ENCAPSULATION OF CHOKEBERRY PHENOLICS ON CITRUS FIBERS

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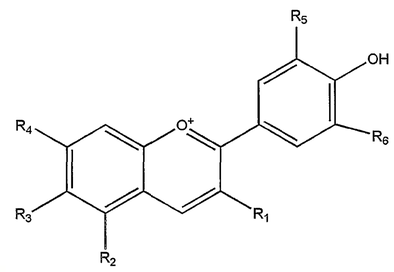
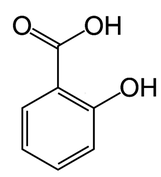
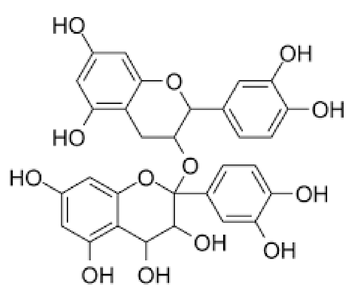
INTRODUCTION

Dietary fibers and phenolics are plant compounds, usually present in human nutrition with reported potentially positive effect on health. Phenolics can interact with dietary fibers which can affect their bioactivity.
The aim of this work was to study possibility of application of citrus fibers for encapsulation of chokeberry phenolics.







MATERIALS AND METHODS

Citrus fibers (1, 2, 3 and 4%) + Chokeberry juce (50 ml)

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Mixing (15 min., room temp.)

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Centrifugation (15 min., 4000 rpm)

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Freeze-drying

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Dry sample of CF/C complex

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Extraction with acidified MeOH

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Spectrometric determination of total phenolics, anthocyanins, proanthocyanidins and antioxidant activity (DPPH, ABTS, CUPRAC, FRAP methods)

Determination of colour parameters

FTIR-ART analysis

RESULTS

Table 1 Total phenolic content, proanthocyanidins and anthocyanins of citrus fiber/chokeberry complexes

Samples	Total phenolics (mg/g)	Proanthocyanidins (mg/g)	Anthocyanins (mg/g)
CF_1%_C	35.942±0.047[a]	18.639±0.032[a]	3.419±0.096[a]
CF_2%_C	24.812±0.085[b]	11.522±0.033[b]	2.652±0.037[b]
CF_3%_C	16.991±0.048[c]	5.548±0.012[c]	1.676±0.073[c]
CF_4%_C	12.997±0.048[d]	1.665±0.005[d]	1.697±0.066[c]

CF - citrus fiber; C – chokeberry; 1 – 4 % - amount of used citrus fiber for complexation
Within the row, means followed by superscript different letters are significantly different at $p \leq 0.05$ (ANOVA, Fisher's LSD).

Table 2 Antioxidant activity of citrus fiber/chokeberry phenolics complexes

Samples	DPPH (µmol/g)	ABTS (µmol/g)	CUPRAC (µmol/g)	FRAP (µmol/g)
CF_1%_C	1.992±0.005[a]	3.560±0.010[a]	20.118±0,048[a]	0.232±0.002[a]
CF_2%_C	1.672±0.018[b]	2.022±0.063[b]	15.927±0,110[b]	0.191±0.003[b]
CF_3%_C	1.137±0.007[c]	1.178±0.005[c]	10.373±0,058[c]	0.122±0.002[c]
CF_4%_C	0.909±0.014[d]	0.923±0.004[d]	8.508±0,055[d]	0.092±0.001[d]

Table 3 Colour parameters of citrus fiber/chokeberry phenolics complexes

Samples	L*	a*	b*	ΔE	ΔE[1]	°h	C*
CF_100%	82.69±0.15[a]	1.20±007[a]	19.21±0.03[a]			86.42±0.19[a]	19.25±0.03[a]
CF_1%_C	40.03±0.02[b]	21.26±0.04[b]	3.90±0.02[b]	49.55		10.41±0.03[b]	21.61±0.04[b]
CF_2%_C	43.60±0.07[c]	23.14±0.01[c]	4.21±0.03[c]	47.26	4.04	10.31±0.07[b]	23.52±0.01[c]
CF_3%_C	45.92±0.05[d]	23.69±0.03[d]	3.79±0.04[d]	45.76	6.37	9.09±0.02[c]	23.97±0.03[d]
CF_4%_C	46.54±0.02[e]	23.64±0.02[d]	3.71±0.04[d]	45.27	6.94	8.92±0.01[d]	23.93±0.03[d]

L*- lightness of sample, L* = 0 dark, L* = 100 light; a* > 0 red, a* < 0 green; b* > 0 yellow, b* < 0 blue; °h - hue; C* - saturation;
ΔE – colour change of the complex relative to citrus fibers; ΔE[1] – colour change in complex colour relative to complex CV_1%_A

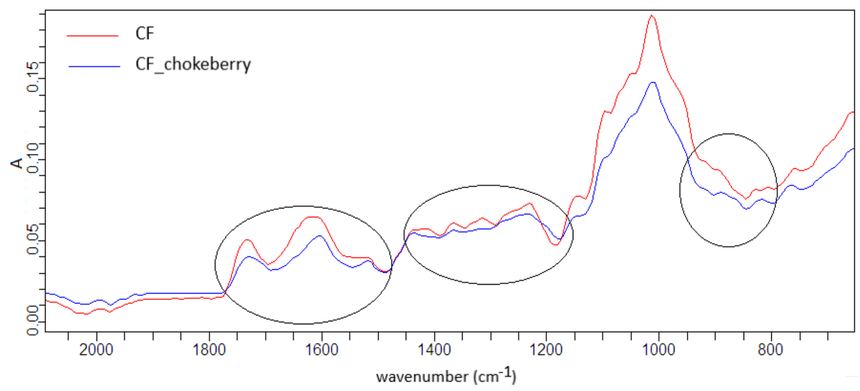

Figure 1 IR spectra of citrus fibers and citrus fibers/chokeberry complexes

Table 4 Correlation coefficient (R^2) showing the dependence of phenolic components content and antioxidant activity

	DPPH	ABTS	FRAP	CUPRAC
Total phenolics	0.9607	0.9873	0.9611	0.9806
Proanthocyanidins	0.9803	0.9634	0.9809	0.9886
Anthocyanins	0.9488	0.9599	0.9475	0.9738

DISCUSSION

With the increase of used fibers for complexation decrease of adsorption of phenolics, anthocyanins and proanthocyanidins occurred. Results of antioxidant activity followed the same tendency obtained for phenolic compounds. Also, amount of used fibers had an effect on colour parameters (L*, a*, b*, °h and C*) of obtained complexes. The highest colour change was found for the complex CF_1%_C, while in the complexes with 3% and 4% of citrus fibers there was no significant difference. FTIR spectra were used to evaluate differences in structure of complexes in comparison to pure citrus fibers. Differences found in three regions (changes in C=O, C-C, C-H, PO_2^-bonds) confirmed the binding of chokeberry phenolics to citrus fibers.

CONCLUSION

These results suggest an efficient plant-based approach to produce value-added citrus fiber/phenolics dry complexes with possible utility as food additive in order to enrich products with phenolic compounds.

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