ALGAE FOR FOOD

Lisbon
April 10, 2024

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Iceland Liechtenstein Norway grants

YUM ALGAE
enzYmes for improved sensory qUality of MicroALGAE ingredients in foods

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EUROPEAN ALGAE BIOMASS ASSOCIATION

moving forward...

1.

European Algae Biomass Association

EUROPEAN ALGAE BIOMASS ASSOCIATION

APRIL 20 2021

EUROPEAN ALGAE BIOMASS ECOSYSTEM

INFOGRAPHIC MINDMAP

Supporting and networking with EC Funded Projects

H2020

Macroalgae (seaweed)
www.macrofuels.eu
www.macrocascade.eu
www.genialg.eu

and many others

INTEREG

Microalgae
www.multistream
www.eu-sabana.eu
www.spiralg.eu
https://miraclesproject.eu

and many others

COST

National Projects

Representing:
More than 150 members including companies, academia and other stakeholers from Research to Industry and Services including: Macro and Microalgae, technology neutral, worldwide networking & collaboration

Global conference:
Algae Europe • https://algaeurope.org

Thematic Conferences
Seaweed Valorisation Conference
Young Algeneers Symposium (YAS)
European Chlorella Conference
European Spirulina Conference (2022)

Technical Webinars
www.algaeworkshops.org

Working Groups
Position and Info papers

www.what-are-algae.com

Networking initiatives

Seaweed Manifesto

SEAWEED for EUROPE

safe seaweed coalition
www.safeseaweedcoalition.org

Interface with the European Commission
DG-MARE, DG-AGRI, DG-ENVI, DG-HEALTH, DG-RTD, JRC…

Food and Agriculture Organization of the United Nations

FAO Codex Alimentarius

International Networking

ISAP

AB Algae Biomass Organization

AIIC Algae Industry Incubation Consortium JAPAN

Algae Planet

ASC
www.asc-aqua.org

ABES
www.abes.tsukuba.ac.jp/en

Standards

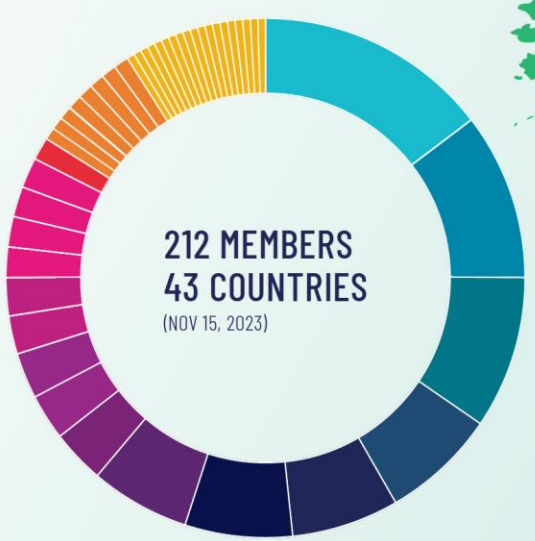
CEN/TC 454
Algae and Algae products

European Committee for Standardization

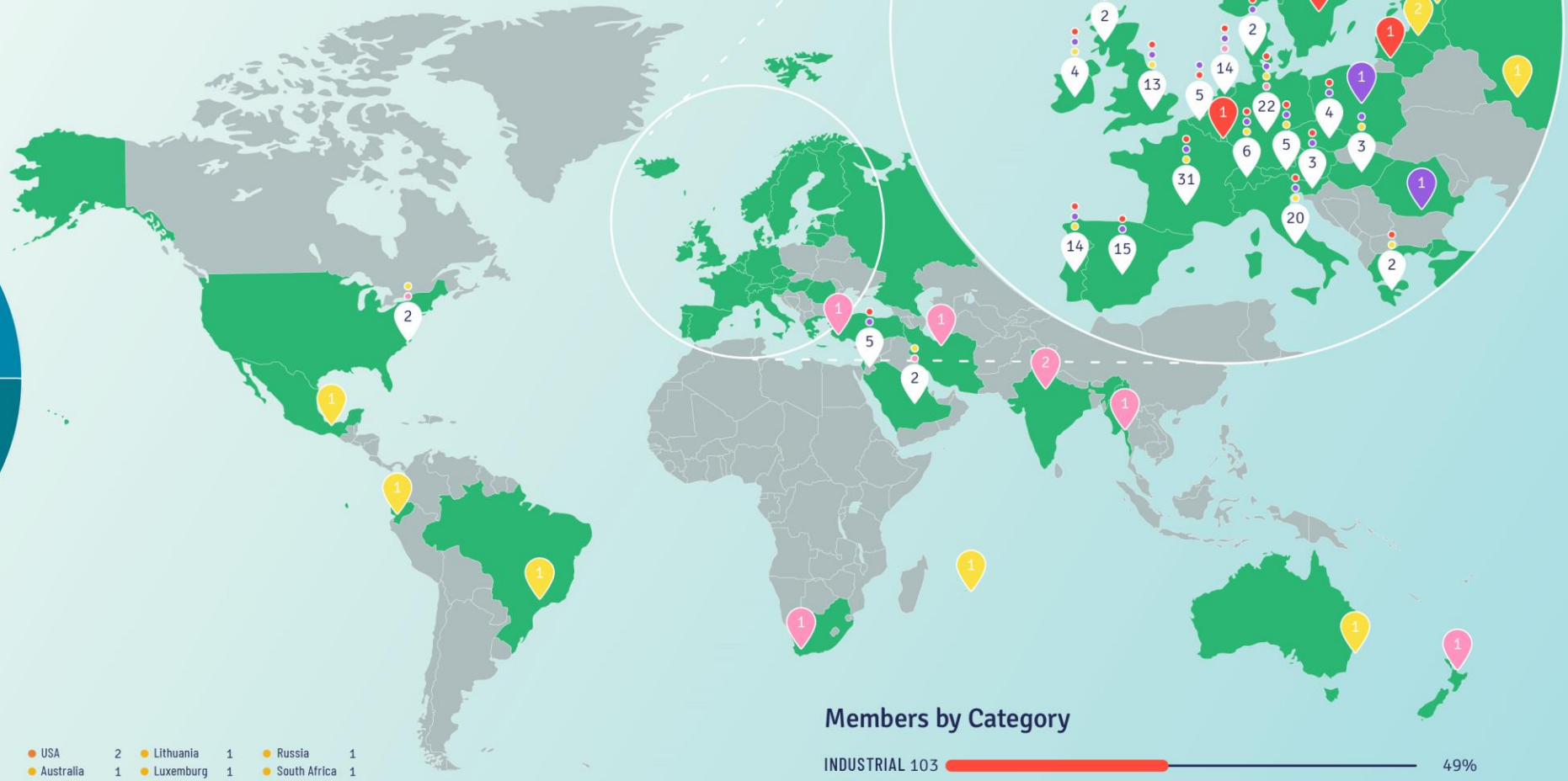
ASC – Aquaculture Stewardship Council
MSC – Marine Stewardship Council

EABA is the backbone for the ALGAE sector in Europe

EUROPEAN ALGAE
BIOMASS ASSOCIATION



212 MEMBERS
43 COUNTRIES
(NOV 15, 2023)



Members by Country

France	31	Switzerland	6	Hungary	3	USA	2	Lithuania	1	Russia	1
Germany	22	Israel	6	Denmark	2	Australia	1	Luxemburg	1	South Africa	1
Italy	20	Austria	5	Greece	2	Brazil	1	Mauritius	1	Turkey	1
Spain	15	Belgium	5	Kingdom of Saudi Arabia	2	Ecuador	1	Mexico	1		
Portugal	14	Czech Republic	4	Latvia	2	Estonia	1	Myanmar	1		
The Netherlands	14	Finland	4	Scotland	2	Faroe Islands	1	New Zealand	1		
United Kingdom	13	Iceland	4	Slovenia	2	India	1	Poland	1		
Norway	7	Ireland	4	Sweden	2	Iran	1	Romania	1		

Members by Category

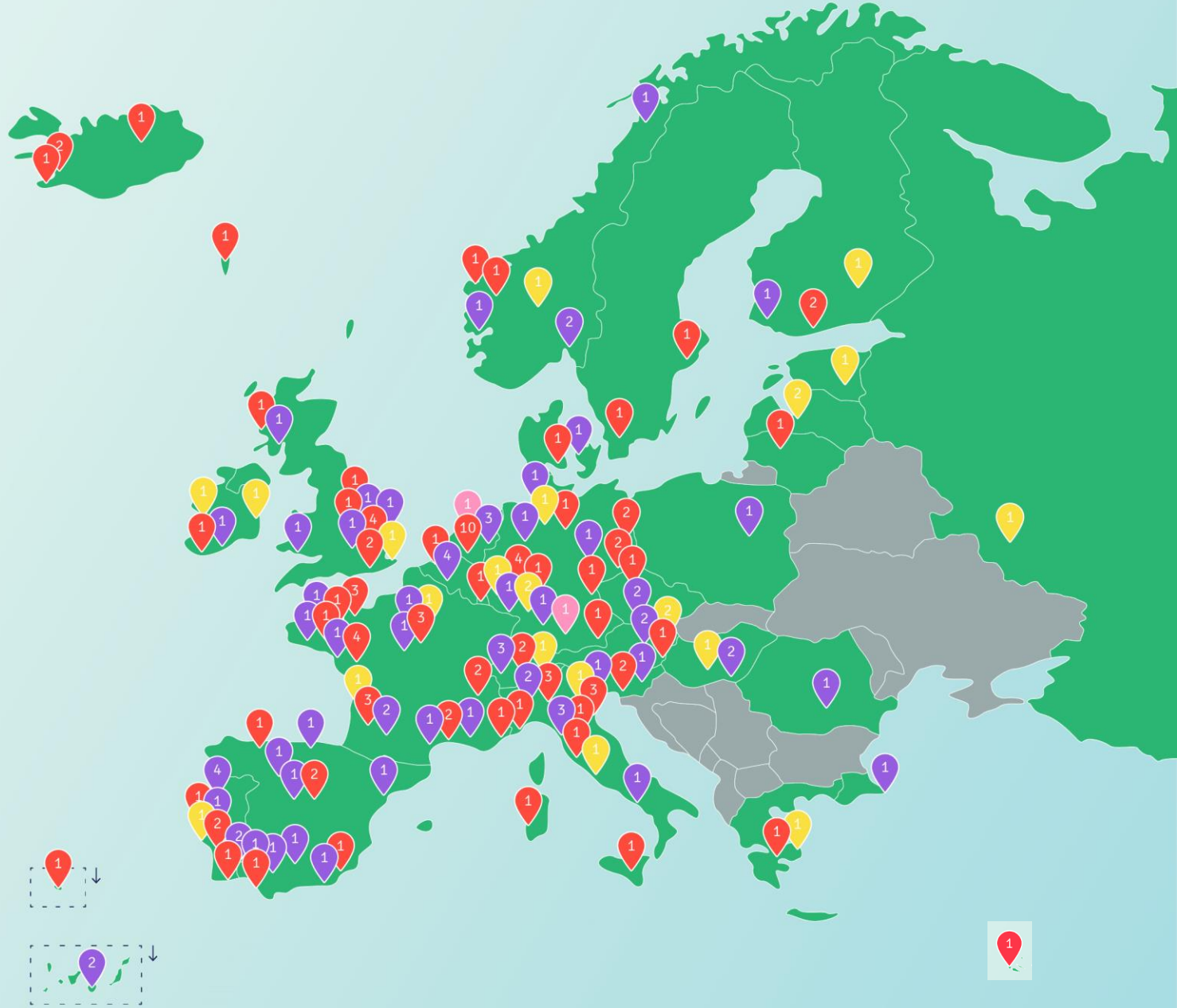
INDUSTRIAL	103	49%
SCIENTIFIC	72	34%
INDIVIDUAL	28	13%
OBSERVER	9	4%
TOTAL	212	100%

EUROPEAN ALGAE
BIOMASS ASSOCIATION

197 EUROPEAN MEMBERS
30 EUROPEAN COUNTRIES
(NOV 15, 2023)

Members by Category

INDUSTRIAL	103	52%
SCIENTIFIC	72	37%
INDIVIDUAL	20	10%
OBSERVER	2	1%
TOTAL	197	100%



2.

Concepts and definitions

ALGAE EXTRACTS ARE FOOD SUPPLEMENTS OR FOOD INGREDIENTS?

Algae extract can actually be **both** a **food supplement and** a **food ingredient**, depending on its intended use and processing.

As a Food Ingredient

When the product is used even in **small quantities** to **enhance** the **nutritional, functional, or sensory properties** of a food product, it acts as a food ingredient.

This can involve adding protein, fiber, pigments, or even unique flavours to various food items.

Examples of incorporating algae extract as a food ingredient include:

- **Boosting protein content** in plant-based products.
- Adding **dietary fibers** for better digestion.
- Introducing **natural colours** like blue or red to beverages or snacks.
- Offering **subtle umami or seafood-like** flavours in savoury dishes.

Therefore, the specific category of an algae product depends on its **composition**, intended use, and dosage.

As a Food Supplement

If the algae product is **high** in specific nutrients or bioactive compounds with a stable and controlled composition (like omega-3s, antioxidants, etc.) and is intended to be consumed in **measured doses** to **supplement** a regular diet, it falls under the **food supplement** category.

These supplements often come in the form of **capsules, tablets,** or **powders**

- **Dietary supplements:** Primarily used in the United States by the Food and Drug Administration (FDA) https://www.fda.gov/food/dietary-supplements.
- **Food supplements:** More common in Europe, used by the European Food Safety Authority (EFSA) https://www.efsa.europa.eu/en.

Microalgae & Seaweed as Food Supplements

Whole biomass: Dried microalgae (like Spirulina and *Chlorella*) and some seaweeds are packaged as tablets, powders, or capsules. These deliver a concentrated dose of nutrients.

- High protein content
- Source of essential vitamins and minerals (e.g., iodine in seaweed)
- Rich in antioxidants and anti-inflammatory compounds

Extracted compounds: Specific components are isolated and sold as concentrated supplements.

- Omega-3 fatty acids (EPA and DHA) from certain microalgae as a fish oil alternative
- Pigments like astaxanthin (from microalgae) or fucoxanthin (seaweed) for their powerful antioxidant properties

Microalgae & Seaweed as Food Ingredients

Nutritional & Functional Enhancement:

- Boosting protein content of foods (especially appealing for plant-based diets)
- Adding dietary fiber for better digestive health
- Providing natural pigments (seaweeds for green/brown, microalgae can offer reds/blues)
- Potential thickeners, emulsifiers, or textural enhancers

Unique flavours:

- Seaweeds add umami, salty, and "ocean" flavours to dishes
- Certain microalgae strains offer subtle seafood-like aromas

ALGAE BIOMASS AND ALGAE EXTRACTS CAN BE CONSIDERED FUNCTIONAL FOODS?

Functional foods are natural or processed food products that deliver demonstrably beneficial health effects beyond basic nutrition. They may contain specific bioactive compounds, nutrients, or dietary fibers that offer scientifically supported evidence of:

Promoting health

This could include boosting immunity, improving cognitive function, supporting heart health, reducing inflammation, or enhancing gut health.

Preventing chronic diseases

Some functional foods may have the potential to help prevent chronic conditions like heart disease, diabetes, or certain types of cancer, although this requires strong scientific evidence.

Adapted from Institute of Food Technologists (IFT): https://www.ift.org/ defines functional foods as "foods that have a potentially beneficial effect on health beyond basic nutrition."

EXAMPLES OF ALGAE & ALGAE EXTRACTS AS FUNCTIONAL FOODS

Here are some examples of algae and their extracts used as functional foods, along with the potential health benefits associated with them:

1. SPIRULINA

Blue-green microalgae (*Limnospira platensis*);

Products: Phycocyanin (blue pigment), protein powder;

Potential benefits

May support immune function
May provide antioxidant and anti-inflammatory effects
High in protein, vitamins and minerals.

2. CHLORELLA

Green microalgae (*Chlorella vulgaris*);
Chlorella Growth Factor (CGF), protein powder.

Potential benefits

May contribute to detoxification processes; Supports healthy digestion due to fiber content; Good source of protein, vitamins, and minerals.

3. ASTAXANTHIN

Product: Oleoresin derived from microalgae like *Haematococcus pluvialis*.

Potential benefits

Powerful antioxidant with potential benefits for skin health and sun protection; May offer anti-inflammatory properties; Supports overall well-being and can be found in beverages or supplements.

4. FUCOXANTHIN

Product: Derived from brown seaweed like *Undaria pinnatifida*.

Potential benefits

May support healthy weight management by promoting fat metabolism; Possesses anti-inflammatory properties; Can be incorporated into weight management supplements or functional food products.

5. SEAWEED

Algae: Various types of seaweed (e.g., wakame, nori, kombu);
Whole algae: Dried, ground, or powdered seaweed used as seasoning;

Potential benefits

Rich in dietary fiber, promoting gut health and digestion; Good source of iodine, essential for thyroid function; Offers umami flavour and mineral content to various dishes.

WHAT ARE FOOD INGREDIENTS, FOOD ADDITIVES AND DIETARY SUPPLEMENTS?

FEATURE	ALGAE as FOOD INGREDIENTS	FOOD ADDITIVES	ALGAE in (DIETARY) FOOD SUPPLEMENTS
PRIMARY PURPOSE	Structure, flavour, nutrition	Functional qualities	Supplement deficiencies, enhance health
ALGAE-BASED EXAMPLES	Nori, wakame, kombu, dulse spirulina, chlorella, etc.	*Agar-agar, carrageenan, alginate, spirulina extract, beta-carotene*	Kelp, Spirulina, chlorella, algae oil (omega-3)
REGULATION (EU) - EFSA 	General food law	*Regulation (EC) No 1333/2008* *positive list*	Directive 2002/46/EC
REGULATION (US) - FDA 	Generally, no pre-approval	*Pre-market approval by FDA required*	FDA regulation for labeling and safety, but not pre-market approval
LABELING	Common or usual name (e.g., "nori seaweed", "spirulina powder")	Approved name or function (e.g., "agar-agar")	Supplement facts panel with specific information
NUTRITIONAL VALUE	Can be significant (protein, vitamins, minerals)	*Usually not significant*	Varied, can be significant for specific nutrients (e.g., protein, omega-3s, antioxidants)
SOURCE	Whole or processed algae	*Algae are a source*	Whole algae or derived from algae

3.

Why algae as food?

THE MOST UNIQUE AND UNMACHABLE CHARACTERITIC OF ALGAE AS FOOD IS RELATED WITH FLAVOUR

Algae, encompassing microalgae to seaweeds, offer compelling dietary advantages, with seaweeds having been a staple in human diets for thousands of years.

NUTRITIONAL POWERHOUSE

Algae are rich in essential vitamins, minerals, protein, and omega-3 fatty acids.

SUSTAINABLE

Cultivation requires less land and freshwater resources and can be grown in diverse environments.

CLIMATE RESILIENT

Algae can thrive in various conditions, offering a potential solution for regions affected by climate change.

FUNCTIONAL INGREDIENTS

Algae contain bioactive compounds with potential health benefits.

CULINARY VERSATILITY

Algae offer a diverse range of flavours, textures, and culinary applications.

Amino acid profile of protein sources

AMINO ACIDS CONTENT (mg/g of protein) FROM LITERATURE											
Essential AA	**FAO (2007) reference protein**	**Milk**	**Egg**	**Meat**	**Fish**	**Wheat**	**Corn**	**Soya**	**Lentils**	**Arthrospira**	**Chlorella**
Protein (%)	**/**	**3.30**	**12.5**	**29.6**	**23.5**	**13.7**	**13.0**	**36.0**	**9.0**	**65.0**	**55.0**
Valine	**39**	65	68	50	52	48	45	47	50	71	55
Isoleucine	**30**	52	53	53	46	35	42	48	43	67	38
Leucine	**59**	95	96	75	81	67	122	77	73	98	88
Lysine	**45**	84	73	84	92	**27**	**30**	61	70	48	84
Sulfated AA	**22**	32	52	40	40	28	29	25	22	23	22
Aromatic AA	**38**	102	94	74	73	64	75	89	76	56	50
Threonine	**23**	43	44	42	44	31	30	36	36	62	48
Tryptophane	**6**	13	13	12	11	**0**	**5**	13	9	**3**	21
Histidine	**15**	30	25	31	29	22	27	26	26	22	20

Protein digestibility-corrected amino acid score (**PDCAAS**) for different algae

Food Source	PDCAAS Value
Chlorella	0.75–0.82
Spirulina	0.83–0.94
Milk	1.00
Egg	1.00
Meat	1.00
Fish	1.00
Wheat	0.25–0.40
Corn	0.42–0.45
Soybeans	0.91–0.99
Lentils	0.52–0.76

Protein Digestibility–Corrected Amino Acid Score (PDCAAS) for various food sources, including macro and microalgae, as well as common protein-rich foods.

The PDCAAS is a method used to evaluate the quality of protein based on both the amino acid requirements of humans and their ability to digest it.

The Protein Digestibility–Corrected Amino Acid Score Schaafsma Gertjan https://doi.org/10.1093/jn/130.7.1865S

4.

Whole food… algae for cooking

Algae for cooking
Not a mystery anymore

ALGAE FOR COOKING

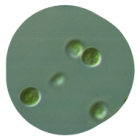
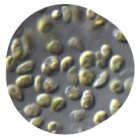
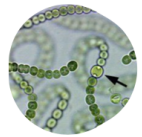
EABA

TOP 10 SEAWEED USED IN COOKING

	TASTE	RICH IN
 ULVA	SORREL	Protein, magnesium, magnenese
 ENTEROMORPHA	SALTY	Protein, magnesium; magnenese
 PALMARIA	NUTS	Magnesium, potassium
 PORPHYRA	OYSTER	Protein
 CHONDRUS	ND	Carrageanans used as a gelling agent

	TASTE	RICH IN
 LAMINARIA DIGITATA	IODINE	Fibers, Alginate used as a gelling agent
 SACCHARINA LATISSIMA	UMAMI	Fibers, magnesium, potassium
 UNDARIA	OYSTER	Fibers, Protein
 HIMANTHALIA	NEUTRAL	Fibers, magnesium, vitamin C
 CODIUM	SALTY	nd

TOP 5 MICROALGAE USED IN COOKING

	TASTE	RICH IN
 ATHROSPIRSA	SEAWATER	Protein, phycocyanin coloring
 CHLORELLA	SULPHUR	Fatty acids, vitamin B12
 NANNOCHLOROPSIS	SARDINE PASTE	Fatty acids, Protein
 DUNALIELLA	SALT	B-caroten
 NOSTOC	NEUTRAL	Protein, vitamin C

NOTES:
EAA Essential Aminoacids
Porphyra umbilicalis
Is a good replacer for Nori used in Sushi

MacArtain P, Gill C, Brooks M, Campbell R, Rowland I. Nutritional value of edible seaweeds.
Nutrition Reviews. 2007; 65(12 Pt 1):535-543.

CONTRIBUTORS:
prannie rhatigan, fiona houston, donald deschagt, antonio muiños insua, jack lee, Jörg ullmann, willem sodderland, pedro escudero, marie dominique plan, leonel pereira, monique ras, valeria montalescot + other to add.

5.

Algae as food ingredient

Any whole or processed part of algae that is directly incorporated into a food product during production

Food ingredients are directly consumed in food, while supplement and nutraceuticals are taken as separate products.

NO SPECIFIC HEALTH CLAIMS

Food Ingredient

EU - Defined in Regulation (EC) N.º 178/2002 as "*any substance or product, whether in its natural state or processed, that is intended to be used for human consumption, either for itself or as a part, ingredient or constituent of a foodstuff.*"

US - Defined in 21 CFR §201.20(a) as "*any substance or article that is used for human consumption, wholly or partially, to affect the characteristics of any food.*"

EXAMPLES

Seaweed extract powder

Seaweed flour, rich in dietary fiber, used in small amounts to boost the fiber content of bakery products or snacks.

Blue spirulina extract

Concentrated extract of the blue pigment phycocyanin from Spirulina, used in small quantities to naturally color beverages or snacks in blue or green shades.

Microalgae protein powder

Isolate from a specific microalgae strain with high protein content, used in protein bars or plant-based meat alternatives to increase protein content.

Seaweed flavouring

Liquid extract capturing the umami and "ocean" flavours of seaweed, used in tiny amounts to enhance the taste of savoury dishes.

Closest product in the market to Salmon!
0% Fish 100% Taste

A 100% natural food, vegan and tasty, high nutritional quality, rich in Omega-3, marine proteins and many marine compounds good for the whole family.

ODONTELLA created Solmon for the pleasure of you and your guests , a vegan alternative to smoked fish. From ingredients carefully selected, ODONTELLA brings you all the nutritional qualities of marine algae.

To consume fresh, but also pan-fried, fried, as a garnish on pasta, on your pizzas, in salad, in verrines, in tapas, sushi…

Odontella is not a common company; the team behind the product are Marine Biologists and world specialists in micro-algae & marine life. They have created the first Vegetable Marine Salmon in the world made from micro algae in the hope to develop new alternatives that will reduce our impact in our precious marine life

Dunaliella salina

PHYCOCYANIN FROM SPIRULINA AS A FOOD INGREDIENT

Identifiers

INS No. 134
CAS No. 20298-86-6

Physical Description

Spirulina occurs as a fine, uniform powder or flakes, darks blue green to green in color. Spirulina extract is prepared by the filtered aqueous extraction of the dried biomass of *Arthrospira platensis*, and contains phycocyanins as the principal coloring components.

Common Uses

Spirulina extract can be used in a wide range of foods and beverages including flavored dairy products, cheese, dairy based desserts, processed fruits and vegetables, baked good and baking mixes, alcoholic and non-alcoholic beverages and beverage bases, breakfast cereals, cocoa products, confectionery products (including soft and hard candy and chewing gum), egg products, gravies and sauces, herbs and spices, condiments and soup and soup mixes, as well as in nutritional supplements and pharmaceuticals.

Specifications

JECFA

US FDA

Regulatory Approvals

JECFA: A temporary ADI "not specified" was established at the 86th JECFA (2018).

USA: Spirulina extract is exempt from certification and may be safely used to color confections (including candy and chewing gum), frostings, ice cream and frozen desserts, dessert coatings and toppings, beverage mixes and powders, yogurts, custards, puddings, cottage cheese, gelatin, breadcrumbs, ready-to-eat cereals (excluding extruded cereals), coating formulations applied to dietary supplement tablets and capsules at levels consistent with GMP, and to seasonally color the shells of hard-boiled eggs,(21 CFR 73.530) coating formulations applied to drug tablets and capsules at levels consistent with GMP (21 CFR 73.1530)

EC: Spirulina extract is typically considered a coloring food in the EU, rather than a color additive. A coloring food is a food ingredient used for coloring purposes.

ARTHROSPIRA (SPIRULINA)

Makes 20 protein balls
200 g (2 cups) whole raw almonds
200 g (2 cups) whole raw cashew nuts
199 g (1 cup) pumpkin seed
1/2 teaspoon sea salt
1 teaspoon ground cinnamon
1 scoop (21 g) natural vanilla protein powder
1 teaspoon **spirulina powder**
16 whole fresh pitted dates
squeeze orange juice or lemon
coconut to roll

www.thehealthychef.com/2011/11/spirulina-protein-power-balls/

Supercharged Spirulina Popcorn

Heat afflower oil in a pot with a lid when the oil is nice and hot add the popcorn shake often until all the kernels are popped. Now for the yummy, goody good healthy stuff.

Once the popcorn is ready, place it in a paper bag (make sure you pick a bag that is large enough).

Add

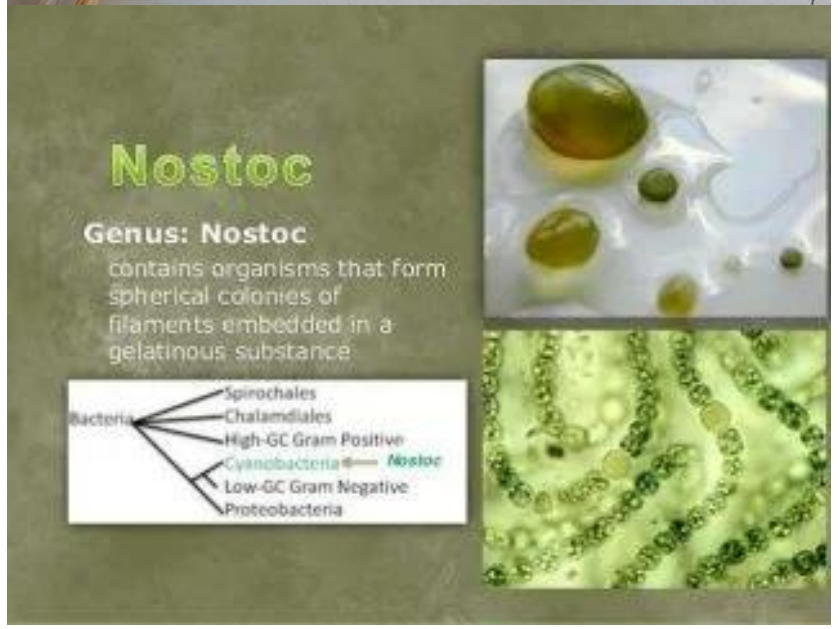
- 1 small tablespoon (5 gr) of Spirulina powder;
- 1 tablespoon (15 gr) of nutritional yeast
- A little bit of sea salt.

Shake well. Make sure that the popcorn is evenly coated and it's ready!

Simpliigood Icecream

Chlorella

Nostoc commune



Spirulina

O-Yes! Spirulina Cracker - 25 Sachets

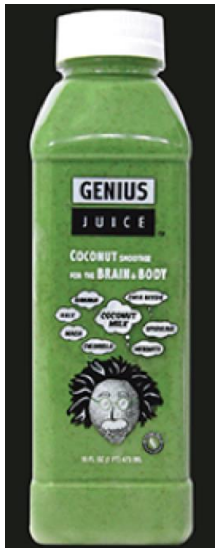
Spirulina

Lee Biscuits (Pte.) Ltd.

Chlorella

Euglena gracilis

Chlorella and *Spirulina*



Chlorella

1. SOME DAIRY PRODUCTS

Dairy products are a common source of carrageenan, a thickening ingredient derived from red seaweed. You might find carrageenan in dairy products like yogurt, whipped cream, chocolate milk, cottage cheese, ice cream and coffee creamers.

Ingredients used for preparation of seaweed chocolate with Ulva reticulata.

http://dx.doi.org/10.1016/j.fshw.2015.03.001

A unique sensory experience due to pearls alginate based on Alqogel 3001. Added to the drink, the pearls explode in the mouth to bring flavours and texture.

Saccharina *and* ***Laminaria*** *(kombu)*

Undaria pinatifida *(wakame)*

CAVINOIR

Cavinoir® Vegan Classic Style - Gourmet Seaweed Pearls
Based on seaweed with a liquid core. 110 gr. 8.95 €
100% vegan 100% vegetarian 100% dairy free.

Cavinoir® Vegan Classic Style is completely free from fish ingredients and composed entirely of vegetable products. In terms of properties, this vegan line is not inferior to real caviar: every pearl bursts open like that of fish roe. The shiny black pearls have a surprisingly subtle sea flavor, they are salty, fishy, umami, complex and melt in the mouth.

Cavinoir® Vegan Classis Style is the result of an environmentally conscious production process, an exceptional delicacy and a jewel on every table or banquet. Cavinoir® is low in calories and rich in vitamins and proteins. The fish was replaced in the production process by high-quality seaweed and herbs. The experience remains the same! In addition to the 'Classic and Imperial Selection', Cavinoir® is also available as 'Classic Vegan Style' and 'Vegan Lax Style'. The composition of the broth is so sophisticated that the taste of the best caviar is approached to perfection.

www.seamorefood.com
Seamore B.V.
The Netherlands

Palmaria palmata *Dulse*

Seamore

Seaweed Bacon

Seaweed bacon is a 100% wild, organic seaweed that turns into (green) bacon when you fry it. With no saturated fats very little calories. With calcium, potassium & iodine Is really good for your vision and gut health.

Made from 100% wild, organic seaweed, I sea bacon is a nutritional powerhouse that tastes just like (green) bacon when it's fried. Salty, smoky and delicious, this "vegan bacon" is jam-packed with protein, potassium, calcium, iodine and zinc.

Besides, it helps the immune system. So put it on anything that deserves a crunchy, salty, smoky kick or use the soft leaves as a flavor boost in salads, pastas or anything else.

Viva Maris

www.viva-maris.de
Viva Maris GmbH
Germany

Eucheuma Sacarina latissima

Algae sausage substitute
vegan. For the spoiled gourmet

Our vegan algae sausage replacement products are prepared by hand with selected ingredients. The vegan Viva Maris algae sausage alternatives are based on peas and potatoes, without soy, gluten, lactose, palm oil and artificial flavors. We only use high quality ingredients to get a first class taste experience. The Nordic seaweed *Saccharina latissima* (sugar kelp) provides important nutrients and vitamins as well as the vital iodine and selenium.

ALGAE bratwurst, vegan
Ingredients:
Water, rapeseed oil, onions, starch, potato protein, pea protein, pea flour, thickener, cellulose, *Eucheuma* algae, seaweed (S.Latissima), table salt, spices, sea salt, citric acid, sodium gluconate

Algae currywurst, vegan
Ingredients:
Water, rapeseed oil, starch, potato protein, pea protein, pea flour; Thickening agents: methyl cellulose, cellulose, processed *Eucheuma* algae, sugar kelp (*S. latissima*) 3.4%, table salt, sea salt, spices, dextrose, sucrose, spice extracts, citric acid, sodium gluconate, curry, beech wood smoke

Algae Wienerwurst, vegan
Ingredients:

Sacharina Laminaria

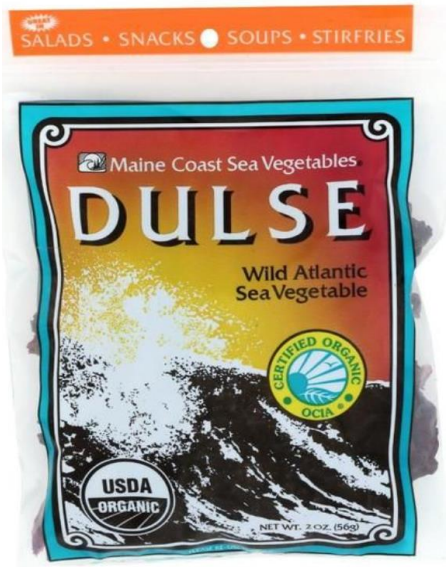
THE DUTCH WEEDBURGER

Family package - 10 x The Dutch Weed Burger. € 44.00

Ingredients:

Soy protein (46.3%) , hydrated soy flour (14.7%), water, kombu (seaweed) (9.5%), salt, potato protein, modified corn starch, flavor, wheat flour, potato fiber, thickener: carrageenan, White pepper*, Soy from controlled European (90%) and North American cultivation, free from GMO.

Laminariales *(Kelp)*



Palmaria palmata *(Dulse)*

Laminariales (Kelp)

UmaBurger: Pure Dutch beef enriched with seaweed. Special fibers distribute the moisture better, creating a juicy bite.

Ingredients:

Pure Dutch beef
15% European seaweed
Produced
UmaWorst
Spiced pure Dutch beef enriched with seaweed as a natural flavor enhancer. Eight hours traditionally smoked on beech wood.

UmaMeats

https://umameats.nl
Uma Meats
The Netherlands

Saccharina latissima

What is Kelp Jerky?

A 100% vegan, nutrient dense, protein and fiber packed snack made with all clean-label ingredients including ocean-farmed kelp from Maine, U.S.A, top quality shiitake mushrooms, and superfoods like nori, turmeric, spirulina, and more.

Jerky is lean trimmed meat that has been cut into strips and dried (dehydrated) to prevent spoilage. Normally, this drying includes the addition of salt to prevent bacteria growth before the meat has finished the dehydrating process. The word "jerky" derives from the Quechua word ch'arki which means "dried, salted meat". All that is needed to produce basic "jerky" is a low-temperature drying method, and salt to inhibit bacterial growth.

http://akua.co
Beyond the Shoreline, LLC
USA

Caulerpa lentillifera

Pyropia Nori

Hamburguesa de Tofu com Algas Zuaitzo
150 gr. 3.29 €

Ingredients:

Tofu * (38.1%) (water, soy * and nigari), brown rice *, glasses of avena *, seitan * (harina wheat *, tamari *, kombu seaweed * and ginger *), onion *, seaweed nori * (1.6%), tamari * (soy parsley), whole wheat harina *, salt, sunflower oil * and sesame*.

(*) ecological production)

6.

Algae in food supplements

https://www.efsa.europa.eu/en/topics/topic/food-supplements

FOODS SUPLEMENTS

Food supplements are concentrated sources of nutrients (i.e. *mineral* and vitamins) or other substances with a nutritional or physiological effect that are marketed in " *dose* " form (e.g. pills, tablets, capsules, liquids in measured doses). A wide range of nutrients and other ingredients might be present in food supplements, including, but not limited to, vitamins, minerals, amino acids, essential fatty acids, fibre and various plants and herbal extracts.

Food supplements are intended to correct nutritional deficiencies, maintain an *adequate intake* of certain nutrients, or to support specific physiological functions. They are not medicinal products and as such cannot exert a pharmacological, immunological or metabolic action. Therefore, their use is not intended to treat or prevent diseases in humans or to modify physiological functions.

In the EU, food supplements are regulated as foods. Harmonised legislation regulates the vitamins and minerals, and the substances used as their sources, which can be used in the manufacturing of food supplements. For ingredients other than vitamins and minerals, the European Commission has established harmonised rules to protect consumers against potential health risks and maintains a list of substances which are known or suspected to have adverse effects on health and the use of which is therefore controlled.

This signifies a concentrated form of algae biomass, often in powder, capsule, or liquid form, taken alongside regular meals to complement a diet.

FOOD SUPLEMENTS

They are not intended to replace food but rather provide additional nutrients.

Food Supplements focus on general nutritional deficiencies, while nutraceuticals target specific health concerns.

NO SPECIFIC HEALTH CLAIMS

Food Ingredient

EU - Defined in Directive 2002/46/EC as *"concentrated sources of nutrients or other substances with a nutritional or physiological effect, in single or combined forms, marketed in dosage units of any kind, including capsules, pastilles, tablets, liquids, sachets, powders, ampoules and other similar forms, intended to be supplemented to the normal diet."*

US - has no specific definition (Unlike the EU) for "food supplement" but considers them under dietary supplements, which are defined in 21 CFR § 101.33 as "a product taken orally that contains a dietary ingredient intended for supplementing the diet."

EXAMPLES

- **Spirulina capsules for protein and vitamin intake**
- **Chlorella tablets for antioxidants**
- **Algae oil supplements for Omega-3 fatty acids**

Spirulina capsules

Spirulina biomass, a rich source of protein, vitamins (B12, A), and antioxidants, sold in capsule form as a dietary supplement.

Astaxanthin liquid

Oleoresin of astaxanthin, a powerful antioxidant from certain microalgae, offered in liquid form as a supplement for its potential health benefits.

Omega-3 supplement

Extract rich in omega-3 fatty acids (EPA and DHA) from microalgae, presented in capsules as an alternative to fish oil supplements.

EU regulations for food products relating to algae

General Food Law Regulation

This overarching regulation establishes the fundamental principles of food law in the EU, ensuring consumer safety and fair practices and it applies to all food, including nutraceuticals.

EU General Food Law Regulation
https://food.ec.europa.eu/horizontal-topics/general-food-law_en

Novel Food Regulation

This regulation applies to food or food ingredients that haven't been used for human consumption within the EU to a significant degree before May 15, 1997. If a nutraceutical is derived from a new source of algae or uses a novel processing method, it might fall under this regulation.

EU Novel Food Regulation
https://eur-lex.europa.eu/eli/reg/2015/2283/oj

European Food Safety Authority (EFSA)
https://www.efsa.europa.eu/en

European Commission - Food Safety
https://food.ec.europa.eu/index_en

Food Supplements Regulation

This regulation addresses specifically food supplements, which are defined as concentrated sources of nutrients or substances with a potential health benefit, intended to supplement a regular diet.
It sets standards for safety, labeling, and marketing of food supplements.

EU Food Supplements Regulation
https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R2454&from=EN

Regulation on Nutrition and Health Claims

This regulation addresses claims made about nutritional and health benefits associated with food products, including potential claims made for nutraceuticals. It ensures that claims are truthful, clear, and based on scientific evidence.

EU Regulation on Nutrition and Health Claim
https://europa.eu/youreurope/business/product-requirements/food-labelling/general-rules/index_en.htm

NUTRACEUTICAL
Nutrition + Health benefit

This term refers to a product derived from algae biomass that possesses specific health benefits beyond basic nutrition.

These benefits can be **disease prevention, improved cognitive function**, or **enhanced energy levels**.

Nutraceuticals are often marketed with specific claims and may require higher doses than food supplements.

Examples:

- Astaxanthin supplements for skin health
- Lutein supplements for eye health
- Phycocyanin supplements for inflammation reduction

NUTRACEUTICAL

No single, universally accepted definition. It's often used interchangeably with "functional food" or "dietary supplement" depending on the context and region.

There is no specific regulation in EU for "nutraceutical." Products with claimed health benefits beyond basic nutrition may fall under the category of "novel food" and require further authorization.

Similar to the EU, in US "nutraceutical" is not formally defined by the FDA. However, products with specific health claims must comply with regulations for dietary supplements or drugs depending on the nature of the claim.

15 SPECIES

12 approved in Europe

Arthrospira platensis

Arthrospira maxima

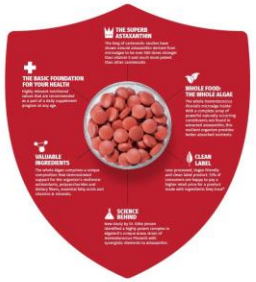
Chlorella vulgaris

Chlorella pyrenoidosa

Chlorella minutissima

Dunaliella salina

Odontella aurita



Haematococcus pluvialis

Aphanizomenon

Nannochloropsis

Diacronema lutheri
(Pavlova)

Euglena

Nostoc sphaeroides

Tetraselmis

Schizochytrium

11 NUTRACEUTICAL EXTRACTS

Xanthophylls from *Phaeodactylum*

Phycocyanin From *Arthrospira*

CGF from *Chlorella*

EPA / DHA from *Nannochloropsis*

Beta-carotene From *Dunaliella*

Astaxanthin from *Haematococcus*

SOD from *Tetraselmis*

Beta-glucan From *Euglena*

DHA from *Schizochytrium*

AFA estract from *Aphanizomenon*

Chlorophyl From *Chlorella*

Spirulina


SMART 138
ALL NATURAL 100% ORGANIC
SPIRULINA POWDER
GLUTEN FREE | VEGAN | NON-GMO | KOSHER
Net Wt 8oz (226g)


MAJU
SPIRULINA
Powder


ZHOU
SPIRULINA
LONGEVITY SUPERFOOD*


NATURAL elements
SPIRULINA
SUPERFOOD POWDER
USDA ORGANIC


TRIQUETRA HEALTH
ORGANIC SPIRULINA
120 Tablets
30 Servings


BIOOPTIMAL
ORGANIC
Spirulina
TABLETS
Nature's Most Nutrient Dense Superfood*
100% Organic·Non-GMO·Vegan


nutricost
Spirulina
Arthrospira Platensis
500MG 500 83


PURECO
ORGANIC SPIRULINA
USDA ORGANIC
75
SUPERFOOD


HEALTH FORCE
SPIRULINA AZTECA
100% TRUGANIC


GNC
SUPERFOODS
SPIRULINA
WITH PHYTONUTRIENTS

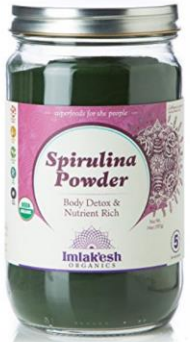

SOURCE NATURALS
EMERALD GARDEN 100% ORGANIC
CHLORELLA
VEGETARIAN SUPERFOOD
200 MG • 600 TABLETS


EARTHRISE
Spirulina Natural
Green Superfood for Longevity*
California Grown
360 TABLETS (500 MG)


SOURCE NATURALS
SPIRULINA
500 MG • 500 TABLETS


PREMIUM HERBAL
Nature's Way
Spirulina
Micro-Algae
PROTEIN SOURCE
100 Capsules / Certified 500 mg


nutrex
PURE
Hawaiian
Spirulina


Spirulina
Powder
Body Detox &
Nutrient Rich
Imlakesh
ORGANICS


SPIRULINA
Important Source of Plant Enzymes
DIETARY SUPPLEMENT
500 mg · 100 Capsules


Organic
Spirulina
Dietary Supplement
50 vegetarian capsules
www.irealherbs.com


now
Certified Organic
Spirulina
1000 mg
Nutrient Rich Superfood
Double Strength
120 Tablets


ANTLER FARMS
100% PURE NEW ZEALAND
ORGANIC
GREENS
Dietary Supplement
Wheat Grass | Barley Grass | Spirulina | Chlorella
7 oz. (200 g)


SPIRULINA
3000mg*
Excellent Source of Vitamin A from Beta Carotene
Natural Source of Chlorophyll


VITAL PROTEINS
CALIFORNIA GROWN
SPIRULINA
Dietary Supplement
120 Capsules • 650mg each


Swanson
GreenFoods
Formulas
100% Certified Organic
Spirulina
Dietary Supplement
180 tablets
Swanson


Spirulina
BLUE-GREEN ALGAE
Premium Green Superfood
60


SPIRULINA
(PLANT PLANKTON)
750 MG
OVERALL WELL-BEING*
DIETARY SUPPLEMENT


pureplanet
Spirulina
NATURE'S PERFECT MULTIVITAMIN
with
VEGAN PROTEIN & ANTIOXIDANTS*


Nature Bound
Spirulina
500mg
Formulated to Help Support Immune Health

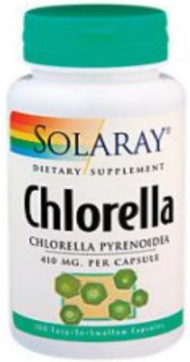

SOURCE NATURALS
100% ORGANIC
SPIRULINA
NATURE'S GREEN SUPERFOOD*
500 MG • 200 TABLETS

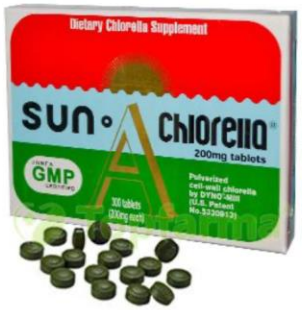
MICROALGAE

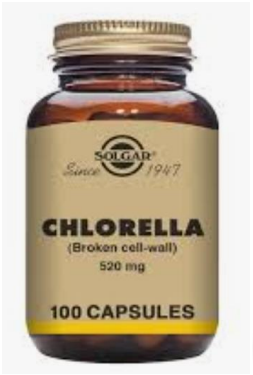
NUTRACEUTICALS

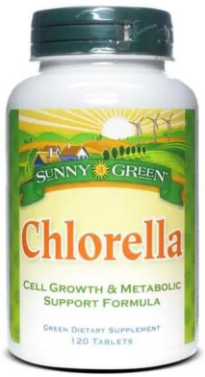
FOOD SUPLEMENTS

Chlorella

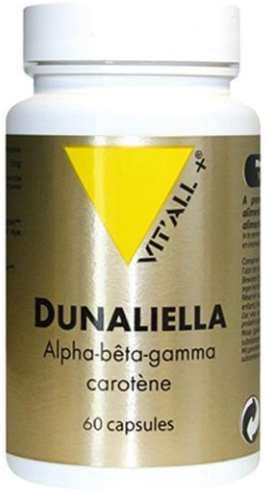








Dunaliella based products

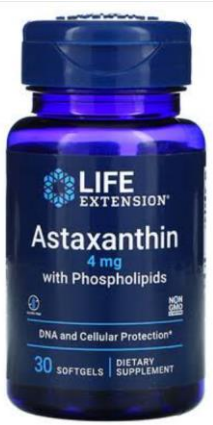


Haematococcus based products

Astaxanthin products from ***Haematococcus*** with a wide range of formulations

Coconut oil

Spirulina



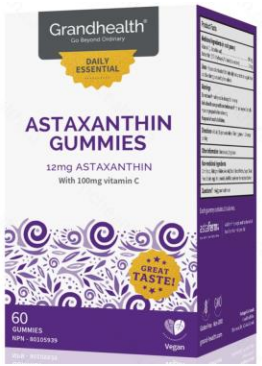
Phospholipids

Carotenoids

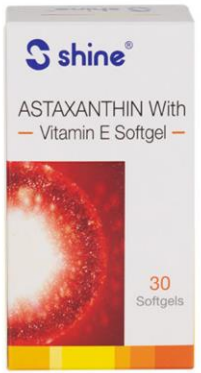
Myrtillus

Liquid Astaxanthin

Vitamin E



collagen



Gummies

Lutein + Zeaxanthin

Olive oil

→ A última imagem não tem legenda

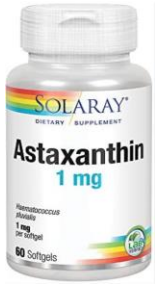
MICROALGAE | NUTRACEUTICALS

FOOD SUPLEMENTS

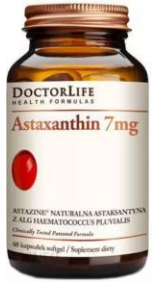
Haematococcus based products

Astaxanthin products from ***Haematococcus*** (1 to 24 mg / capsule)

1 2 4 5 6 7 8 10 12 15 24

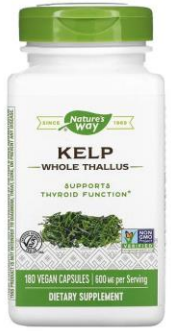


EABA
EUROPEAN ALGAE BIOMASS ASSOCIATION

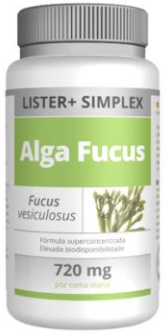


There is no set dosage for astaxanthin. Some studies have recommended doses of 4 milligrams per day. The US Food and Drug Administration (FDA) has approved doses up to 12 milligrams per day.

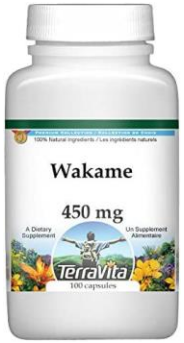
The EFSA Panel on Nutrition, Novel Foods and Food Allergens, delivered an opinion on the safety of astaxanthin when used as a novel food in food supplements at maximum levels of 8 mg/day, 05/02/2020



Ascophyllum nodosum



Fucus vesiculosus

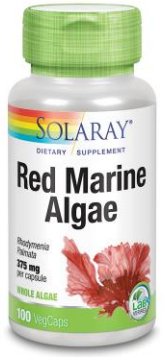


Undaria pinatifida

Laminaria japonica

Macrocystis pyrifera

Macrocystis integrifolia



Rhodymenia palmata

Ecklonia cava

Gelidium

Palmaria palmata

Sacharina latissima

Laminaria digitata

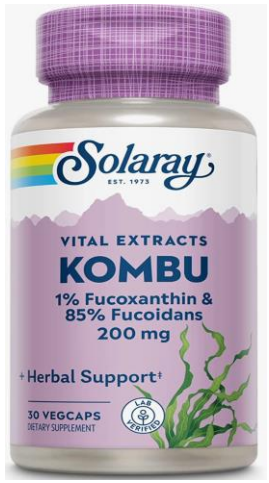
Chondrus crispus

Ulva latuca

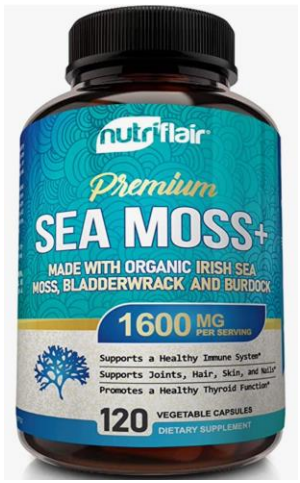
Alaria esculeta

Ecklonia kurome

Marine iodine
Fucus vesiculosus



Fucoxanthin
Undaria pinatifida

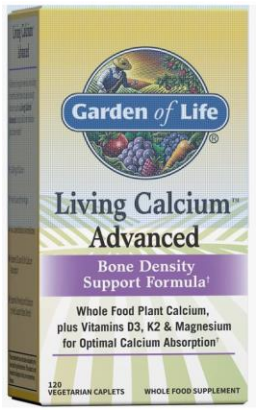


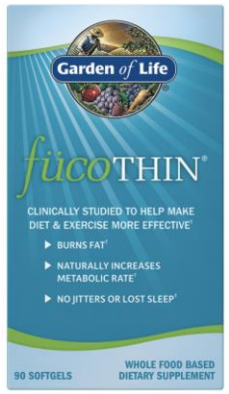
Hyroid & Immune Support
Chondrus crispus

Polysaccharides
Gigartina skottsbergii

Fucoidan
Fucus vesiculosus

Alginic acid
Ascophylum nodosum



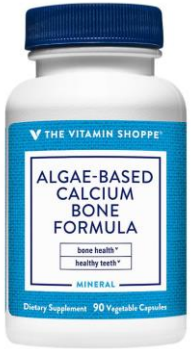


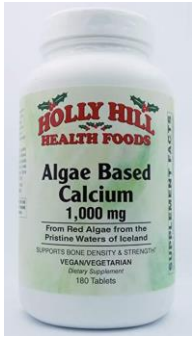
Fucoidan
Fucus vesiculosus

Alginic acid
Ascophylum nodosum

Algae Calcium

Lithothamnion glaciale and ***Phymatolithon calcareum***





SUPPLEMENT FACTS

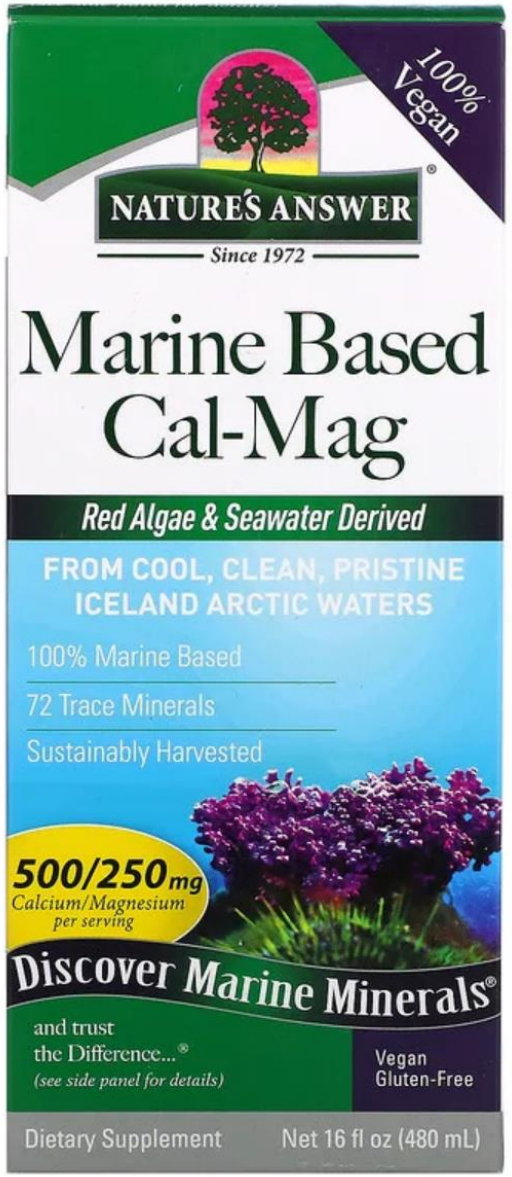
Serving Size 3 Tablets — Servings Per Container 60

	Amount Per Serving	% Daily Value
Vitamin D-3 (lichen, equivalent to 800 IU)	20 mcg	100%
Vitamin K-2 (MK-7 from natto)	85 mcg	71%
Calcium (Aquamin® Icelandic red algae*)	1,000 mg	77%
Magnesium (Aquamin® Icelandic red algae*)	96 mg	23%
Strontium (Aquamin® Icelandic red algae*)	7 mg	**
Silica (Aquamin® Icelandic red algae*)	3 mg	**
Boron (Aquamin® Icelandic red algae*)	93 mcg	**
Vanadium (Aquamin® Icelandic red algae*)	26 mcg	**
Organic Vegan & Red Algae Blend: (Mineralized Icelandic Red Algae, Strawberry^, Raspberry^, Blueberry^, Tart Cherry^, Pomegranate^, Cranberry^ Broccoli Sprouts^, Broccoli^, Tomato^, Carrot^, Spinach^, Kale^)	3,535 mg	**
Citrus Bioflavonoids	150 mg	**

**Daily Value not established

Other Ingredients: Cellulose, cellulose gum, magnesium stearate.
^ Organic

Lithothamnium



Supplement Facts

Serving Size 1 Tablespoon (15 mL)
Servings Per Container about 32

Amount Per Serving		% Daily Value
Calories	32	
Total Carbohydrate	8 g	3%*
Calcium (from Aquamin® Red Algae (from Lithothamnium sp. Thallus) and Seawater)	500 mg	50%
Magnesium (from Aquamin® Seawater (Magnesium Hydroxide))	250 mg	62%
Sodium	15 mg	1%

*Percent Daily Values are based on a 2,000 calorie diet.

Other Ingredients: Purified Water, Glycerin, Natural Vanilla Flavor, Acacia Gum, Xanthan gum.

Suggested Use: As a dietary supplement, take one (1) tablespoon (15 mL) per day. May be taken with water and/or your favorite beverage.

WARNING: KEEP OUT OF REACH OF CHILDREN. Do not use if safety seal is damaged or missing. If you are pregnant, nursing, taking any medications, planning any medical procedure or have a medical condition, consult with your healthcare practitioner before use.

Store in a cool, dry place.

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease.

Aquamin® is a registered trademark of Marigot Limited.

26124IFCBOX REV 0001

0 83000 26124 4

Manufactured by:
NATURE'S ANSWER®
85 Commerce Drive
Hauppauge, NY 11788 USA
www.naturesanswer.com
For product information, call
(800) 439-2324

MICROALGAE | NUTRACEUTICALS

FOOD SUPLEMENTS

The most expensive algae supplement

Supplement Starter Kit	€575
One-Off Purchase	LYMA Life Limited Edison House 223-231 London, NW1 5QT UK +44-2070970198 www.lyma.life EMPLOYEES 13 SALES 5.50 M€ 2021
90 Days	
Quantity	

The microalgae *Nannochloropsis oceanica* was shown to produce relatively high levels of vitamin D_3 (1 ± 0.3 µg/g dry matter) after exposing growing cultures to UVB.

Not only algae

Ten Proven Ingredients. One Perfect Formula

Turmeric Extract

HydroCurc™ (600mg) Highly Specialised Anti Inflammatory Curcumins

Prebiotic Beta Glucans

Wellmune® Blend (250mg) Immunity Boosting Natural Fibres

Defence Protein

Levagen®+ (350mg) Highly Localised Naturally Occuring Fatty Acid

Plant Based Vitamin D

Vita-Algae D3™ (2000 i.u.) Algae-Derived Immunity Boosting Vitamin D3

More than a vitamin pill. Taking you beyond a balanced diet.

Ashwagandha Root Extract

KSM-66 Ashwagandha® (600mg) Full Spectrum Ayurvedic Adaptogen

Smart Nootropic

Cognizin® (250mg) Highly Purified Neuro Nutrient Citicoline

Lycopene Nutrient

Lycored Lycopene™ (30mg) Powerful Natural Carotenoid

Stable Vitamin K

K2Vital Delta® (75µg) Bone Strengthening Vitamin K2 as MK7

Soluble Keratin

Cynatine HNS® (500mg) Active Keratin Cosmeceutical for Hair, Skin and Nails

Saffron Extract

affron® (28mg) Unique Standardised Saffron Actives

7.

Approvals in the food catalog

The Novel Food status Catalogue (New) (https://food.ec.europa.eu/safety/novel-food/novel-food-status-catalogue_en) **is a non-binding tool that lists products of animal and plant origin, algal species, food cultures and other substances subject to the Novel Food Regulation, based on information provided by the EU Member States.**

This should be read in conjunction with the Union list of novel foods. In simple words, it is a tool to check if a product can be put on the EU market as food or food supplement, or it has to be authorised by the EU because it is Novel and as such has to pass a safety assessment. Algae products in the Catalogue include more than 60 entries covering several species of microalgae and seaweed whole biomass and products derived thereof (extracts, oils).

There are six possibilities for a generic algal product, a Food Business Operator (FOB) is interested in: Approvals in the Food Catalog

1.The product is listed in the Catalog as "**Not novel in food**", i.e. it was present in EU people diet before 1997 and is recognised as safe. It is a "normal" food, and its access to the market is not subject to the pre-market authorisation in accordance with Regulation (EU) 2015/2283. Example: wheat (Triticum aestivum L.) seeds; spirulina biomass .

2. The product is listed as "**Not novel in food supplements**". According to the information available to Member States' competent authorities, this product was used in food supplements in the EU before 15 May 1997. Therefore, its use in food supplements is not considered to be novel and is not subject to the pre-market authorisation in accordance with Regulation (EU) 2015/2283. Any other food uses of this product, other than as, or in, food supplements, might be considered to be novel and consequently might need to be authorised pursuant to the requirements of the Novel Food Regulation (EU) 2015/2283 before they can be placed as food on the EU market. Example: wheat aerial parts; ***Haematococcus*** biomass.

3. The product is listed as "**Authorised Novel Food**" This is an authorised novel food and it has been included in the Union list established by Commission Implementing Regulation (EU) 2017/2470. The authorisation for the novel food in the Union list https://food.ec.europa.eu/safety/novel-food/authorisations/union-list-novel-foods_en identifies under what conditions of use (table 1) and specifications (table 2) this novel food can be placed on the EU market. Example: Wheat bran extract; Tetraselmis biomass.

4. The product is listed "**Novel Food**". According to the information available to Member States' competent authorities, this product was not consumed in the EU to a significant degree as a food before 15 May 1997. Therefore, a pre-market authorisation in accordance with Regula tion (EU) 2015/2283 is required before it can be placed as food on the EU market. Example: Fermented (fermentation with baker's yeast) wheat germ extract, ***Chlamydomonas Reinhardtii*** biomass.

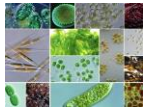
5. The product is listed "**Subject To A Consultation Request**" - This product is currently the subject of a consultation request to a Member State submitted pursuantto the requirements of Implementing Regulation (EU) 2018/456 on the procedural steps of the consultation process for determination of novel food status.

6. The product is not listed in the Catalog: it is the FOB responsibility to comply with Regulation (EU) 2015/2283. When a food business operator is unsure about a food as novel, they shall consult the competent authorities of the EU country where they first intend to place the food on the market. In doing so, the provisions on Commission Implementing Regulation (EU) 2018/456 should be followed.

EABA Members please contact EABA for any additional details or explanations

EUROPEAN ALGAE BIOMASS ASSOCIATION

EU Novel Food State-of-the-art
10 years later



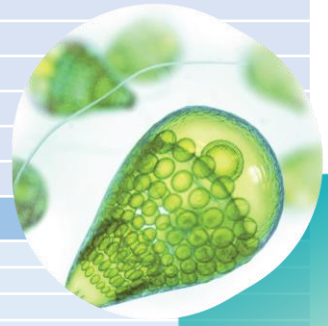
Information paper
EABA Novel Food Information
www.algae-novel-food.com

EABA Linkedin Group (2750 members)
Information and awareness
www.linkedin.com/groups/8177076/

ALGAE BIOMASS Novel Foods October 28-29 • 2014

First EABA NF Workshop
Cascais, Portugal,
November 2014

Microalgae species			Notes
NEW ENTRIES IN THE NOVEL FOOD CATALOG https://ec.europa.eu/food/food-feed-portal/screen/novel-food-catalogue/search			
Chlorella sorokiniana Shihira & R.W.Krauss 1965	Not novel in food	FI	already published
Dunaliella salina (Dunal) Teodoresco 1905	Not novel in food supplements	FS	from BELFRIT - Belgium - France - Italy food supplements list published in the national OJ
Graesiella emersonii (Shihira & R.W.Krauss) H.Nozaki, M.Katagiri, M.Nakagawa, K.Aizawa & M.M.Watanabe 1995	Not novel in food	FI	previously *Chlorella emersonii*
Haematococcus lacustris (Girod-Chantrans) Rostafinski 1875	Not novel in food supplements	FS	from BELFRIT, should be listed pluvialis, the most common name
Jaagichlorella luteoviridis (Chodat) Darienko & Pröschold 2019 Chlorella luteoviridis	Not novel in food	FI	already published
Limnospira fusiformis (Voronichin) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019	Not novel in food	FI	formerly *Arthrospira* (spirulina)
Limnospira indica (Desikachary & N.Jeeji Bai) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019	Not novel in food supplements	FS	formerly *Arthrospira* (spirulina)
Limnospira maxima (Setchell & N.L.Gardner) Nowicka-Krawczyk, Mühlsteinová & Hauer 2019	Not novel in food	FI	formerly *Arthrospira* (spirulina)
Parachlorella kessleri (Fott & Nováková) Krienitz, E.H.Hegewald, Hepperle, V.Huss, T.Rohr & M.Wolf 2004	Not novel in food	FI	already published
Scenedesmus vacuolatus Shihira & Krauss	Not novel in food	FI	the current name is *Coelastrella vacuolata* (I. Shihira & R.W. Krauss) Hegewald & N. Hanagata
Spirulina major Kützing ex Gomont 1892	Not novel in food	FI	Also reported *Arthrospira platensis* Gomont 1892
PREVIOUSLY ALREADY IN THE NOVEL FOOD CATALOG			
Aphanizomenon flos-aquae Ralfs ex Bornet & Flahault 1886	Not novel in food supplements	FI	two entries in NFC for the same species
Arthrospira platensis Gomont 1892	Not novel in food	FI	= *Oscillatoria platensis* (Gomont) Bourrelly 1970; *Spirulina platensis* (Gomont) Geitler 1925
Auxenochlorella protothecoides (Krüger) Kalina & Puncochárová 1987	Not novel in food	FI	
Chlorella vulgaris Beyerinck [Beijerinck] 1890, Chlorella pyrenoidosa, Jaagichlorella luteoviridis	Not novel in food	FI	*Chlorella sp.* is present in NFC
Euglena gracilis G.A.Klebs 1883	Whole: authorized novel food (Union list)	FI	
Odontella aurita (Lyngbye) C.Agardh 1832	Whole: authorized novel food (Union list)	FI	
Tetraselmis chui Butcher 1959	Whole: authorized novel food (Union list)	FI, FS	
Auxenochlorella pyrenoidosa (H. Chick) Molinari & Calvo-Pérez 2015	Not novel in food	FI	[= *Chlorella pyrenoidosa* H. Chick 1903]
ALGAL NF PRODUCTS IN THE UNION LIST			
Astaxanthin-rich oleoresin from *Haematococcus pluvialis* algae	Food Supplement		Astaxanthin-rich oleoresin from *Haematococcus lacustris* (the current name)
Odontella aurita	Food		*Odontella aurita*
Schizochytrium sp. oil rich in DHA and EPA	Food, FS		'DHA and EPA-rich oil from the microalgae Schizochytrium sp.'
Schizochytrium sp. (ATCC PTA-9695) oil	Food, FS		'oil from the microalgae *Schizochytrium* sp.'.
Schizochytrium sp. (FCC-3204) oil	Infant formula, FS		'oil from the microalgae *Schizochytrium* sp.'.
Schizochytrium sp. oil	Food, FS		'oil from the microalgae *Schizochytrium* sp.'.
Schizochytrium sp. (T18) oil	Food, FS		'oil from the microalgae *Schizochytrium* sp.'.
Schizochytrium sp. (WZU477) oil	Infant formula		'oil from the microalgae *Schizochytrium* sp.'.
Algal oil from the microalgae *Ulkenia sp.*	Food		'oil from the micro-algae Ulkenia sp.'
Euglena gracilis	Food, FS		'dried biomass of *Euglena gracilis* algae'.
Tetraselmis chui	Food, FS		'dried microalgae *Tetraselmis chui*'



● New entries ● Old entries FS = supplement FI = ingredient

Macroalgae species			Notes
NEW ENTRIES IN THE NOVEL FOOD CATALOG https://ec.europa.eu/food/food-feed-portal/screen/novel-food-catalogue/search			
Alsidium helminthochorton (Schwendimann) Kützing 1843	Not novel in food supplements	SW FS	
Corallina officinalis L. 1758	Not novel in food supplements	SW FS	FROM BELFRIT
Durvillaea antarctica (Chamisso) Hariot 1892	Not novel in food supplements	SW FS	FROM BELFRIT, kind of FUCUS
Ecklonia cava Kjellman 1885	Whole: not novel in food supplements.	SW FS	*Ecklonia cava* phlorotannins - authorized novel food as FS (included in Union list)
Erythroglossum laciniatum (Lightfoot) Maggs & Hommersand 1993	Not novel in food	SW FS	
Eucheuma denticulatum (N.L.Burman) Collins & Hervey 1917	Not novel in food supplements	SW FS	
Eucheuma horridum J. Agardh 1852	Not novel in food supplements	SW FS	
Gelidium amansii (J.V. Lamouroux) J.V.Lamouroux 1813	Not novel in food	SW FS	
Gelidium corneum (Hudson) J.V.Lamouroux 1813	Not novel in food	SW FS	
Gracilaria gracilis (Stackhouse) M. Steentoft, L.M. Irvine & W.F. Farnham 1995	Not novel in food supplements	SW FS	
Laminaria hyperborea (Gunnerus) Foslie 1885	Not novel in food	SW FI	status uprated from FS to FI
Macrocystis pyrifera (L.) C. Agardh 1820	Not novel in food supplements	SW FS	Giant kelp
Mastocarpus stellatus (Stackhouse) Guiry 1984	Not novel in food supplements	SW FS	
Neopyropia leucosticta (Thuret) L.-E.Yang & J.Brodie 2020	Not novel in food	SW FI	the correct name is now *Pyropia leucosticta* (Thuret) Neefus & J.Brodie
Porphyra dioica J.Brodie & L.M.Irvine 1997	Not novel in food	SW FI	*Porphyra tenera* already in the NFC
Porphyra purpurea (Roth) C.Agardh 1824	Not novel in food	SW FI	
Porphyra umbilicalis Kützing 1843 Erythroglossum laciniatum (Lightfoot) Maggs & Hommersand 1993	Not novel in food	SW FI	
Pyropia yezoensis (Ueda) M.S.Hwang & H.G.Choi 2011	Not novel in food	SW FI	
Saccharina japonica (Areschoug) C.E.Lane, C.Mayes, Druehl & G.W.Saunders 2006	Not novel in food	SW FI	
Sargas*sum fusiforme* (Harvey) Setchell 1931	Not novel in food	SW FI	Synonym: Hizikia fusiformis (Harvey) Okamura 1932
Ulva intestinalis Linnaeus 1753	Not novel in food	SW FI	
PREVIOUSLY ALREADY IN THE NOVEL FOOD CATALOG			
Alaria esculenta (Linnaeus) Greville 1830	Not novel in food	SW FI	NOT NEW ADDITION
Ascophyllum nodosum (Linnaeus) Le Jolis 1863	Not novel in food	SW FI	= *Fucus nodosus* Linnaeus 1753; *Ascophyllum laevigata* Stackhouse 1809, *Ozohallila nodosa*, *Ozothallia nodosa*, *Physocaulon nodosum*
Chondrus crispus Stackhouse 1797,	Not novel in food	SW FI	
Mastocarpus stellatus (Stackhouse) Guiry 1984	Not novel in food	SW FI	
Eisenia bicyclis (Kjellman) Setchell 1905	Not novel in food	SW FI	
Fucus serratus L. 1773	Not novel in food	SW FI	
Fucus spiralis L. 1753	Not novel in food	SW FI	
Fucus vesiculosus L. 1773	Not novel in food	SW FI	
Gracilariopsis longissima (S.G.Gmelin) Steentoft, L.M.Irvine & Farnham1995	Not novel in food	SW FI	
Himanthalia elongata (L.) S.F. Gray 1821	Not novel in food	SW FI	
Laminaria digitata (Hudsoon) J.V. Lamouroux 1813	Not novel in food	SW FI	
Pyropia tenera (Kjellman) N.Kikuchi, M.Miyata, M.S.Hwang & H.G.Choi 2011	Not novel in food	SW FI	Synonim of Porphyra tenera, in the NFC already
Palmaria palmata (Linnaeus) F.Weber & D.Mohr 1805 Rhodymenia palmata	Not novel in food	SW FI	
Phymatolithon calcareum (Pallas) W.H.Adey & D.L.McKibbin ex Woelkering & L.M.Irvine 1986	Not novel in food	SW FI	Synonim of Lithothamnion calcareum, in the NFC already
Saccharina latissima (L.) C.E.Lane, C.Mayes, Druehl & G.W.Saunders2006	Not novel in food	SW FI	
Ulva lactuca Linnaeus 1753 *Porphyra purpurea* (Roth) C. Agardh 1824	Not novel in food	SW FI	
Undaria pinnatifida (Harvey) Suringar 1873	Not novel in food	SW FI	

MICROALGAE

23 species

There is an evoution is taxonomy that imapcts the names of alge in the Food Catalog and food safe or novel food.

5

Limnospira = Arthrospira = Spirulina

9

Chlorella

= globally 11 microalgae species

Aphanizomenon flos-aquae

Arthrospira platensis
Limnospira fusiformis
Limnospira indica
Limnospira maxima
Spirulina major

Auxenochlorella protothecoides
Auxenochlorella pyrenoidosa
Chlorella luteoviridis
Chlorella pyrenoidosa,
Chlorella sorokiniana
Chlorella vulgaris
Jaagichlorella luteoviridis
Parachlorella kessleri
Graesiella emersonii

Dunaliella salina
Euglena gracilis

Haematococcus lacustris
Odontella aurita
Scenedesmus vacuolatus
Tetraselmis chui

Ulkenia sp.

Schizochytrium sp.

MACROALGAE

38 species

Alaria esculenta
Alsidium helminthochorton

Ascophyllum nodosum

Chondrus crispus

Corallina officinalis
Durvillaea antarctica
Ecklonia cava
Eisenia bicyclis
Erythroglossum laciniatum

Eucheuma denticulatum
Eucheuma horridum

Fucus serratus
Fucus spiralis
Fucus vesiculosus

Gelidium amansii
Gelidium corneum

Gracilaria gracilis
Gracilariopsis longissima

Himanthalia elongata

Laminaria digitata
Laminaria hyperborea

Macrocystis pyrifera

Mastocarpus stellatus
Neopyropia leucosticta

Palmaria palmata
Phymatolithon calcareum

Porphyra dioica
Porphyra purpurea
Porphyra umbilicalis

Pyropia tenera
Pyropia yezoensis
Rhodymenia palmata

Saccharina japonica
Saccharina latissima

Sargassum *fusiforme*

Ulva intestinalis
Ulva lactuca

Undaria pinnatifida

8.

Future trends and algae uniqueness for food

Which is the most unique characteristic of algae as food?

1. **Spirulina**: earthy, slightly grassy, with a hint of seaweed flavor, some describe it as nutty or slightly sweet.
2. ***Chlorella***: similar to spirulina but with a more pronounced grassy flavor and a slightly bitter aftertaste.
3. **Dulse** *(Palmaria palmata):* salty and savory, with a hint of ocean brine, can also have a slightly chewy texture.
4. **Nori** *(Pyropia):* mildly salty and briny, with a subtle umami flavor, often used in sushi rolls.
5. **Wakame** *(Undria pinnatifida):* ildly sweet with a slightly salty taste, tender texture with a slight crunch.
6. **Kombu** *(Sacharinna):* savory and umami-rich, often used to enhance the flavor of broths and soups.
7. **Arame (***Eisenia bicyclis)*: mildly sweet with a delicate flavor reminiscent of the ocean, often used in salads and stir-fries.
8. ***Sargassum*** *(Sargassum):* salty and slightly bitter, with a chewy texture, can have a strong marine flavor.
9. **Agar-agar** *(Gelidium):* virtually tasteless on its own, with a neutral flavor and gelling properties, a vegan gelatin alternative
10. ***Ulva* (sea lettuce)**: mildly salty with a subtle vegetal taste, often used in salads or as a garnish.

Algae most relevant uniqueness for food is related with algae taste profiles.

Technological advancements

- **Algae cultivation:** Research is ongoing to develop cost-effective methods for growing different algae strains, enabling wider use.
- **Processing innovations:** New methods are being developed to extract and purify valuable components from algae while preserving their benefits.
- **Flavor improvements:** Efforts are underway to address challenges related to unappealing flavors or textures of some algae strains.
- **Innovative products:** Algae are being used to develop various food products like plant-based meat alternatives and snacks.
- **Functional ingredients:** Algae are used as thickeners, stabilizers, and emulsifiers in food manufacturing. Additionally, specific strains offer potential health benefits.

Market awareness expansion

- **Highly nutritious:** Algae is rich in protein, vitamins, minerals, and antioxidants, making it appealing for health-conscious consumers.
- **Sustainable growth:** Compared to traditional crops, algae requires less land, water, and resources.
- **Diverse products:** The market offers a growing variety of algae-based products, including protein powders, snacks, and meat alternatives.
- **Increased investment:** Growing interest from investors is fueling research and development in the algae food sector.
- **Overcoming challenges:** Educating consumers is crucial to address potential cultural barriers and encourage wider adoption of algae-based foods.

Thank You!

From the book:
The Business Case Roadmap

Vítor Verdelho

General Manager

EUROPEAN ALGAE BIOMASS ASSOCIATION

President

Associação Portuguesa de Algologia Aplicada