



Allmicroalgae
natural products

**Organic *Chlorella vulgaris* PT BIO 03 –
Allmicroalgae case study**

Joana Laranjeira Silva, Plant Manager

IMPORTANT FACTS – *Chlorella vulgaris*

- ✓ Classified as **Food by EFSA** and as **GRAS by FDA**
- ✓ Included as **Medicinal Ingredient by NHPID** and as **Active Ingredient by TGA**
- ✓ Recognized worldwide as a **SUPER**, Trendy, Nutra/Supplemented **FOOD**.



- ✓ ***Chlorella vulgaris* by Allma**

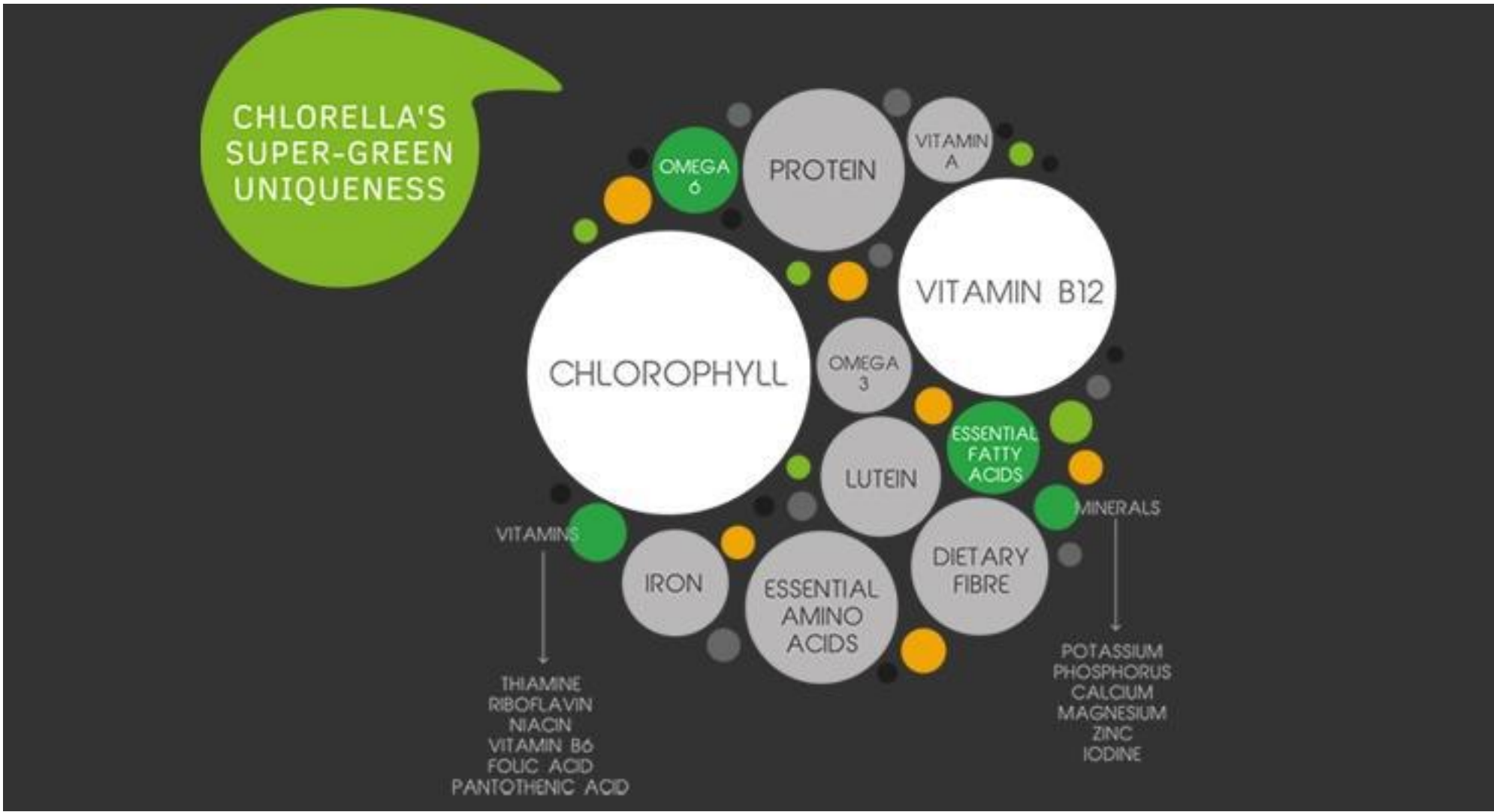
- 100% natural
- PT-BIO-03 (EU Legislation)^{Novel} (2 years R&D development, **MILESTONE 1**)
- Produced in Byphasic Mode^{Novel} **MILESTONE 2**
- 2013 to 2021 (8 years)
- Powder/ Paste^{Novel} / Tabs and Caps



At least 1 new product/year

National and International Collaborations, R&D unit totally allocated to R&D tasks, high qualified staff, ...

IMPORTANT FACTS – *Chlorella vulgaris*



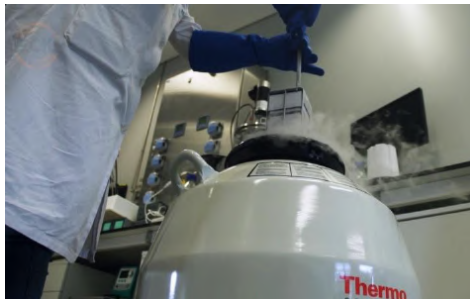
-  **GMO-FREE**
-  **100% NATURAL**
-  **NUTS-FREE**
-  **ADDITIVE FREE**
-  **SUITABLE FOR VEGAN & VEGETARIAN**

-  **GROWN IN THE SUN**
-  **IRRADIATION FREE**
-  **SOY-FREE**
-  **PESTICIDE FREE**
-  **GLUTEN-FREE**
-  **LACTOSE-FREE**

ALLMICROALGAE CASE – Production of *Chlorella vulgaris*



Master and Working cell bank (-196°C)



- ✓ Consistency
- ✓ Homogeneity
- ✓ Quality
- ✓ Capacity

SCIENTIFIC
REPORTS
nature research

OPEN

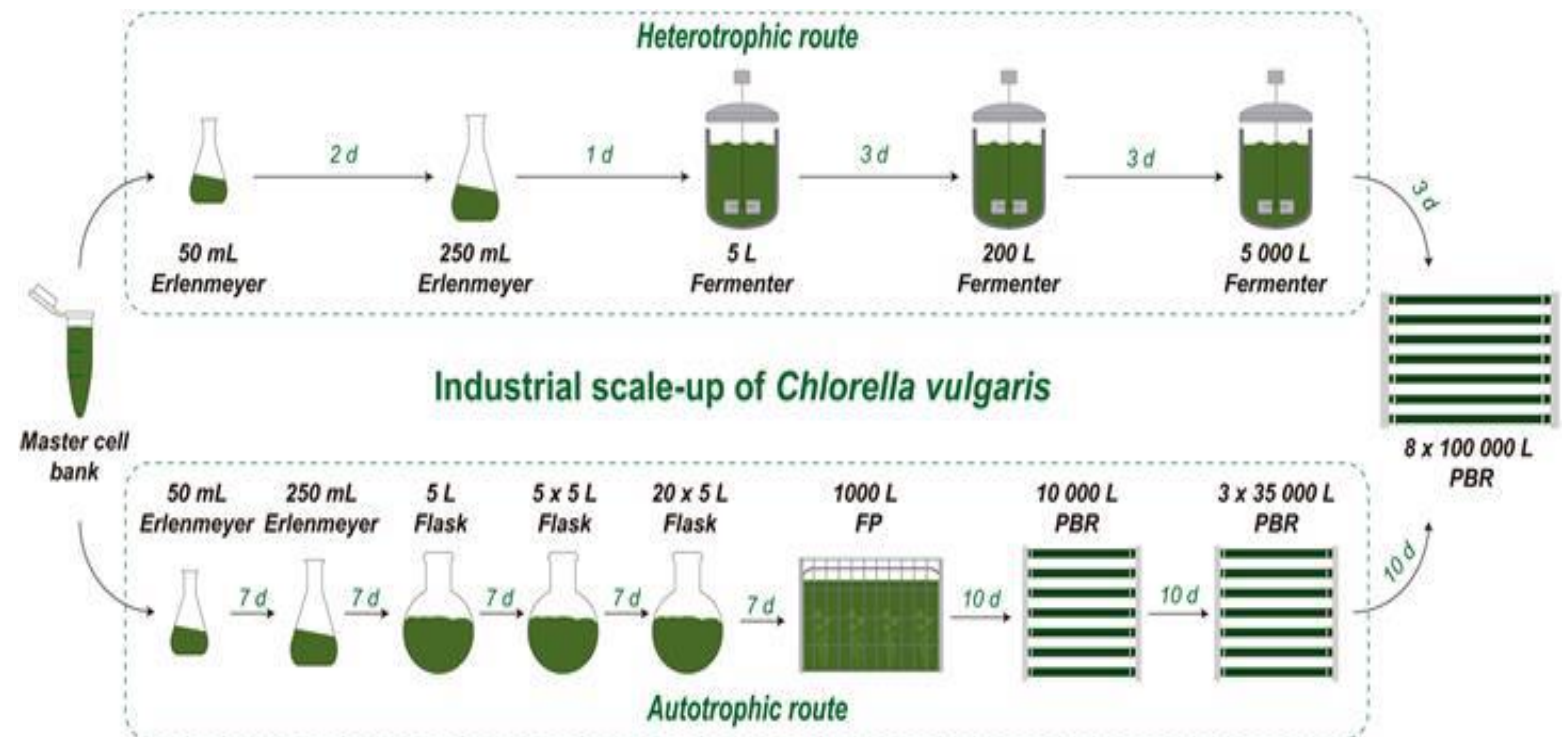
Heterotrophy as a tool to overcome the long and costly autotrophic scale-up process for large scale production of microalgae

Received: 18 February 2019

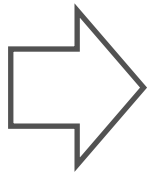
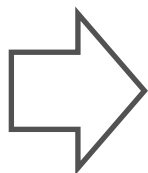
Accepted: 2 September 2019

Published online: 26 September 2019

A. Barros¹, H. Pereira², J. Campos¹, A. Marques¹, J. Varela² & J. Silva¹



ALLMICROALGAE CASE – Production of *Chlorella vulgaris*



Batch and Fed batch conditions

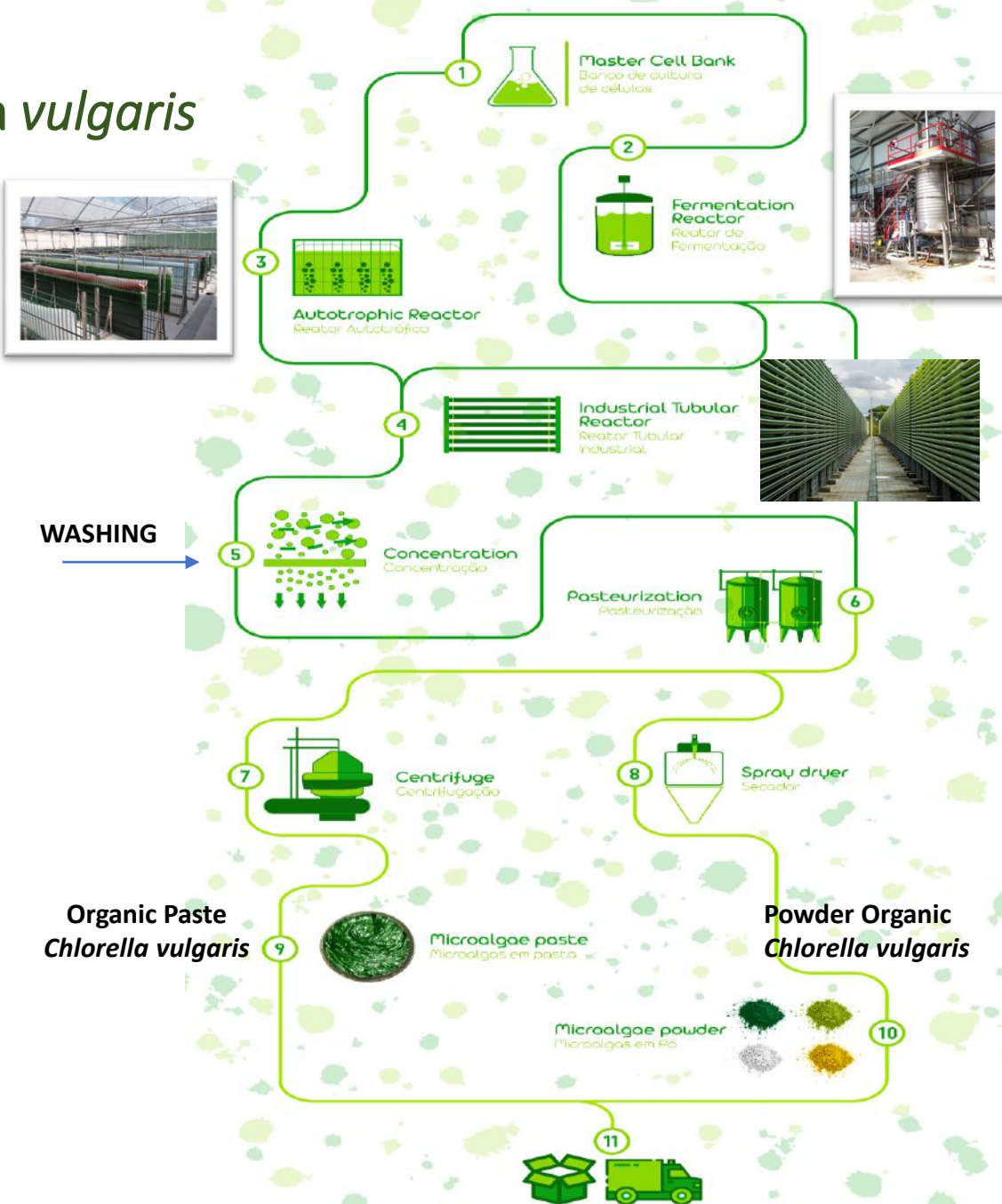
Nominal capacity = 77t (2021)

CERTIFICATIONS



On progress

ALLMICROALGAE CASE – Production of *Chlorella vulgaris*



Organic *Chlorella vulgaris* – Nutritional Facts



NUTRITIONNAL ADVANTAGES

- High protein content ($\geq 55\%$)
- Omega 3 ($>30\%$ of total lipids)
- High vitamin and mineral content:
 - > 3g *Chlorella* = 3000% of Vit B12 RI
 - > 3g *Chlorella* = 32% of Iron RI
- Protein:
 - > All essential amino acids
 - > Protein Digestibility : 76%
 - > Limiting amino acid : Met
 - > PDCAAS : 44%

HEALTH BENEFITS

- **CARDIOVASCULAR PROTECTION**
- **IMMUNOMODULATION**
- **ANTIOXIDANT**
- **ANTI-INFLAMMATORY**
- **DETOX**

APPLICATIONS

Functional/Nutritional ingredient, ideal for vegetarian/vegan

FOOD INGREDIENT

FUNCTIONAL INGREDIENT
NUTRITIONAL ENHANCER
COLORANT
TEXTURIZING
EMULSIFIER

AVAILABLE FORMATS

POWDER
FROZEN PASTE
FRESH PASTE

POTENTIAL APPLICATIONS

- Bakery/pasty preparations
- Pasta
- Specialized nutrition
- Vegetal milk
- Sauces
- Soups
- Confectionary
- Vegan food & beverage



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Organic *Chlorella vulgaris* – State of the art

HEALTH

Chlorella vulgaris, a microalga with multiple health benefits

- > **Omega-3 fatty acids** and **carotenoids** for their roles in **preventing of chronic diseases** and **maintaining good health** (Panahi *et al.*, 2016).
- > *C.vulgaris* is an essential source of **vitamin B12** which gives it **many beneficial health effects** (Koyande *et al.*, 2019; Ryan-Harshman & Aldoori, 2008). Vitamin B12 is much more available in *C.vulgaris* than in other species (Watanabe *et al.*, 2002).
- > *C.vulgaris* **produces lutein** which has been proved to **prevent and treat macular degeneration** and has **anti-cataract properties** (Rani *et al.*, 2018)
- > *C.vulgaris* possess **antibacterial** and **antitumor activities** and specifically its polysaccharides demonstrate **anti-inflammatory response** in edema test (Barkia *et al.* 2019)
- > *C.vulgaris* is **used to prevent cancer** and can **reduce side effects of conventional anticancer agents** (Raus *et al.*, 2021)
- > *CC.vulgaris* could **improve blood sugar levels, blood sugar control** and **glycemic status** for example by increasing insulin sensitivity (Jeong *et al.*, 2009 ; Ebrahimi-Mameghani *et al.*, 2017)
- > *C.vulgaris* supplementation **reduces cardiovascular risk factors** by improving total cholesterol levels, LDLC levels, systolic and diastolic blood pressure (Fallah *et al.*, 2018)

Vitamin
B12

Polysaccharides
(Glucans)

Lutein

Omega-3
Fatty Acids



Organic *Chlorella vulgaris* – State of the art

DETOX	<h2><i>Chlorella vulgaris</i> to eliminate unwanted compounds</h2> <ul style="list-style-type: none">> <i>C.vulgaris</i> has a powerful capacity to detoxify the body of heavy metals such as mercury, ash and heterocyclic amines via induction of antioxidant enzymes and acts as an ion exchange resin (Qian <i>et al.</i>, 2016; Lee <i>et al.</i>, 2015, Rani <i>et al.</i>, 2018)> <i>C.vulgaris</i> can also assist with the elimination of persistent organic pollutants (Klein & Kiat, 2015)> <i>C.vulgaris</i> is an excellent antioxidant that can be useful in managing respiratory diseases, thanks to its bioactive compounds including carotenoids, astaxanthin, lutein and fucoxanthin (Panahi <i>et al.</i>, 2012 ; Sikiru <i>et al.</i>, 2019).> <i>C.vulgaris</i> polysaccharides are a key factor influencing antioxidant activity (Yu <i>et al.</i>, 2019)
IMMUNITY	<h2><i>Chlorella vulgaris</i>, an immunity booster</h2> <ul style="list-style-type: none">> <i>C.vulgaris</i> ameliorates physiological health conditions by improving the immune function by increasing the production of cytokine (An <i>et al.</i>, 2008).> <i>C.vulgaris</i> may improve the immune response to flu vaccine in older patients (Halperin <i>et al.</i>, 2003)> Polyunsaturated fatty acids act as a booster of the immune response by regulating inflammatory processes (Calder <i>et al.</i>, 2014; Paschoal <i>et al.</i>, 2013).> Vitamin B12 plays a crucial role in the proper functioning of immune system promoting lymphoproliferation and maintaining the natural killer's activity. (Partearroyo <i>et al.</i>, 2013; Erkurt <i>et al.</i>, 2008; Tamura <i>et al.</i>, 1999). <i>C.vulgaris</i> improves the activation of production of molecules responsible for the immune response (enhancement of natural killer cell) (Kwak <i>et al.</i> 2012)> Iron is an essential nutrient at the forefront of the battle between the human host and infectious microbes (Nasir <i>et al.</i>, 2014; Johnson & Wessling-Resnick, 2012).> Polysaccharides (especially béta-1,3-glucan) are immunostimulators and act effectively in reducing the blood lipid levels, and presenting inhibitory actions against pathogens (Rani <i>et al.</i>, 2018)> <i>C. vulgaris</i> could raise the viability of probiotics in fermented dairy products (Beheshtipour <i>et al.</i>, 2013). <i>C.vulgaris</i> could have a strong potential for use as prebiotics on gut microbiota (Jin <i>et al.</i>, 2020)



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IMPORTANT FACTS R&D Allmicroalgae – *Chlorella vulgaris* by ALLMA



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Volume 53, March 2021, 102128



PUFAs

Chemoplasticity of the polar lipid profile of the microalgae *Chlorella vulgaris* grown under heterotrophic and autotrophic conditions

Daniela Couto ^a, Tânia Melo ^{a, b}, Tiago A. Conde ^a, Margarida Costa ^c, Joana Silva ^c, M. Rosário M. Domingues ^{a, b}, Pedro Domingues ^a

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<https://doi.org/10.1016/j.algal.2020.102128>

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Highlights

- *Chlorella vulgaris* was grown in autotrophic (C-Auto) and heterotrophic (C-Hetero) conditions.
- We detected 173 lipid species in C-Auto and 167 in C-Hetero.
- C-Auto was rich in omega-3 PUFAs while C-Hetero was rich in omega-6 PUFAs
- C-Hetero had a high content of phospholipids while C-Auto had a high content of glycolipids.
- The two lipid extracts had a high antioxidant activity and COX-2 inhibitory capacity.

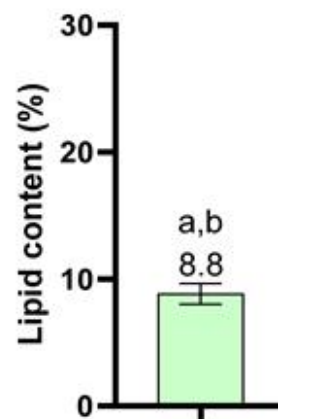


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IMPORTANT FACTS – *Chlorella vulgaris* by ALLMA



Chlorella Vulgaris

Open Access Article

Microalgae as Sustainable Bio-Factories of Healthy Lipids: Evaluating Fatty Acid Content and Antioxidant Activity

by [Tiago A. Conde](#) ^{1,2,3,†}, [Bruna F. Neves](#) ^{1,2,†}, [Daniela Couto](#) ^{1,2}, [Tânia Melo](#) ^{1,2}, [Bruno Neves](#) ³, [Margarida Costa](#) ⁴, [Joana Silva](#) ⁴, [Pedro Domingues](#) ¹ and [M. Rosário Domingues](#) ^{1,2,*}

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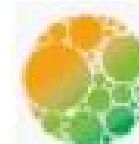
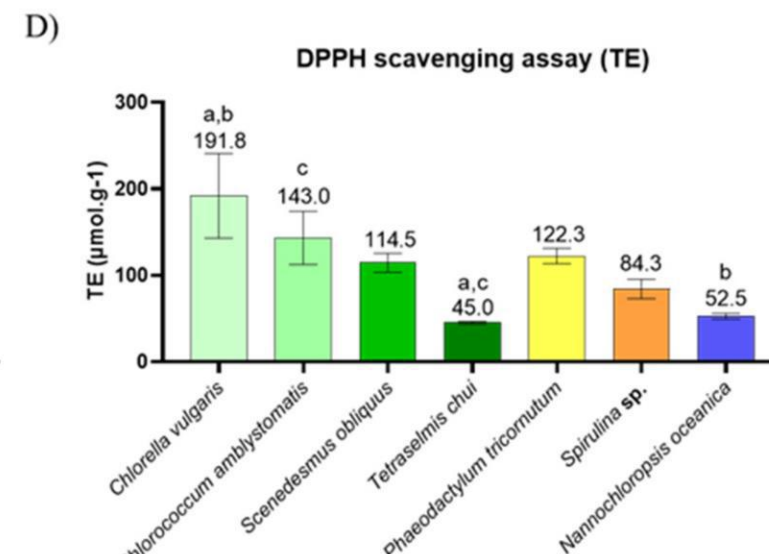
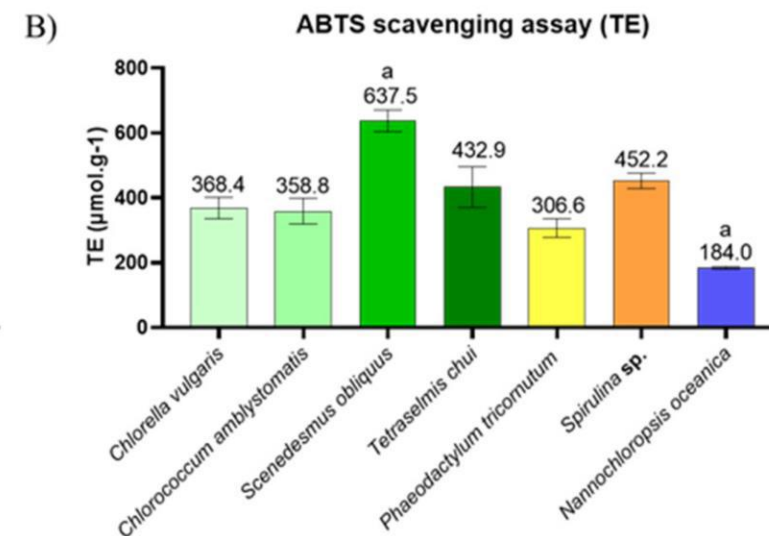
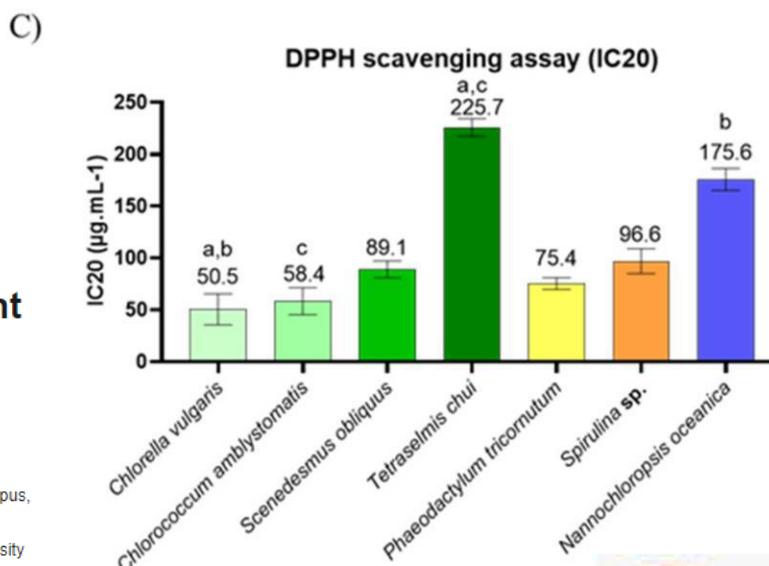
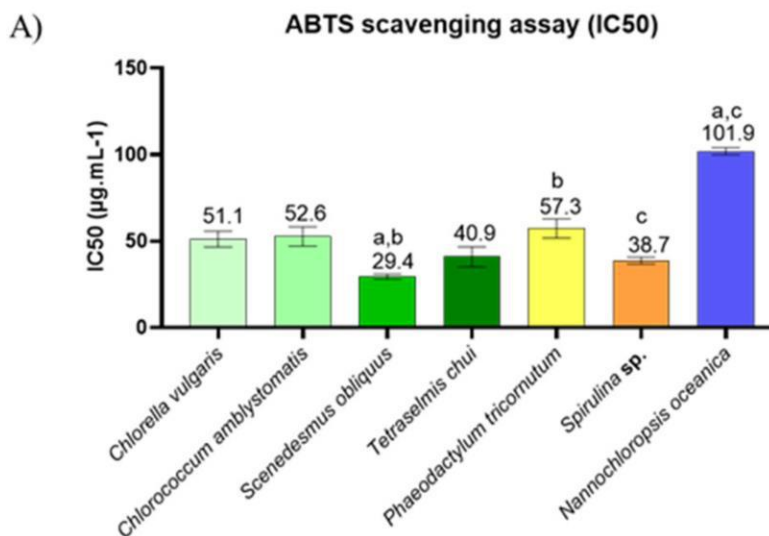
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Chlorella vulgaris by ALLMA - R&D projects






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**Algal Research**
Volume 47, May 2020, 101869






Microalgae n-3 PUFAs Production and Use in Food and Feed Industries
by ¹, ¹, ², ³ and ^{3,4,*}
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* Author to whom correspondence should be addressed.
Academic Editors: Andrew P. Desbois and Óscar Monroig
Mar. Drugs **2021**, *19*(2), 113; <https://doi.org/10.3390/md19020113>
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Incorporation of defatted microalgal biomass (*Tetraselmis* sp. CTP4) at the expense of soybean meal as a feed ingredient for juvenile gilthead seabream (*Sparus aurata*)

Hugo Pereira ^{a,1}, Manuel Sardinha ^{b,1}, Tamára Santos ^a, Luísa Gouveia ^c, Luísa Barreira ^a, Jorge Dias ^b, João Varela ^a 

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scientific reports

www.nature.com/scientificreports



OPEN Polar lipidomic profile shows *Chlorococcum amblystomatis* as a promising source of value-added lipids

Tiago A. Conde¹, Daniela Couto^{1,2}, Tânia Melo^{1,2}, Margarida Costa³, Joana Silva³, M. Rosário Domingues^{1,2} & Pedro Domingues^{1,2} 

 Springer Link

Published: 13 February 2019

Industrial production of *Phaeodactylum tricornutum* for CO₂ mitigation: biomass productivity and photosynthetic efficiency using photobioreactors of different volumes

[Pedro M. Quelhas](#), [Mafalda Trovão](#), [Joana T. Silva](#), [Adriana Machado](#), [Tamára Santos](#), [Hugo Pereira](#), [João Varela](#), [Manuel Simões](#) & [Joana L. Silva](#) 

Journal of Applied Phycology **31**, 2187–2196 (2019) | [Cite this article](#)

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Lab-Scale Optimization of *Aurantiochytrium* sp. Culture Medium for Improved Growth and DHA Production

by ¹, ^{2,*}, ¹, ¹, ¹, ¹, ¹, ¹, ² and ¹ 

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(This article belongs to the Special Issue Physiology and Biotechnology of Microalgae)

We do not walk alone!



Chlorella vulgaris by ALLMA – Take Home Messages

- Our Microalgae Portfolio Is **Certified**:
 - ✓ **Non-GMO, Soy Free, Gluten Free, Lactose Free, Sugar-Free, Nuts Free, Irradiation Free, no pesticides and no additives, perchlorates Free, no *Bacillus cereus*, among others**
- **ORGANIC** *Chlorella vulgaris*, Produced In Portugal (EU):
 - ✓ **Certified By EU (PT-BIO-03) / NOP USDA**
- **Certified** Company:
 - ✓ **ISO 9001; ISO 14001; HALAL; KOSHER; EUROPEAN ORGANIC PRODUCTION; GMP+; GMP;**
- Highly specialized, rigorous and focused **R&D+i Team**:
 - ✓ **TAILOR-MADE Products**, where we can easily achieve customized nutritional profiles!
- **Open Facilities** (Portugal, EU):
 - ✓ Our Facility doors are **always open** to our Business Partners, all year!
- **High Production** capacity:
 - ✓ **Flexible production volumes!**

FOOD & NUTRITION AWARDS – *Chlorella vulgaris* by ALLMA

Thank you!

joana.g.silva@allmicroalgae.com

