EFFICIENCY OF BROWN ALGAE (*Fucus virsoides*) POLYSACCHARIDES IN RETENTION OF LIPOPHILIC BIOACTIVES DURING SEA BUCKTHORN (*Hippophaë rhamnoides* L.) OIL SPRAY DRYING

S. Pedisić[a*], P. Čulina[a], A. Dobrinčić[a], B. Levaj[a], V. Dragović-Uzelac[a]

[a]Faculty of Food Technology & Biotechnology, University of Zagreb, Pierottijeva 6, 10 000 Zagreb, Croatia

E-mail: sandra.pedisic@pbf.unizg.hr

INTRODUCTION

Plant species such as sea buckthorn (*Hippophaë rhamnoides* L.), (SB) and brown algae are rich in numerous lipophilic and hydrophilic bioactive molecules (BAM) but their potential as functional food ingredients is still underutilised. The most valuable part of SB is berry oil due to its high content of carotenoids, tocopherols, fatty acids, sterols, omega-3, -6 and -7 fatty acids while brown algae are valuable source of polyphenols, pigments, lipids, proteins and polysaccharides which possess various biological activities such as antioxidant and anti-inflammatory properties (1,2). Polysaccharides from brown algae are already used in the food industry as gelling, thickening and emulsifying agents. The high content of structurally different BAM in SB oil and brown algae makes them an excellent choice for the development of functional foods. However, the carotenoids and tocopherols present in SB oil are potent antioxidants but highly unstable and susceptible during processing and storage. Encapsulation is an effective approach to prevent their degradation and control their release in food products. The most common method for effective encapsulation of BAM is spray drying (SD), but the quality of the final product considerably depends on the selection of the proper carrier (3).

AIM

- ✓ to determine carotenoid and tocopherol content as well as antioxidant capacity (AC) in SB oil powders produced by SD using different carriers [β-cyclodextrin (CD) and gum arabic (GA)] and oil to carrier ratio (1:2; 1:4) with the addition of polysaccharides (0, 15 and 30%) extracted from brown algae (*Fucus virsoides*) at a drying temperature of 150 °C.

MATERIALS & METHODS

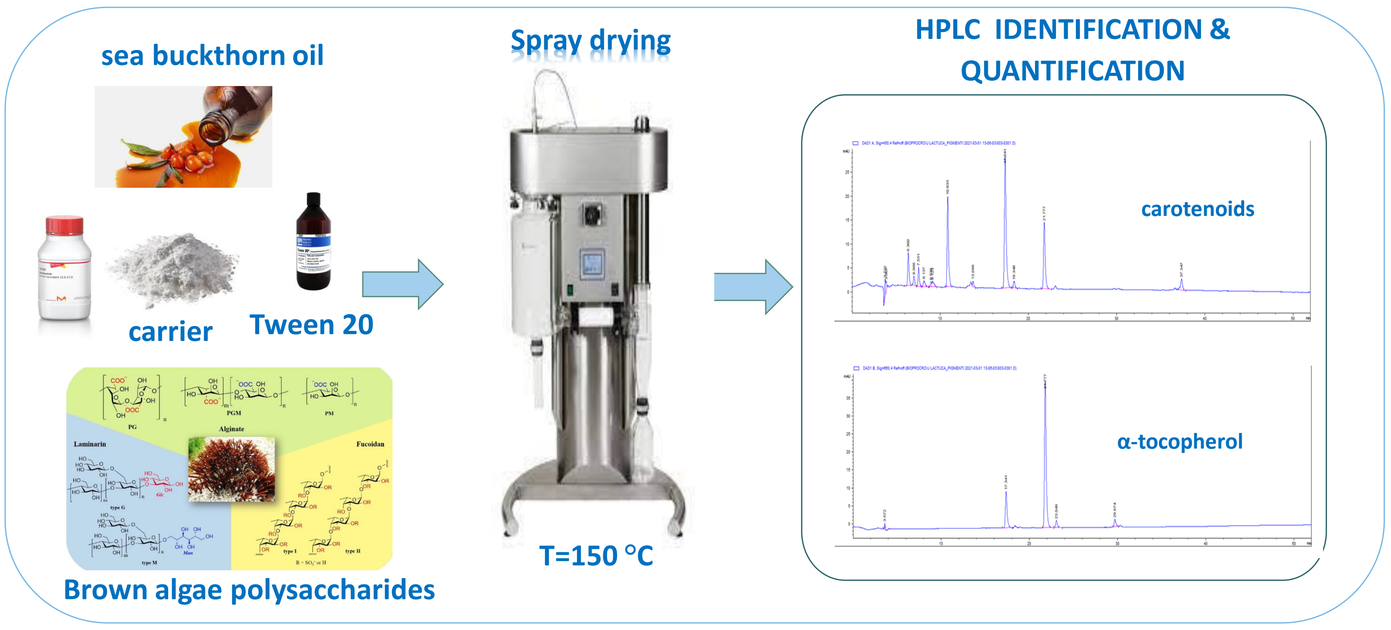

Table 1. Content of lipohilic BAM and AC in spray dried SB oil

Carrier	Oil to carrier ratio	Addition of polysaccharides (%)	α-tocopherols (mg/100 g oil)	Total carotenoids (mg/100 g oil)	ORAC (umol TE/100 g oil)
GA	1:2	0	41.17±1.41	14.09±0.22	239.87±0.42
GA	1:4	0	44.50±1.06	7.41±0.35	299.06±0.52
GA	1:2	15	43.15±1.14	15.74±0.41	246.15±1.05
GA	1:4	15	46.85±0.38	9.50±0.52	301.94±0.74
GA	1:2	30	48.91±0.48	22.26±075	252.01±1.41
GA	1:4	30	51.10±0.45	12.12±0.54	302.93±0.52
CD	1:2	0	51.02±1.25	16.39±0.56	217.96±0.41
CD	1:4	0	67.05±1.45	24.52±0.41	323.12±0.21
CD	1:2	15	51.86±0.56	20.96±0.52	232.05±0.74
CD	1:4	15	68.62±0.88	26.12±0.18	330.75±0.19
CD	1:2	30	55.57±0.45	28.87±0.41	245.84±0.42
CD	1:4	30	70.97±0.22	30.96±0.35	335.65±0.61

Table 2. Influence of SD parameters on lipophilic BAM content and AC of spray dried SB oil

Source of variation		α -tokoferol (mg/100 g oil)	Total carotenoids (mg/100 g oil)	ORAC (umol TE/100 g oil)
		p ≤ .05*	p ≤ .05*	p ≤ .05*
Carrier	GA	45.45±2.25a	13.62±1.54a	270.95±17.06a
	CD	59.17±2.25b	23.05±1.54b	278.18±17.06a
Oil to carrier ratio	1:2	51.63±2.09a	17.89±1.43a	272.15±15.80a
	1:4	53.51±2.09a	19.14±1.43a	277.08±15.80a
Addition of polysaccharides (%)	0	49.31±2.86a	14.76±1.95a	262.59±19.35a
	15	52.34±2.86a	17.83±1.95ab	276.70±19.35a
	30	55.76±2.86a	22.56±1.95b	283.36±19.35a

RESULTS AND DISCUSSION

The results showed that tocopherol content in produced spray dried SB oil powders ranged from 41.17 to 70.97 mg/100 g oil, total carotenoids from 7.41 to 30.96 mg/100 g oil while antioxidant capacity was in range from 217.96 to 335,65 umol TE/100 g oil. Better retention od carotenoids and tochopherols and higher antioxidant capacity was when β-cyclodextrin was used as carrier during SD. The retention of tocopherols and antioxidant capacity increased when the ratio oil to carrier and the addition of polysaccharide were higher. Higher retention of carotenoids was obtained in spray dried powders when the ratio oil to carrier was 1:4 and β-cyclodextrin as carrier and oil to carrier ratio 1:2 and gum arabic as carrier, respectively. The addition of polysaccharides significantly affected the retention of carotenoids. The highest retention of carotenoids and tocopherols and antioxidant capacity was obtained in powders produced using β-cyclodextrin carrier and oil to carrier ratio 1:4 with addition of 30% of polysaccharides.

CONCLUSIONS

- ✓ The addition of polysaccharides extracted from brown algae significantly affected retention of carotenoids in spray dried SB oil powders.
- ✓ SB oil powders produced using β-cyclodextrin carrier and oil to carrier ratio 1:4 with addition of 30% of polysaccharides showed the highest retention of carotenoids, tocopherols and antioxidant capacity.
- ✓ Encapsulation by spray drying could be an effective approach for formulating bioactive molecules from sea buckthorn and algae suitable for the development of functional foods.

REFERENCES

1. Shah R. K., Idate A., l Ugale V., Poorva. (2021) Comprehensive review on sea buckthorn: Biological activity and its potential uses. The Pharma Innovation Journal; 10(5): 942-953

2. Quitério E., Soares C., Ferraz R., Delerue-Matos C., Grosso C. (2021) Marine Health-Promoting Compounds: Recent Trends for Their Characterization and Human Applications; Foods, 10, 3100. Eun et al. 2019

3. Eun J.B., Maruf A., Rani Das P., Nam S-H. (2019) A review of encapsulation of carotenoids using spray drying and freeze drying; Critical Reviews in Food Science and Nutrition, 1-27.

4. Castro-Puyana, M., Pérez-Sánchez, A., Valdés, A., Ibrahim, O.H.M., Suarez-Álvarez, S., Ferragut, J.A., Micol, V., Cifuentes, A., Ibáñez, E., and García-Cañas, V. (2017) Pressurized liquid extraction of Neochloris oleoabundans for the recovery of bioactive carotenoids with anti-proliferative activity against human colon cancer cells; Food Research International 99, 1048-1055.

This research is conducted within the project „Bioactive molecules of medicinal plants as natural antioxidants, microbicides and preservatives" supported by the European Union, from the European Regional Development Fund - Program: Investment in Science and innovations; Competitiveness and Cohesion Operational Program 2014-2020.