

Novel Sweet Food Products with “Sea Lettuce” (*Ulva* spp.): A science-based food product development

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Introduction

Marine macroalgae are known to have a high nutritional value (1), however studies in the context of “phycogastronomy” (the art of cooking with algae, taking advantage of its nutritional potential and enhancing or improving its organoleptic properties) are scarce. The ALGA4FOOD project aims to: i) research new seaweed conservation processes (e.g. lyophilization, high pressure processing, modified atmosphere packaging, etc.) which optimize functional and organoleptic characteristics; ii) develop new strategies and products able to change dietary daily habits and to introduce seaweeds in the Portuguese diet (2). The current work describes the science-based development process of novel sweet food products using the macroalgae “Sea Lettuce” (*Ulva* spp.) – See Fig. 1.



Figure 1. Dried “Sea Lettuce”

Flavour Profile Analysis

Instrumental and sensory analyses of the algae were carried out to build a flavour profile. Results indicated that dried *Ulva* spp. has distinctive green tea notes.

GC-MS: Results of studies about volatile components in “Sea Lettuce” shown that it shares many volatile organic compounds (VOCs) with green tea: 12 of the 14 VOCs identified in the dried sample and 17 of the 25 VOCs identified in the fresh seaweed – see Table 1 and Fig. 2. In general, the aroma of green tea is related to the abundance of its aldehydes, ketones, and alcohols. The key compounds for the characterization of the green tea seem to be (E,E)-2,4-Heptadienal, Nonanal and β -Ionone. The last two chemical compounds are possibly, along with Dimethyl sulfide (DMS), primarily responsible for the aroma of the dried “Sea Lettuce”.

	Green tea and dried <i>Ulva</i> spp.	Green tea and fresh <i>Ulva</i> spp.
Volatile Organic Compounds	Dimethyl sulfide; Hexanal; Heptanal; Benzaldehyde; Octanal; (E,E)-2,4-Heptadienal; 2,2,6-Trimethyl-cyclohexanone; Nonanal; Decanal; β -Cyclocitral; β -Ionone; Pentadecane	Dimethyl sulfide; Hexanal; (E)-2-Hexenal [leaf aldehyde]; (Z)-4-Heptenal; Heptanal; 1-Octen-3-ol [matsutake alcohol]; (E,E)-2,4-Heptadienal; 2,2,6-Trimethyl-cyclohexanone; (E,E)-3,5-Octadien-2-one; Nonanal; (E,Z)-2,6-Nonadienal [cucumber aldehyde]; (E)-2-Nonenal; Decanal; β -Cyclocitral; 2,4-Decadienal; α -Ionone; β -Ionone

Table 1. Common VOCs found both in green tea and in *Ulva* spp. (fresh and dried)

Sensory Analysis: A focus group with trained assessors, carried out in the context of a previous work (3), associated the flavour of dried “Sea Lettuce” with the aroma of green tea.

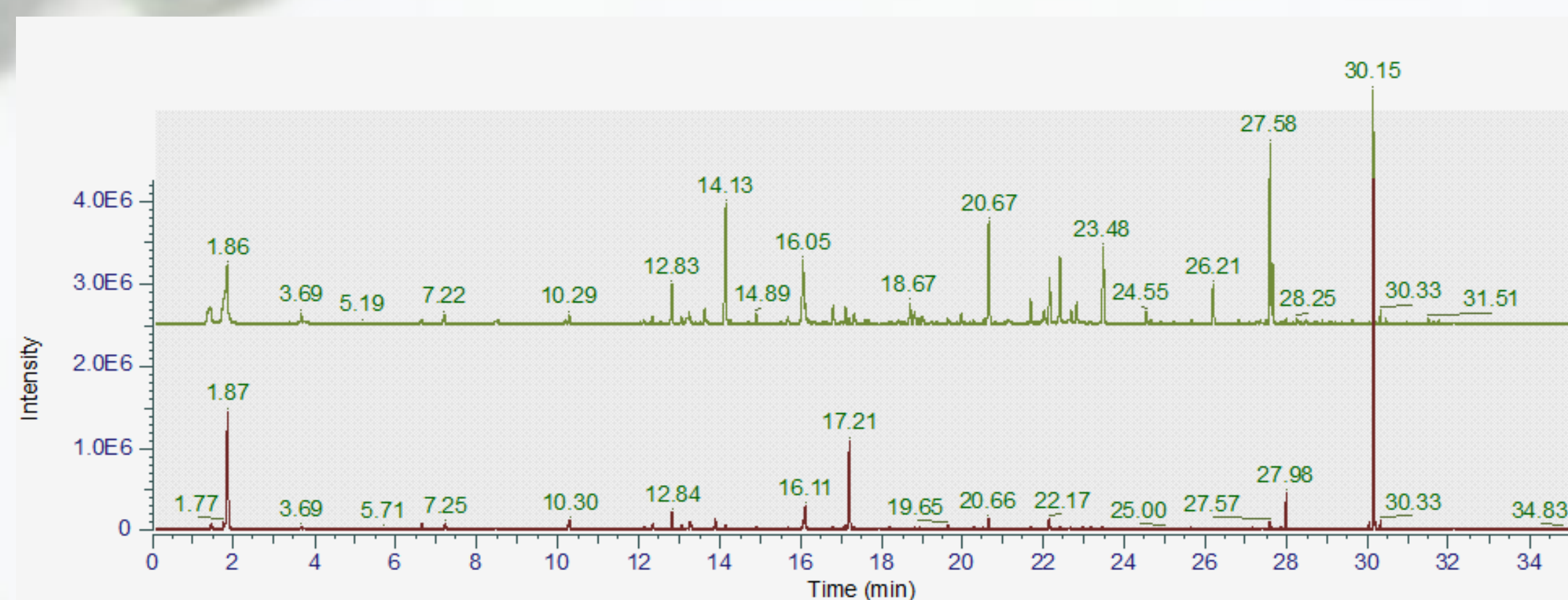


Figure 2. Above: fresh “Sea Lettuce” chromatogram | Bellow: dried “Sea Lettuce” chromatogram

Novel Product Development

In recent years, *matcha* (powdered green tea) has been introduced in a range of sweet product. It imparts an attractive green colour, and a characteristic flavour which are associated with exotic and gourmet food. Based on the analytical results, an ice-cream and white chocolate bonbons were formulated, intending to achieve products with characteristics similar to the referred matcha based ones – see Fig. 3.

Sensory Analysis – “Sea lettuce” Ice-cream: A focus group was performed to describe and evaluate the hedonic response to the appearance, texture and flavour profile of the “Sea Lettuce” ice-cream (2% of *Ulva* spp. powder). Assessors assigned a positive hedonic response to appearance, texture and flavour. Most participants associated the sample’s flavour to seaweed and a smaller group to green tea. One of the negatives points highlighted was the mild aroma.

“Sea Lettuce” Bonbons: Considering the mild aroma critiques, white chocolate bonbons were made with different percentages of powdered “Sea Lettuce” (2%, 3% e 4%). Although only informal tastings of the bonbons were yet made, the results are promising and sensory tests by a trained panel are planned.

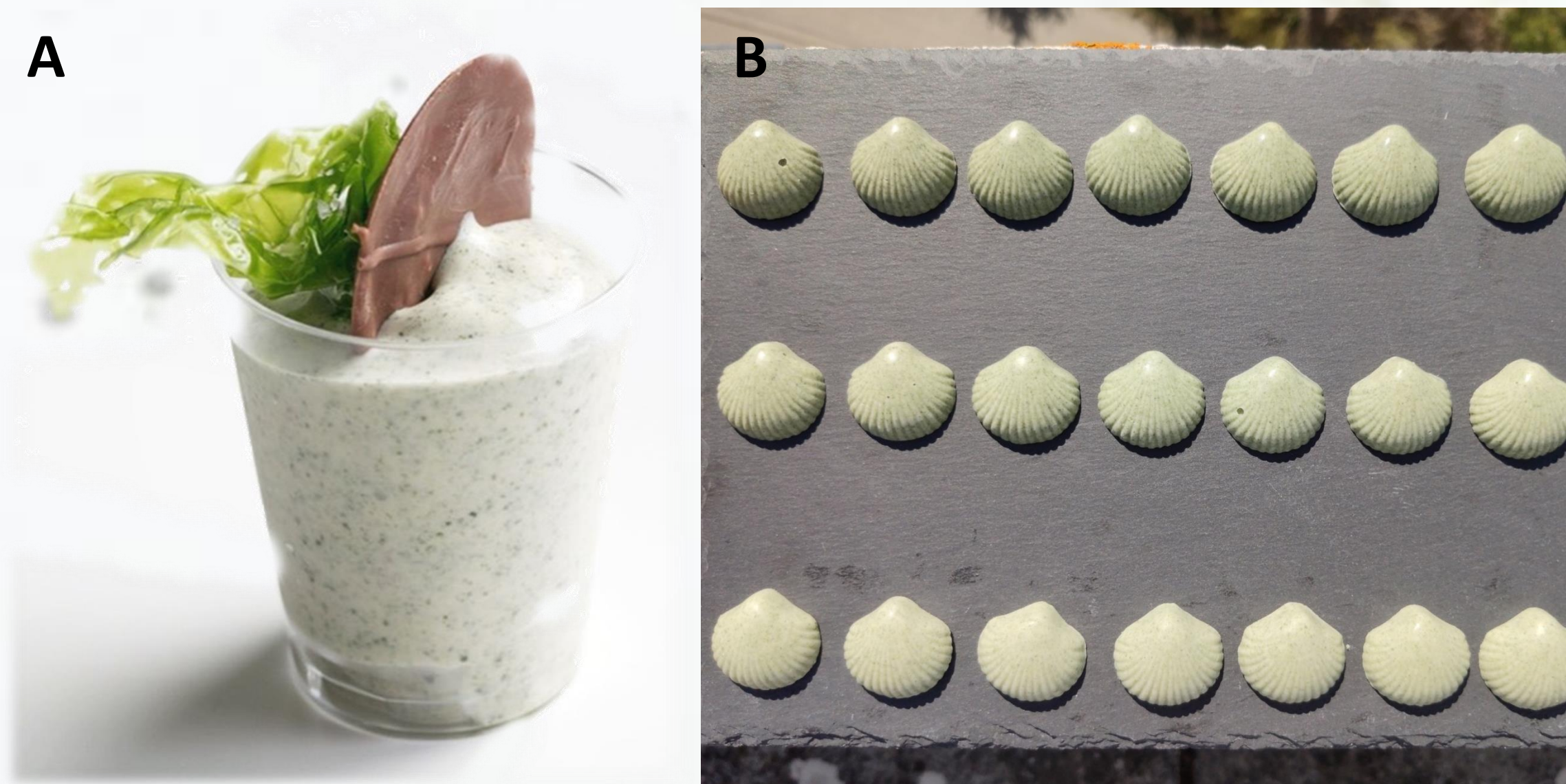


Figure 3. “Sea Lettuce” Bonbons (from top to bottom: 4%, 3% and 2% of *Ulva* spp.)

Conclusions

Results show that some algae, if properly processed and worked, have the potential to be applied in sweet formulations.

Acknowledgements

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