



GreenCoLab

Joining the pieces  
in algal biotechnology.

# Microalgae: general trends and global markets

Hugo Pereira

[www.greencolab.com](http://www.greencolab.com)





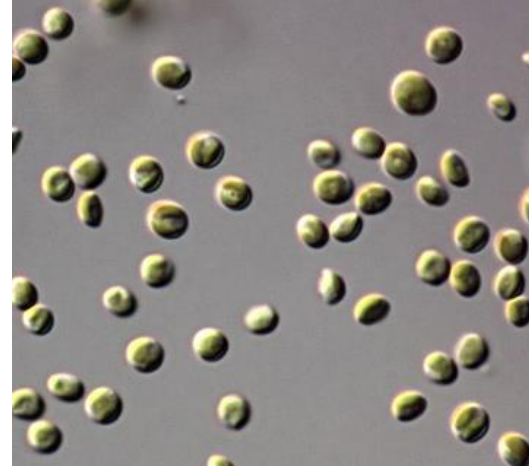
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# Why microalgae?



- ✓ High photosynthetic performance





# Why microalgae?



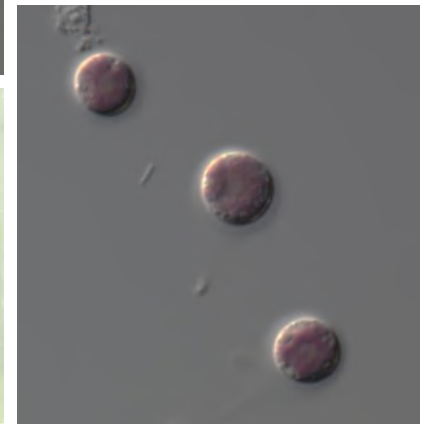
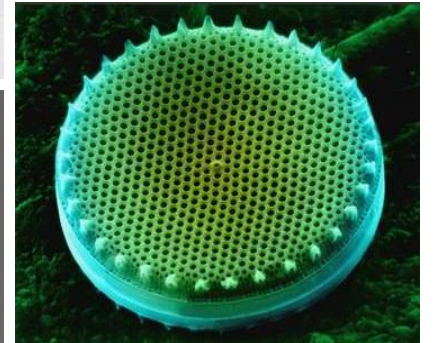
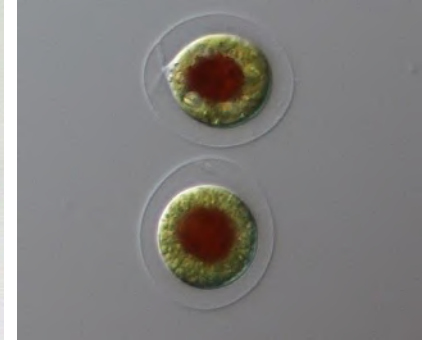
- ✓ High photosynthetic performance
- ✓ Convert inorganic carbon ( $\text{CO}_2$ ) and nutrients into organic matter (microalgal biomass)





# Why microalgae?

- ✓ High photosynthetic performance
- ✓ Convert inorganic carbon ( $\text{CO}_2$ ) and nutrients into organic matter (microalgal biomass)
- ✓ **Wide biodiversity >30 000 species identified**

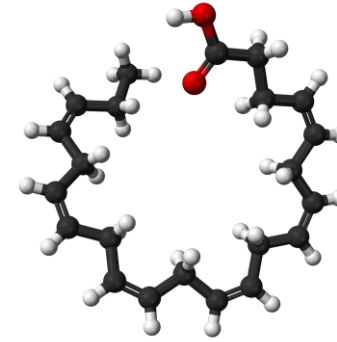




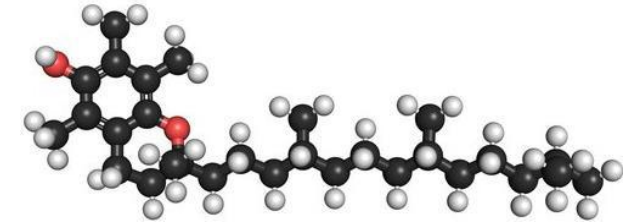
## Why microalgae?

- ✓ High photosynthetic performance
- ✓ Convert inorganic carbon ( $\text{CO}_2$ ) and nutrients into organic matter (microalgal biomass)
- ✓ Wide biodiversity >30 000 species identified
- ✓ Rich nutritional composition and extensive variety of chemically active metabolites

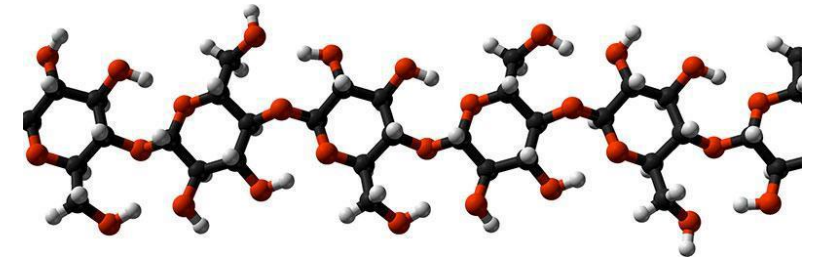
*Biological activities: antioxidant, antibiotic, antifungal, antiviral, anti-inflammatory, neuroprotective, antitumoral, antidiabetic...*



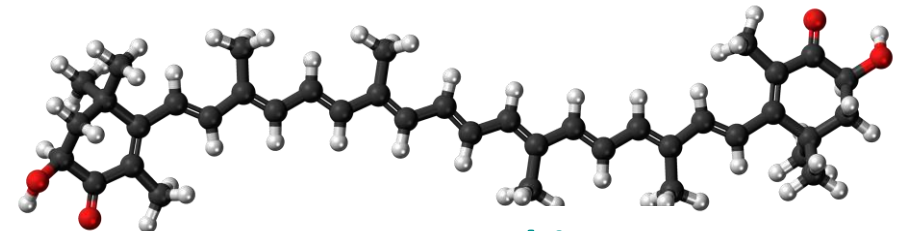
*DHA*



*Alpha-tocopherol (Vit. E)*



*Beta-glucans*



*Astaxanthin*



## Why microalgae?



- ✓ High photosynthetic performance
- ✓ Convert inorganic carbon ( $\text{CO}_2$ ) and nutrients into organic matter (microalgal biomass)
- ✓ Wide biodiversity >30 000 species identified
- ✓ Rich nutritional composition and extensive variety of chemically active metabolites
- ✓ **Feedstock of the future with tremendous potential for biotechnological applications**





# Applications and markets

- ✓ Human nutrition
- ✓ Animal nutrition
- ✓ Agriculture
- ✓ High value (nutra-, pharma-, cosmaceuticals)
- ✓ Environmental (CO<sub>2</sub> mitigation and wastewater)
- ✓ Bioplastics
- ✓ Biofuels
- ✓ Many others





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*Current markets*





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- ✓ Many others

*Current markets*



*Improved sustainability*





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# Agriculture

*Microalgae-based products for different agriculture sectors are already marketed*

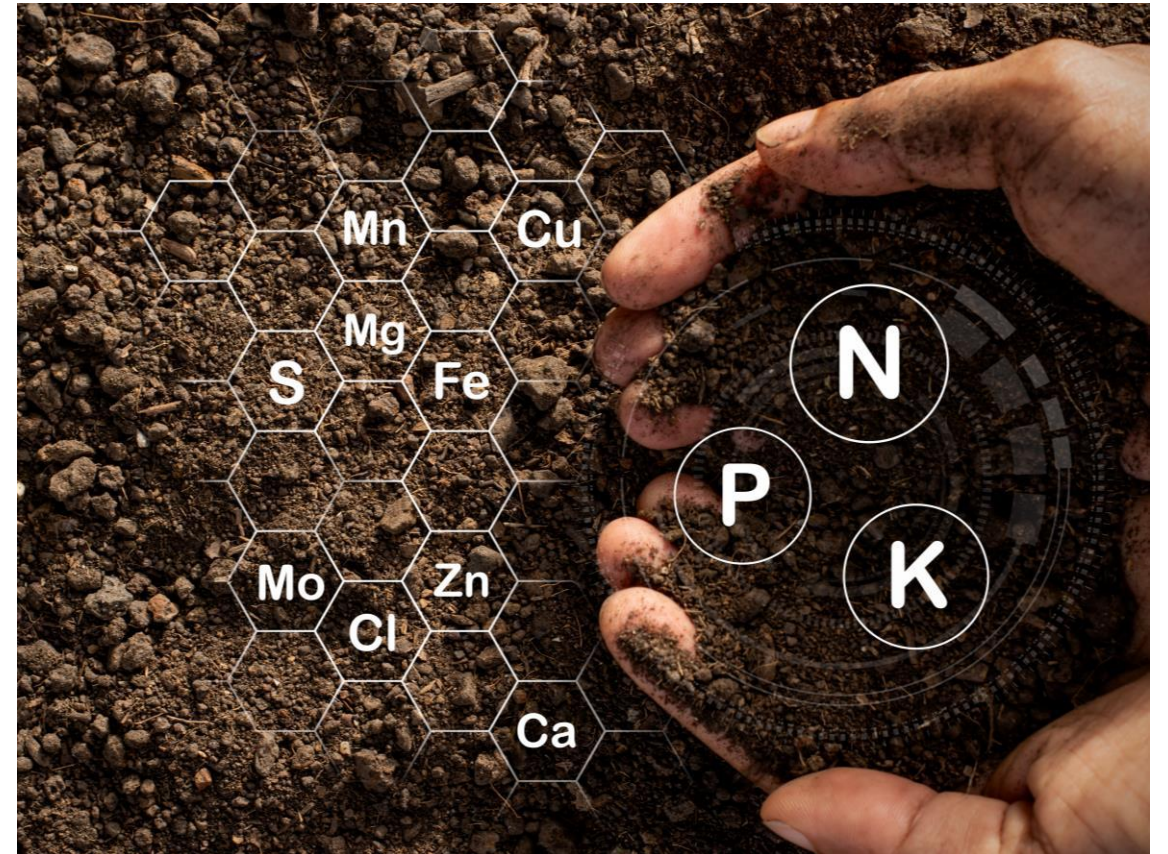




# Agriculture

***Microalgae-based products for different agriculture sectors are already marketed***

- ✓ Biofertilizers





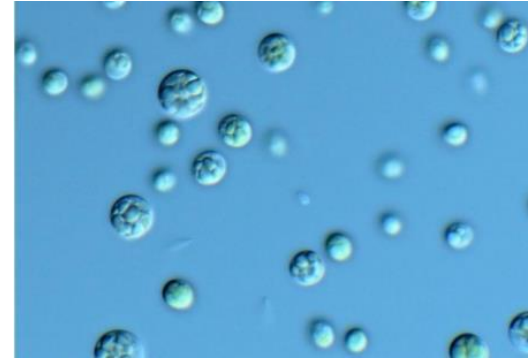
# Agriculture

***Microalgae-based products for different agriculture sectors are already marketed***

✓ Biofertilizers

✓ Biostimulants

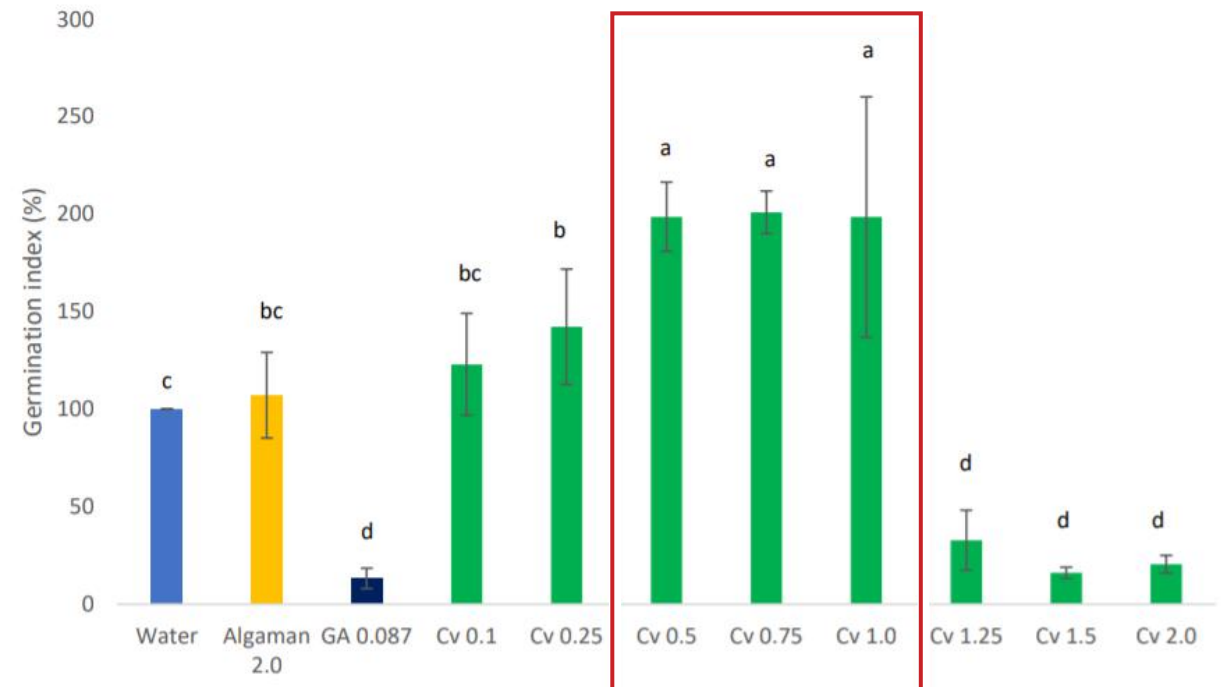
***Phytohormones: Auxins, Gibberellins, Cytokinins.... Improve root growth, cell division and frutification***



*Chlorella vulgaris*



*Eruca sativa*





# Agriculture

***Microalgae-based products for different agriculture sectors are already marketed***

- ✓ Biofertilizers
- ✓ Biostimulants

***Phytohormones: Auxins, Gibberellins, Cytokinins.... Improve root growth, cell division and frutification***



*Lepidium sativum*

range: 1.0 – 1.25 g L<sup>-1</sup>

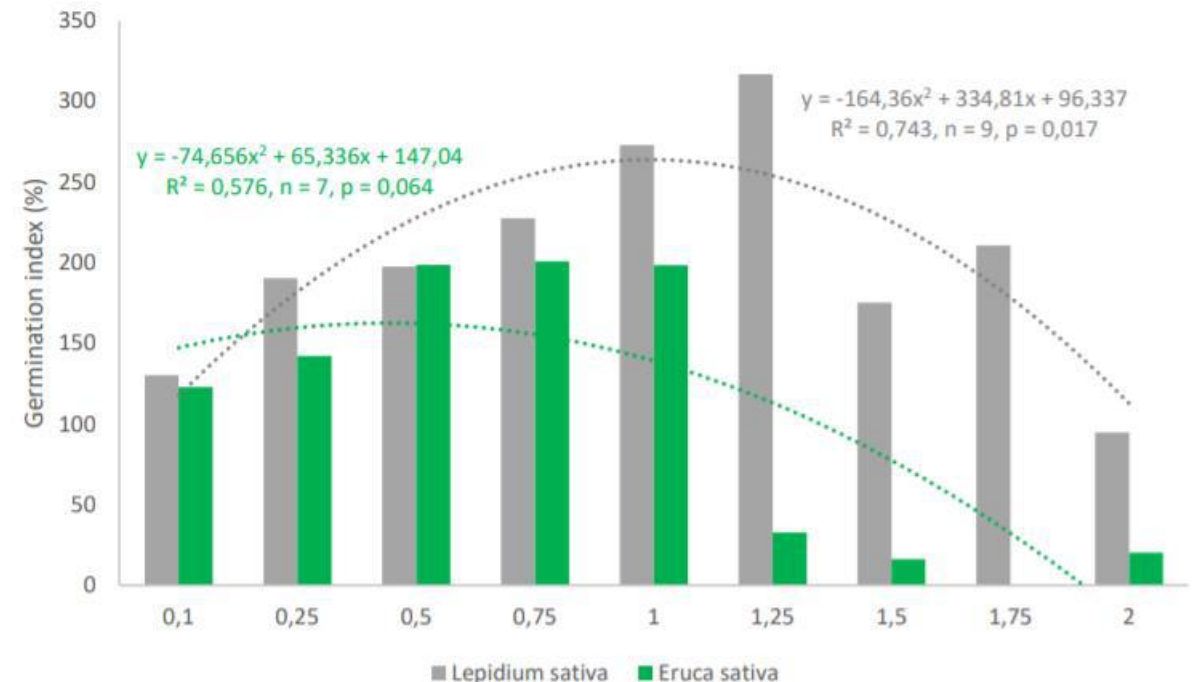
Increase 170 – 215 %



*Eruca sativa*

range: 0.5 – 1.0 g L<sup>-1</sup>

Increase 98 – 100 %





# Agriculture

***Microalgae-based products for different agriculture sectors are already marketed***

- ✓ Biofertilizers
- ✓ Biostimulants
- ✓ Biopesticides

***Microalgae present secondary metabolites with biopesticide activity***



***Aims to reduce the use of chemical and hazardous pesticides by 50% until 2030***

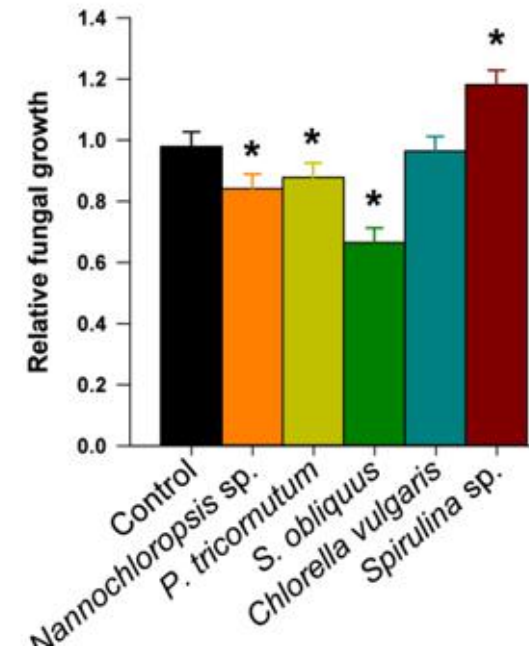


# Agriculture

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***Microalgae present secondary metabolites with biopesticide activity***



***Sclerotium  
rolfsii***



# Agriculture

***Microalgae-based products for different agriculture sectors are already marketed***

- ✓ Biofertilizers
- ✓ Biostimulants
- ✓ Biopesticides
- ✓ Soil correctors and conditioners



***Improve the physical, chemical and biological conditions of soils (pH, microbiota..)***



## Food market

*Microalgae powder is widely used for the formulation of different food products in the market*





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- ✓ Natural colorant





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- ✓ **Detox, beverages and other specialty markets**





## Food market

*Microalgae powder is widely used for the formulation of different food products in the market*

- ✓ Natural colorant
- ✓ Functional foods
- ✓ Detox, beverages and other specialty markets
- ✓ **Vegan source of proteins and  $\Omega$ -3 PUFAs**





# Food market

*Microalgae powder is widely used for the formulation of different food products in the market*

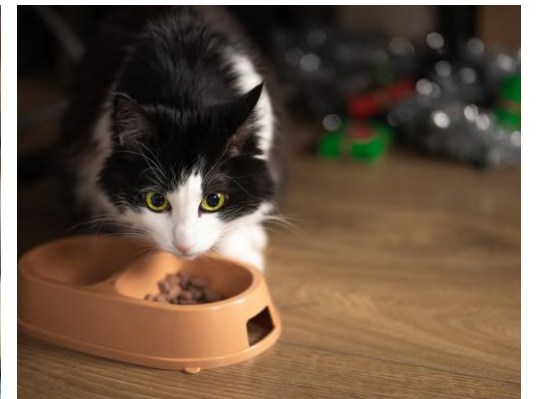
- ✓ Natural colorant
- ✓ Functional foods
- ✓ Detox, beverages and other specialty markets
- ✓ Vegan source of proteins and  $\Omega$ -3 PUFAs
- ✓ **Meat, fish and egg analogues**





## Feed market

***Microalgae are traditionally used in the aquaculture market, both new markets are emerging***





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***Microalgae are traditionally used in the aquaculture market, both new markets are emerging***

✓ **Crucial for aquaculture industry**

***Microalgae are vital for the nutritional enrichment of live preys used for fish larvae and bivalves rearing***





## Feed market

*Microalgae are traditionally used in the aquaculture market, both new markets are emerging*

- ✓ Crucial for aquaculture industry
- ✓ Entering pet food market

*Very low incorporation rates (0.1 – 0.2%)*





## Feed market

***Microalgae are traditionally used in the aquaculture market, both new markets are emerging***

- ✓ Crucial for aquaculture industry
- ✓ Entering pet food market
- ✓ Source of protein,  $\Omega$ -3 PUFAs and carotenoids

***Replace unsustainable feedstocks traditionally used by the aquaculture sector (fishmeal, fish oil, soybean meal...)***





## Feed market

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- ✓ Crucial for aquaculture industry
- ✓ Entering pet food market
- ✓ Source of protein,  $\Omega$ -3 PUFAs and carotenoids
- ✓ **Feed additive with effective functional properties**

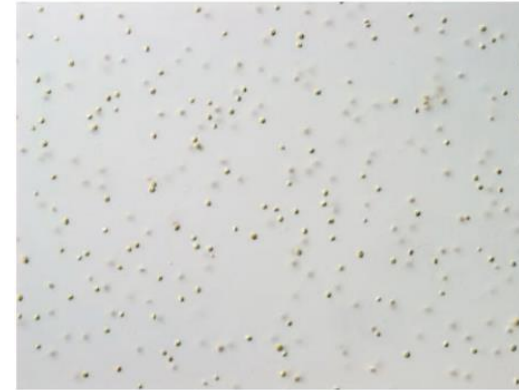




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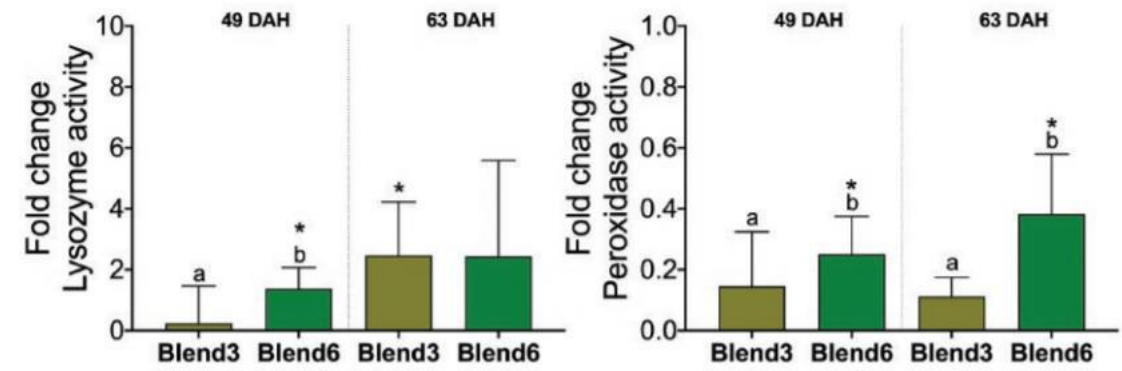
- ✓ Crucial for aquaculture industry
- ✓ Entering pet food market
- ✓ Source of protein,  $\Omega$ -3 PUFAs and carotenoids
- ✓ Feed additive with effective functional properties
- ✓ **High immunostimulant potential**



*Nannochloropsis* sp.



*Gracilaria gracilis*





## High value markets

*Microalgae are traditionally commercialized as nutraceuticals and their incorporation in cosmetic products recently bloomed*





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*Microalgae are traditionally commercialized as nutraceuticals and their incorporation in cosmetic products recently bloomed*

- ✓ Microalgae-based nutraceuticals are well established in the market

*Active metabolites of interest, mainly carotenoids, phycobiliproteins and  $\Omega$ -3 PUFAs*





## High value markets

***Microalgae are traditionally commercialized as nutraceuticals and their incorporation in cosmetic products recently bloomed***

- ✓ Microalgae-based nutraceuticals are well established in the market
- ✓ Novel nutraceuticals are emerging

***Emerging active metabolites for new markets, polyphenols, sterols, superoxide dismutase, among many others***





## High value markets

***Microalgae are traditionally commercialized as nutraceuticals and their incorporation in cosmetic products recently bloomed***

- ✓ Microalgae-based nutraceuticals are well established in the market
- ✓ Novel nutraceuticals are emerging
- ✓ Cosmetics with microalgae ingredients are now widespread in the market

***High relevance for cosmeceuticals, namely, PUFA, polysaccharides, carotenoids and mycosporine-like aminoacids***





## High value markets

***Microalgae are traditionally commercialized as nutraceuticals and their incorporation in cosmetic products recently bloomed***

- ✓ Microalgae-based nutraceuticals are well established in the market
- ✓ Novel nutraceuticals are emerging
- ✓ Cosmetics with microalgae ingredients are now widespread in the market
- ✓ To date microalgae-based pharmaceuticals are still commercially unavailable





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THANK YOU!

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