratio		
	40:60	60:40	80:20
TP (mg/mL)	18.16±0.20^{c}	51.99±1.11^{b}	32.32±0.50^{a}
PAC (mg/mL)	1.19±0.05^{b}	2.92±0.01^{a}	1.01±0.01^{b}
DPPH (µmol/mL)	115.04±0.50	192.60±0.62^{a}	121.11±0.98
ABTS (µmol/mL)	231.21±1.26^{b}	427.11±2.31^{a}	226.33±1.76^{c}
FRAP (µmol/mL)	147.51±2.21^{c}	308.13±1.89^{a}	211.13±0.59^{b}
CUPRAC (µmol/mL)	218.95±1.98^{c}	457.32±2.93^{a}	224.66±1.54^{b}

Table 2 Polyphenols profile of ethanol/water extracts of chokeberry pomace

	etanol:water ratio		
	40:60	60:40	80:20
Cyanidin-3-galacroside (mg/L)	540.39±0.20^{b}	594.52±1.11^{a}	443.09±0.50^{c}
Cyanidin-3-arabinoside (mg/L)	219.40±0.05^{b}	258.11±0.01^{a}	114.41±0.01^{c}
Quercetin-3-rutinoside (mg/L)	3804.17±0.50^{b}	10638.62±0.62^{a}	1908.68±0.98^{c}
Quercetin-3-galactoside (mg/L)	1953.60±2.26^{b}	5089.96±4.31^{a}	1117.11±4.16^{c}
Quercetin-3-glucoside (mg/L)	850.09±2.21^{b}	1526.87±1.89^{a}	671.23±0.59^{c}
Neochlorogenic acid (mg/L)	4069.54±3.98^{c}	4423.27±4.21^{a}	4152.05±4.20^{b}
Chlorogenic acid (mg/L)	2347.86±3.02^{b}	5081.09±4.26^{a}	2393.28±2.87^{b}
Catechin (µL/L)	427.15±1.02^{b}	520.07±1.20^{a}	192.01±0.20^{c}
(-)-epicatechin (µL/L)	874.92±1.45^{a}	427.15±1.31^{c}	807.51±1.98^{b}
Procyanidin B1 (µL/L)	174.60±0.27^{b}	310.83±0.56^{a}	51.70±0.94^{c}

Conclusions

- Comparing all three solvent variations, the best results for total polyphenols, proanthocyanidins and antioxidant activity were achieved with an E:W ratio of 60:40, followed by 40:60, while the lowest values were obtained with 80:20.
- Cyanidin-3-galactoside, cyanidin-3-arabinoside, neochlorogenic acid, chlorogenic acid, quercetin-3-rutinoside, quercetin-3-galactoside, quercetin-3-glucoside, catechin, epicatechin and procyanidin B1 were identified in the extracts by HPLC.
- A different trend was observed for the concentrations of individual polyphenols.
- For all phenolics, the highest concentration was found in the extract obtained with an E:W ratio of 60:40. For cyanidin-3-galactoside, cyanidin-3-arabinoside, quercetin-3-rutinoside, catechin, epicatechin and procyanidin B1, the second-best ratio was 40:60, while for the others it was 80:20.
- The results of this research showed that the choice of extraction method and solvents plays an important part in determining the final polyphenol profile, as polyphenols differ in their structure and properties.

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