

Microalgae as flavouring agents in plant-based food

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In a search for more sustainable food systems, microalgae are believed to be one of the most promising sustainable food sources (no arable land requirement, capture of CO₂,...) while having an interesting nutrition profile such as high protein content, omega-3 fatty acids and vitamins (1). Furthermore, the growing trend in the development of new plant-based foods by industry goes hand in hand with the increasing numbers of vegan, vegetarian and flexitarian consumers which opens opportunities for microalgae in plant-based diets (2). Numerous plant-based meat and dairy alternatives have entered the food market, while the development of plant-based seafood products is still in its infancy (3). Microalgae could have the potential to be used as plant-based seafood flavouring ingredients because of their high protein content, which could elicit umami taste (4), and the presence of volatiles important for seafood aroma (e.g. sulphur compounds, fatty acid-derived compounds) (5,6). However, one of the main barriers for introducing new plant-based food products to become mainstream is the acceptance of the flavour by consumers.

In the framework of the Interreg project ValGOrize, we tackle this barrier by investigating the flavour properties of different microalgae species and study the effect of processing and cultivation conditions on it. An expert panel was trained to quantify specific flavour characteristics of microalgae (e.g. odour, taste). Furthermore, chemical taste and aroma compounds were analysed and correlated with the sensory profiles. Based on the sensory and chemical analysis, microalgae were added with matching food products. Eventually, the appreciation of these food products was compared with the original product by a consumer panel (approximately 45 people) to evaluate how the addition of microalgae influences the flavour.

Based on the sensory and chemical data, microalgae *Rhodomonas salina*, *Tetraselmis chui* and *Phaeodactylum tricornutum* were characterized with highest seafood aroma (crab and fishy) and umami taste, while possessing less off-flavours such as grassy and earthy aromas. Therefore, these microalgae were chosen to be incorporated into self-made veganaises (based on sunflower oil, soy milk, vinegar and mustard) and commercial vegetable broths to evaluate the addition of their seafood flavour. Furthermore, microalgae *Dunaliella salina* was characterized with a floral flavour by the expert panel. Self-made cookies were developed with *D. salina* and will be tested on appreciation (in progress).

Interestingly, the addition of microalgae in veganaises as well as in vegetable broths significantly increased the seafood flavour without being too intense. These results will be further used in the development of plant-based seafood alternatives. Within this proof of concept we illustrate the way to follow for the development of algae-based food products and for a more diverse microalgae food in future.

References

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Acknowledgement

We thank the ValgOrize project and the Interreg 2 seas programme 2014-2020 for supporting and subsidizing this work.

Keywords: Microalgae; Flavour; Taste; Aroma; Seafood; Sensory evaluation; Plant-based foods