

Alga *Fucus* sp. extracts to produce edible films

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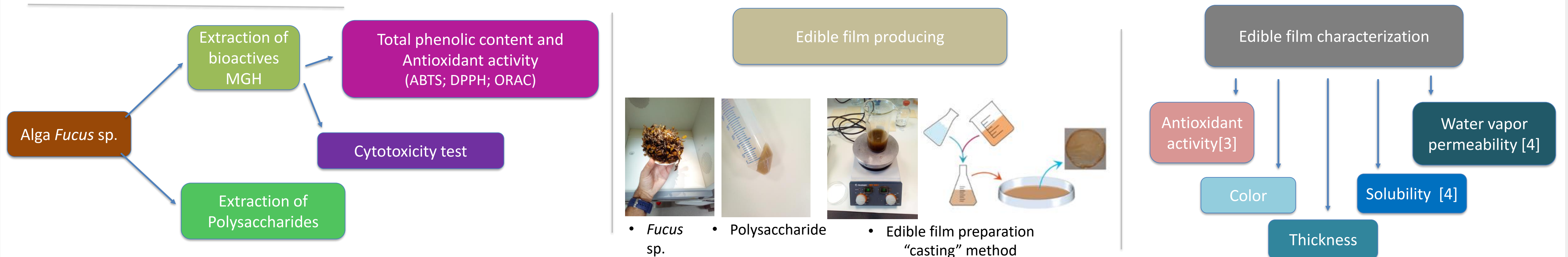
Introduction

Macroalgae are a good source of nutrients, such as carbohydrates (dietary fiber and polysaccharides), proteins, lipids and minerals [1,2]. *Fucus* sp. is composed of valuable bioactive compounds, such as fucoxanthin, vitamins, water-soluble (vitamin C and of complex B) and fat-soluble (vitamins A, D, E and K), phenolic compounds, lipids (MUFA and PUFA), and polysaccharides (fucoidans and alginic acid) [1]. This brown alga has been associated with health benefits, such as antioxidant, antimicrobial, anti-tumoral and anti-cancer properties [2]. Its application in the production of edible films presents high potential in food packaging, extending the shelf life of food products.

Objectives

- To evaluate the antioxidant activity and cytotoxicity bioactive extracts from *Fucus* sp.
- To produce an edible film based on PS enriched with the bioactive extracts.
- To test the antioxidant activity of the edible film.
- To test physico-chemical properties of the edible film, such as the color, thickness, solubility and water vapor permeability.

Material and Methods



Results

- Extracts obtained from hydrodiffusion and gravity microwave

Table 1. Total phenolic content (TPC) and antioxidant activity (AA) of the extracts

Extraction conditions	TPC (mg GAE/100 mL extract)	TPC (mg GAE/100 mg alga DW)	ABTS	DPPH	ORAC
			(μmol TE/100 mg extract DW)		
300 W, 20 min	8.6 ± 1.5 ^a	1.25 ± 1.1 ^a	3.53 ± 0.477 ^a	0.900 ± 0.104 ^a	4.385 ± 0.508 ^a
300 W, 30 min	4.3 ± 0.9 ^b	1.21 ± 0.4 ^a	1.99 ± 0.297 ^b	0.485 ± 0.090 ^b	1.805 ± 0.606 ^b
500 W, 20 min	4.5 ± 0.4 ^b	1.36 ± 0.2 ^a	1.79 ± 0.134 ^b	0.468 ± 0.014 ^b	2.149 ± 0.244 ^b

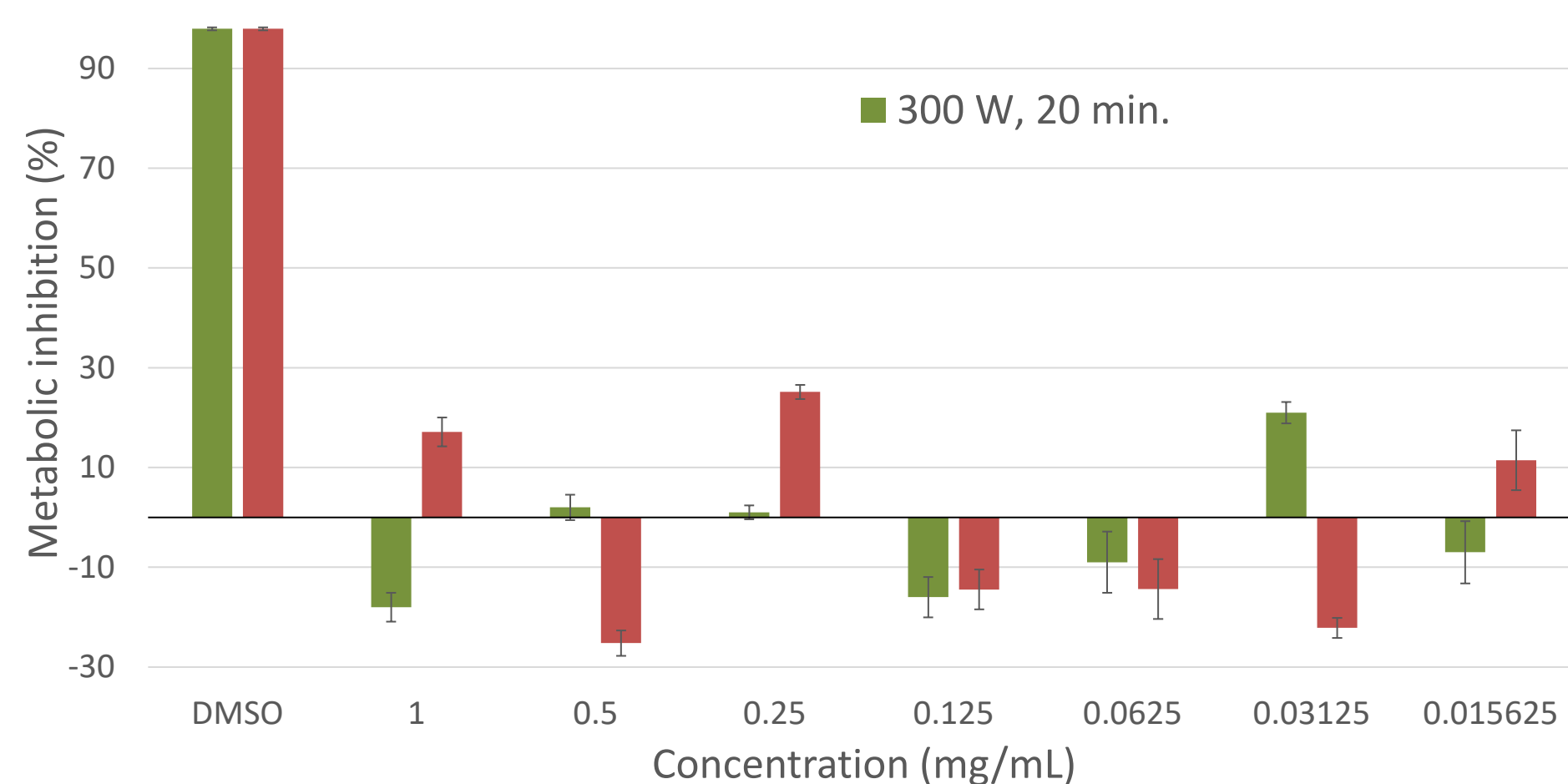


Figure 1. Percentage of metabolism inhibition of the extracts for cell line HaCat.

- Edible film for packaging



Figure 2. A - Alginate (3%) edible film; B - Alginate (2%) + *Fucus* sp. PS (0.5%) + bioactives extract (0.25%) edible film.

Table 2. Antioxidant activity of the edible film.

Film	ABTS	DPPH
	(μM trolox per mg film)	
Alginate (2%) + <i>Fucus</i> PS (0,5%) + bioactive extract (0.25%)	221.000 ± 10.389	186.889 ± 36.062

The thickness of the alginate (2%) + *Fucus* sp. PS (0.5%) + bioactive extract (0.25%) edible film was 0.127 ± 0.004 mm.

Table 3. Values of the color parameters of the edible film.

Color parameters	Alginate (2%) + <i>Fucus</i> PS (0.5%) + bioactive extract (0.25%) film
L*	42.835 ± 6.71
a*	4.07 ± 1.14
b*	10.94 ± 2.74
Hue (°)	69.6
Chrome	11.67

Table 4. Solubility of the alginate (2%) + *Fucus* PS (0.5%) + bioactives extract (0.25%) edible film

Film	H ₂ O	Acetic acid 3%	EtOH 10%	EtOH 20%	EtOH 50%
Alginate (2%) + <i>Fucus</i> sp. (0.5%) + bioactive extract (0.25%)	100	20.71 ± 6.82	100	100	36.12 ± 1.01

The water vapor permeability (WVP) for Alginate (2%) + *Fucus* sp (0,5%) + bioactive extract (0.25%) film was 11.15 ± 1.55 g.mm/m².day⁻¹.kPa⁻¹.

Conclusions

Extraction at 300 W during 20 minutes is recommended for highest TPC and AA of the liquid extract. This extract showed no cytotoxicity for cells line HaCat.

The edible film based on the PS extracted from *Fucus* sp. enriched with bioactives extracted also from this alga shows antioxidant activity, presents a high water vapor permeability, and 100% solubility in water, which simulates hydrophilic foods, and lower solubility in hydroalcoholic solutions, which simulate hydrophobic foods. It has a brown color, characterized by relatively low luminosity and saturation values.

This edible film has potential to be used in food packaging, whereas presenting high biodegradability.

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