



Finding Life Balance
in the Ocean



The first photosynthetic organism
3.5 billion years ago,

MICROALGAE



A sustainable answer found in the sea,
Brootlab leads next-generation functional microalgae solutions.



A functional microalgae ingredient production platform for a sustainable future

Amid complex environmental challenges such as the climate crisis, resource depletion, and population growth, Brootlab, inspired by the ocean, develops sustainable biomaterials applicable to various fields such as health supplements, inner beauty, and food by utilizing smart artificial cultivation technology to transform microalgae into high-functional ingredients. As a leader in the marine bio industry, Brootlab is simultaneously achieving the foundation of self-reliance in the sustainable marine biomaterial industry and expanding into the global market through microalgae-based solutions, creating a future where humans and nature can coexist in harmony.

bio + root + laboratory

The harmony of B' from bio, root signifying origin, and research and development based on core technology

Microalgae
ingredient R&D

Functional ingredient
extraction and
standardization

Mass cultivation and
production infrastructure
solutions

Vision

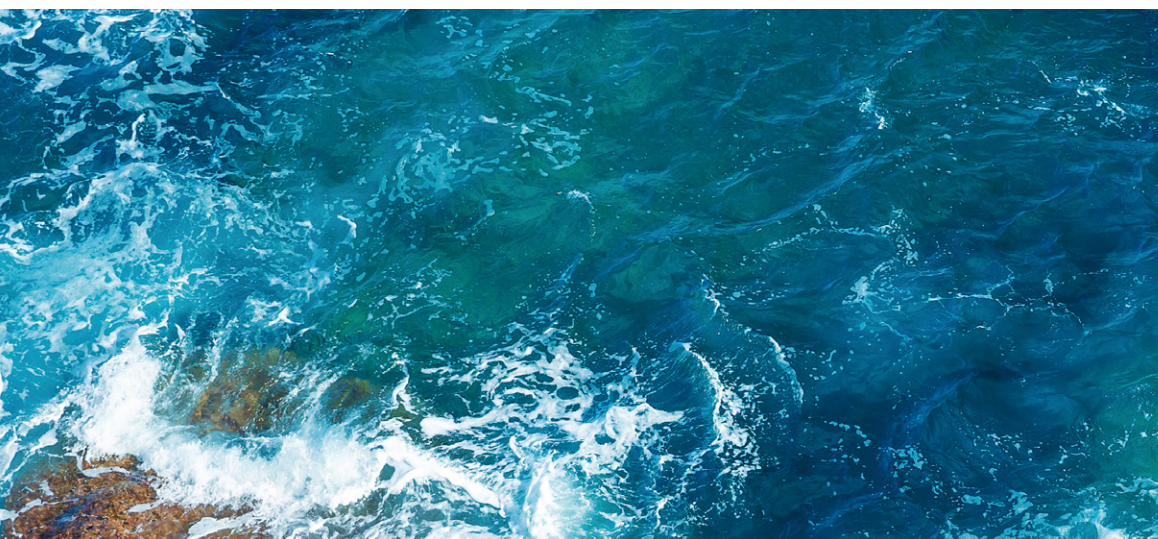
Developing safe future food to protect nature and humanity, and leading carbon neutrality

Mission

Based on science and technology, we develop safe and reliable materials and products to realize the values of a healthy life for our customers and a sustainable planet.

Core Values

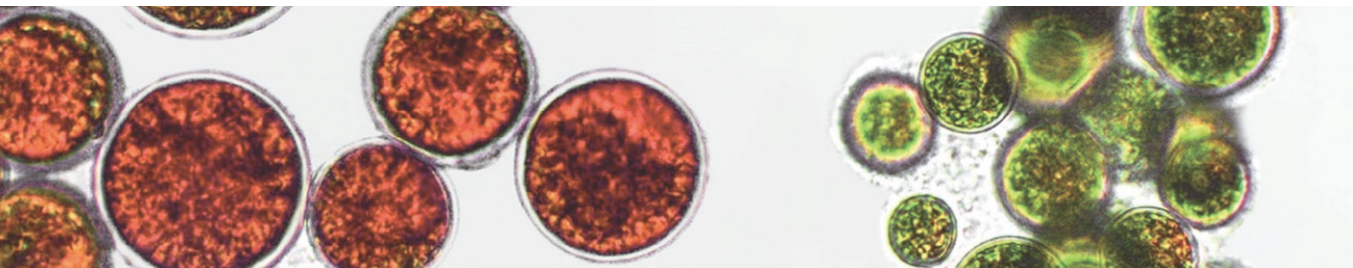
Human / Nature / Responsibility



Resources found in the ocean, Microalgae

The first photosynthetic organisms 3.5 billion years ago, microscopic single-celled life forms

Microscopic, single-celled photosynthetic organisms inhabiting seas and rivers, composed of natural oils, proteins, carbohydrates, and more appearing about 3.5 billion years ago as the earth's first photosynthetic organisms, they absorbed carbon dioxide and released oxygen and water approximately 25,000 species exist worldwide, with about 1,300 species found in Korea



Superfoods, the future complete food verified by international organizations

WHO

Recognized as a complete food and superfood

NASA

Developed as space food

FAO, UNIDO

Recognized as the future complete food

- Building a mass production base through public-private collaboration -

Application fields utilizing microalgae

Food, cosmetics, pharmaceuticals, bio-based ingredients



Microalgae is a next-generation bioresource that encompasses economic feasibility, potential for high added value, eco-friendliness, and industrial scalability.

High-protein source

+

high-efficiency production

+

low resource consumption

01 High production efficiency and economic feasibility

- Can be produced with less land, water, and energy compared to conventional sources for the same protein yield
- Rapid growth rate: proliferates 2-3 times a day → excellent yield per unit time
- Can be cultivated indoors in limited spaces → enables high-density production structures such as urban and vertical cultivation
- Exhibits significantly lower carbon emissions and superior production cost efficiency compared to traditional plant and livestock resources.

Water consumption compared to beef production
Up to 50 times less

Cultivation area compared to beef production
Over 300 times less

In contrast, protein content
At least 25 to as much as 100 times higher

02 Diversity of useful substances and potential for high added value

- In addition to protein, high-functional ingredients such as antioxidants, fatty acids, and pigments can be extracted
- Multifunctional formulas can be developed from a single strain → applicable across multiple industries such as health supplements and cosmetics
- Well-suited to the growing trend of clean-label and natural ingredient demand
- High potential as a future edible resource

03 Eco-friendliness and sustainability

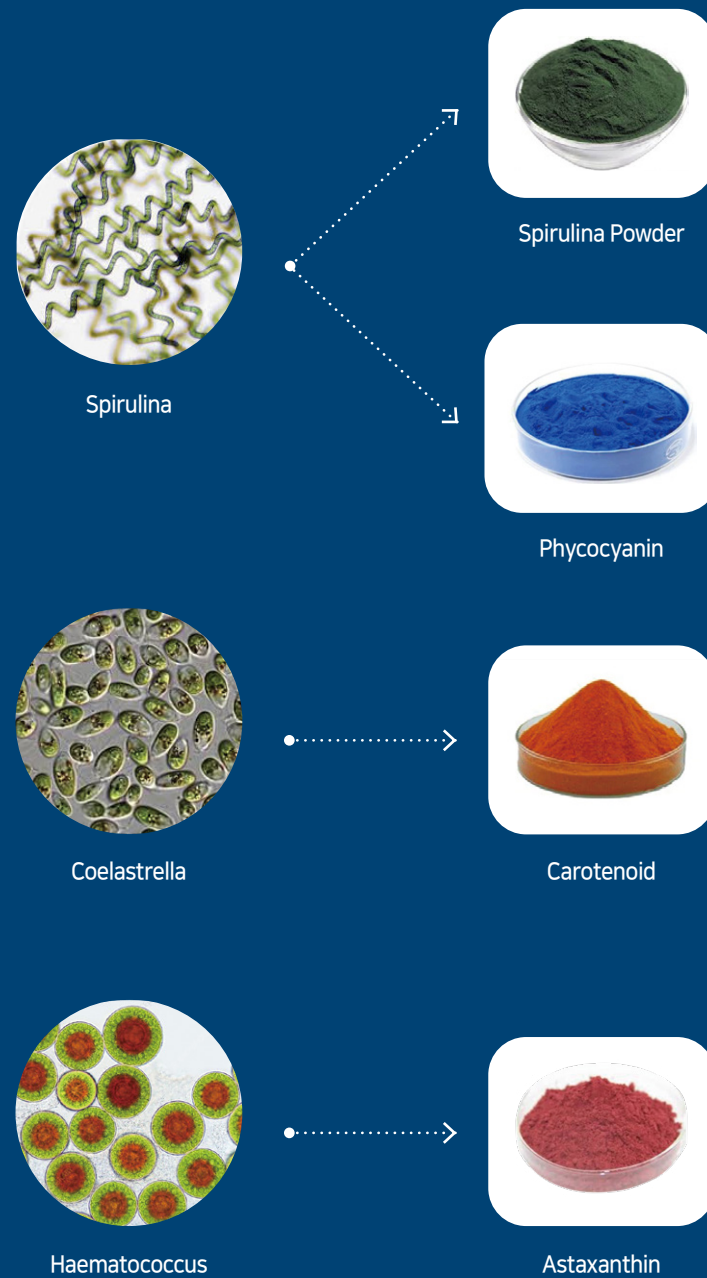
- As photosynthetic organisms, they absorb CO₂ → a resource contributing to carbon neutrality
- Can utilize wastewater, seawater, and low-quality water → enabling resource-circulating production
- Non-terrestrial ingredient → no competition with farmland, independent of food and feed issues
- As a marine and non-agricultural resource, well-suited for ESG and sustainable biomaterial industry

04 Industrial scalability and global potential

- Broad business scalability across chemistry (White), agriculture (Green), and pharmaceuticals (Red)
- Applicable to various industries such as food, feed, energy, pharmaceuticals, and environmental remediation
- Continuous expansion of B2B demand, particularly in high-growth sectors such as health supplements, inner beauty, plant-based proteins, and natural pigments
- Acceleration of industrialization through the integration of AI-based smart cultivation and extraction-purification technologies

Functional ingredient products from microalgae

extractable at Brootlab



Spirulina

One of the oldest microalgae on earth, with three existing species (platensis, fusiformis, **maxima**)

PROTEIN
60%

- Spirulina contains more than 60% protein
- It Has over 90% digestibility and absorption rate



- Recognized as a functional material by authorities such as the Korean MFDS and the FDA
- A ingredient with assured safety



- Rich in useful components such as phycocyanin
- High value for applications including antiviral use and biofuel



Phycocyanin

A natural pigment protein extracted from spirulina



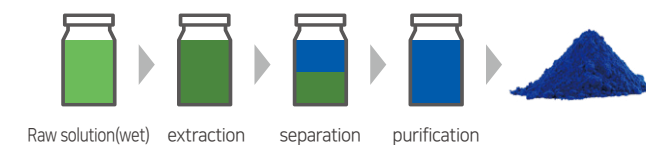
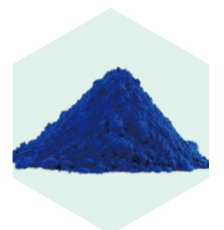
- C-PC (crude-phycocyanin)
- APC (allophycocyanin)
- PE (phycoerythrin)



- Approved in 2013 by the U.S. FDA as a food color additive
- Defined by the Korean MFDS as spirulina pigment



- Inhibits reactive oxygen species, with antioxidant, anticancer, and anti-inflammatory effects
- Various benefits including arthritis improvement and radiation elimination



Coelastrella

A type of microalgae specialized in removing high concentrations of ammonia nitrogen



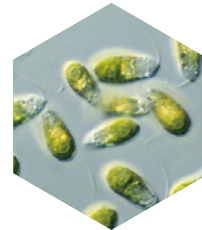
- Shows significantly high growth rate under nitrogen-deficient conditions



- Acts as an antioxidant for eye health, anticancer effects, and skin health
- Rich in lutein, zeaxanthin, and beta-carotene



- Applicable to food (health functional food, dietary supplements)
- Also applicable across various industries including cosmetics and pharmaceuticals



Carotenoid

A functional pigment extracted from Coelastrella



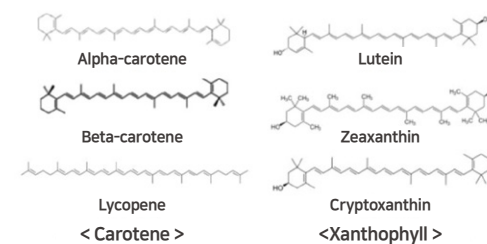
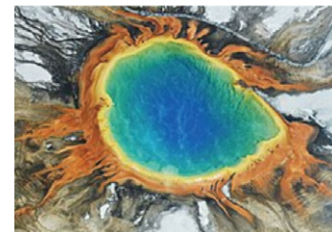
- Fat-soluble pigment found in the cells of plants and algae
- Serves as a precursor of vitamin A



- Functions as an antioxidant deactivating free radicals
- Contributes to maintaining mucosal formation and epithelial cell growth



- Widely used as a yellow pigment food additive



Haematococcus

A unicellular green freshwater alga that produces astaxanthin, a powerful antioxidant, under stress conditions



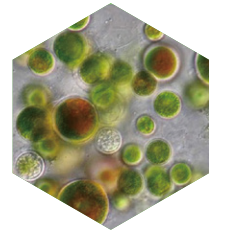
- Rich in astaxanthin, known to support eye health more effectively than that from crustaceans or aquatic animals



- Turns red under strong light and high salinity conditions



- A natural source of high-purity astaxanthin, unlike synthetic astaxanthin



Astaxanthin

A functional ingredient extracted from Haematococcus



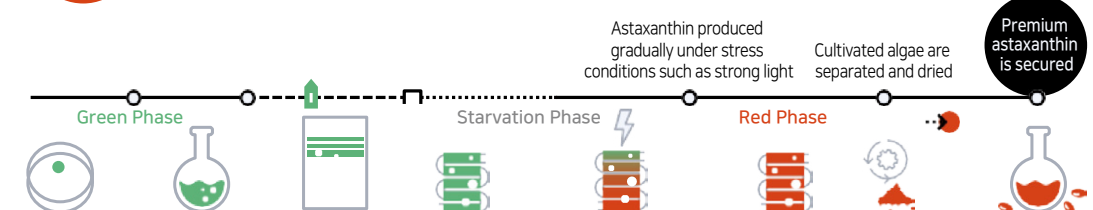
- A red pigment known as the most powerful antioxidant among all antioxidants on earth



- Provides benefits such as antioxidation, anti-inflammation, and eye health (macular protection, eye fatigue relief)
- Skin anti-aging (wrinkle improvement, moisturizing, etc.), cardiovascular health, and brain protection



- Natural astaxanthin offers higher absorption and safety
- Among natural pigments, it possesses a wide range of health benefits.



The first core technology for large-scale microalgae cultivation in Korea

Among microalgae, the global market for spirulina is expanding, but Korea remains dependent on imports. Brootlab aims to create a related market through large-scale domestic production of spirulina ingredients, which are currently nonexistent in Korea, and carries out the entire process of developing valuable biomaterials with its own technology.

Spirulina production: 128,000 tons in 2017 > projected to increase to 322,000 tons by 2026.

Development of microalgae cultivation technology focused on spirulina > improving productivity and enhancing stability

Core technologies for large-scale cultivation



Continuous air delivery and agitation technology

Utilizing sedimentation and spoilage prevention technology to produce high-quality raw materials



Optimization of light intensity and exposure

Establishing optimal light conditions for microalgae cultivation



Optimization of medium components and concentration

Improving profitability by reducing conventional medium components and concentration

Maximized production efficiency + eco-friendly production

Conventional microalgae cultivation technologies rely on farming and extraction from the ocean, which have limitations due to low efficiency and high vulnerability to rapid climate change. Brootlab introduces a closed production system that fundamentally blocks external contaminants, ensuring a stable supply of high-quality ingredients. In addition, planned production is possible regardless of external environmental factors, realizing an eco-friendly production system with maximized efficiency.

Maximizing resource (cost) efficiency in the production process based on the same production volume (protein supply source), Establishing a ground-based smart aquafarm system for large-scale microalgae production.

Patent application

출원 번호 통지서

출원 일자 2023.08.24
특기사항 심사청구(후) 공개신청(후)
출원번호 10-2023-0111400 (청구번호 1-1-2023-053596-48)
(DNA합성코드:1130)
출원인명칭 주식회사 브루트랩(2022-064930-2)
대리인명칭 특허법인 한변상파(2016-100001-1)
발명자성명 나요수 이재경 고영진 차준성
발명의명칭 공기연달식 미세조류 농장용 반응기 및 이를 포함하는 배양시스템

Air-Lift type microalgae photobioreactor and cultivation system incorporating it

Productivity improvement
(6 times higher compared to conventional methods)

Stability enhancement
(Year-round production possible)

Safety assurance
(Heavy metal concentration reduced by 9-27 times compared to overseas products)

Completion of Korea-style microalgae foundry technology



Securing the potential for biomaterial ingredient and product development

through stable production and supply of domestically produced microalgae ingredients

1 Spirulina

Primary goal: Ingredient for general food and additives
Secondary goal: Ingredient for health functional food ingredients



Securing large-scale cultivation technology
High content of phycocyanin, chlorophyll, etc.
Final goal: Standardization of functional ingredients

Key achievements and future plans

- Securing ingredients through indoor closed large-scale production technology
- Acquiring stability data (shelf-life testing)
- Planning to file the first MFDS product manufacturing report in Korea in 2025
- Expanding application fields (food, feed, construction materials, etc.)

Available for supply

3 Complex carotenoids

Ingredient development of complex extracts (functional ingredients) derived from Coelastrella



Extraction technology: Target yield of 15% or higher
Final goal: Standardization of functional ingredients
Functionality: Antioxidant, wrinkle improvement, whitening

Key achievements and future plans

- Achieved primary goal of securing complex extracts (based on 10L scale)
- Verification of wrinkle improvement functionality (in-vitro and in-vivo)
- Development of extraction technology and functional cosmetics through a national R&D project (2024-2025, Ministry of Maritime Affairs and Fisheries)
- Preparing to file a fundamental patent for Coelastrella

To be developed (~2027)

2 Phycocyanin

Content secured at 400 mg/g, purity of 1.5 or higher



Extraction technology: Yield of 40% or higher
Separation/purification technology: Purity of 1.5 secured
Final goal: Standardization of functional ingredients

Key achievements and future plans

- Achieved primary goal of purity 1.5 or higher (based on 100L scale)
- Secured lab-scale separation/purification technology with purity of 3.0 or higher
- Developing extraction and separation/purification technologies through a national R&D project (2023-2025, Ministry of Maritime Affairs and Fisheries)
- Completed development of technology achieving purity of 3.0 or higher by 2024 as the secondary goal

Available for supply
(Under development for individual recognition)

4 Astaxanthin

Ingredient development of complex extracts (functional ingredients) derived from Haematococcus



Extraction technology: Target purity of 95% or higher
Final goal: Standardization of functional ingredients
Functionality: Antioxidant, skin improvement, eye health

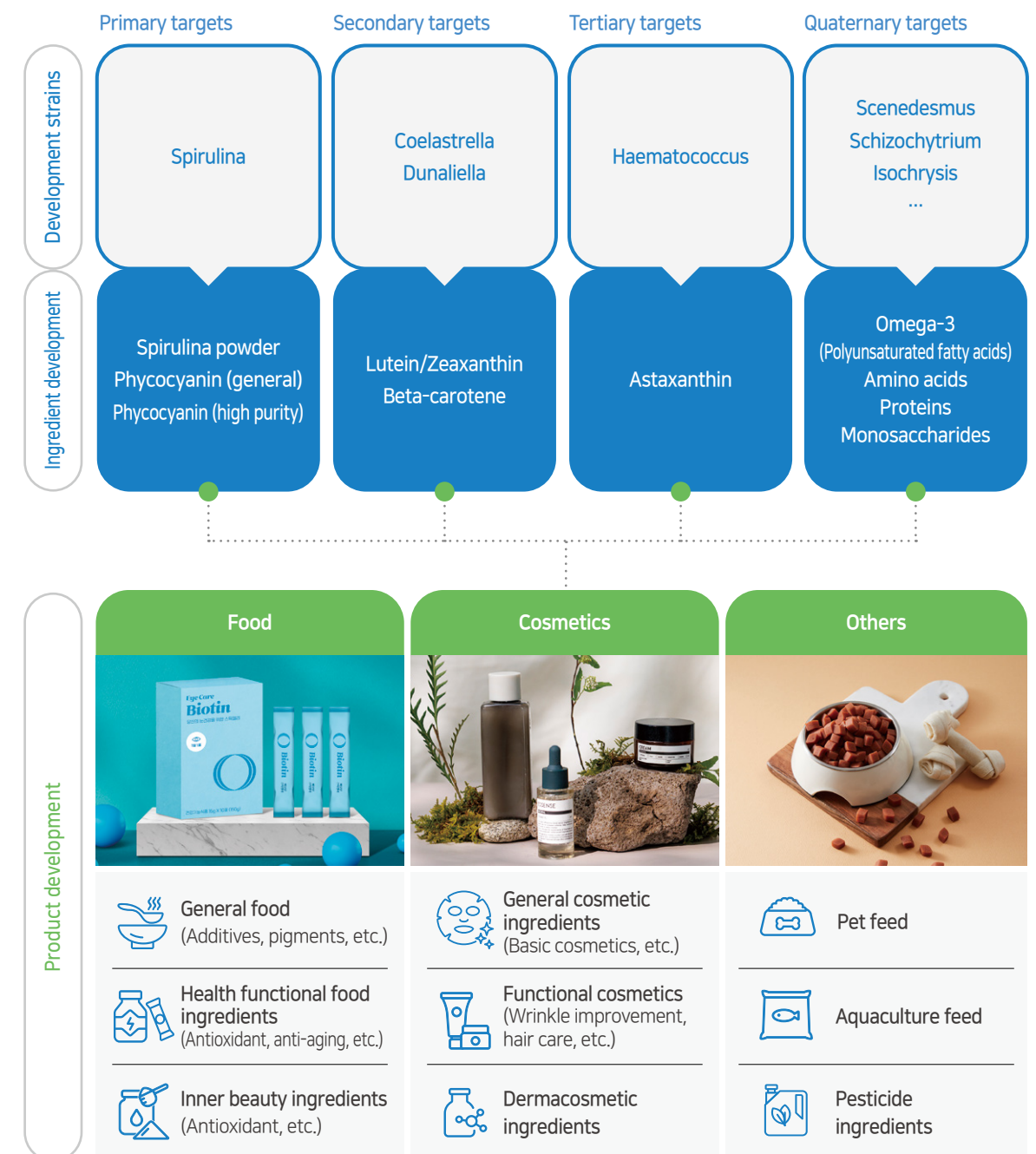
Key achievements and future plans

- Establishment of extraction and separation/purification technologies
- Verification of extract and ingredient functionality (in-vitro and in-vivo)
- Registration of functional ingredient in ICID targeted for 2027
- Completion of secondary goal: development of astaxanthin separation/purification technology by 2027

To be developed (~2027)

Expansion of the functional ingredient and product market

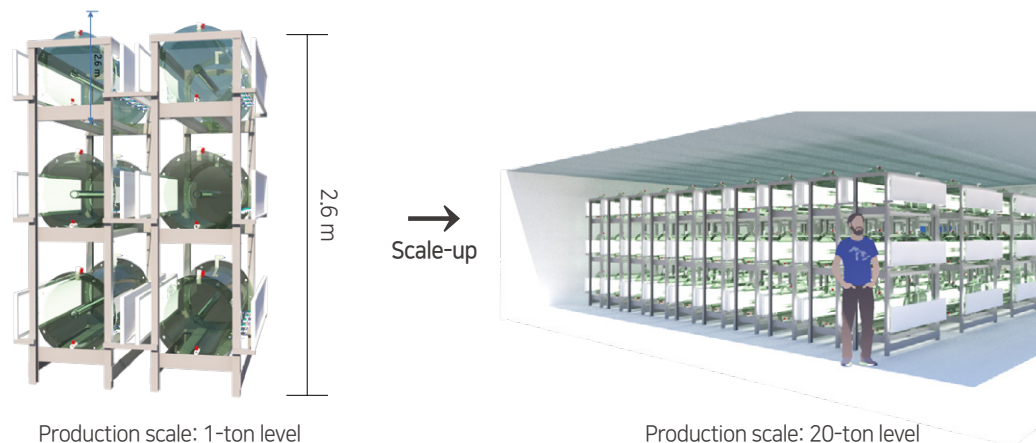
through sustainable production and supply of domestic microalgae



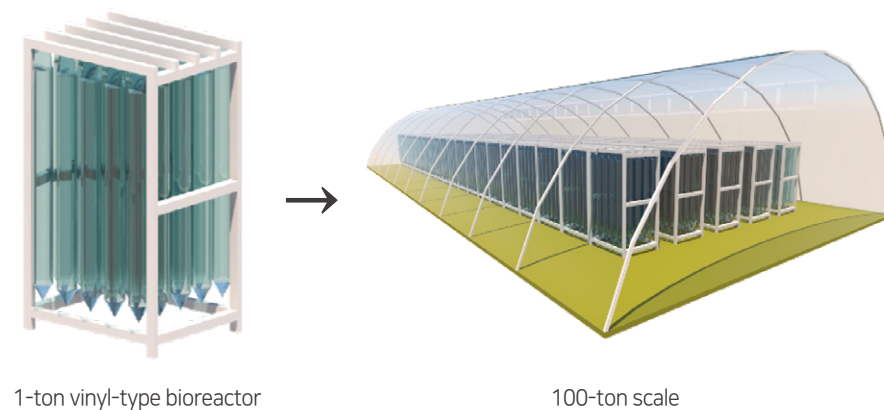
Utilizing functional extracts derived from indoor-cultivated microalgae

We provide B2B solutions applicable to various industries, including health functional food and cosmetic manufacturers as well as ingredient distributors.

Microalgae smart indoor cultivation foundry infrastructure



Large-scale microalgae cultivation facilities for farms



From ingredients to finished products, growing together with BROOTLAB

Based on its proprietary microalgae-based ingredient technology and product development experience, BROOTLAB collaborates with partners throughout the entire process for long-term growth.



Supply of ingredients

Stable delivery of refined spirulina and phycocyanin ingredients



Co-development

Joint planning and testing focused on product concepts and functionality



OEM / ODM

Full-cycle support from planning to production of client-branded products



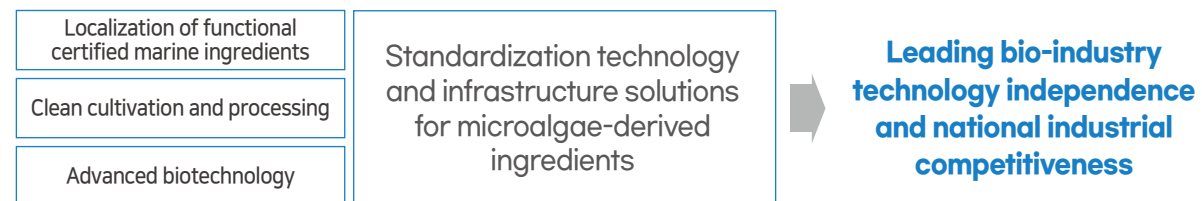
Certification support

Support for functional certification procedures and collaboration on material branding

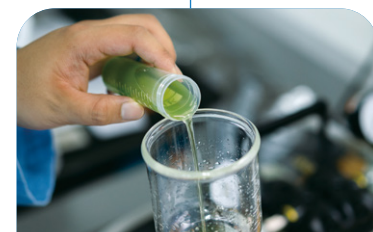


Building a next-generation integrated bio platform based on microalgae

Brootlab is expanding beyond simple ingredient manufacturing into an **integrated bio platform** business that encompasses functional ingredient development, extraction and supply, and smart bio foundry solutions, opening a new market paradigm.



Brootlab



Functional ingredient development and standardization R&D

Practical technologies for large-scale cultivation, purification, and standardization based on the discovery of raw materials/ingredients, planning, and functional verification

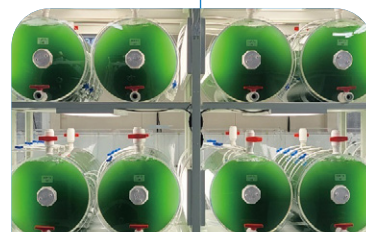
R&D
Tech IP Licensing



Production and supply of functional extracts

Extraction of advanced functional materials from each raw material & production of safe bio ingredients with high quality (high purity/content)

Ingredients
Multi- Formula



Smart bio foundry solutions (to be expanded)

Large-scale microalgae cultivation and production systems based on bio-manufacturing process automation utilizing big data and AI

Data-driven
Smart Plant Solution

HISTORY

- 2020. 11. Establishment of Brootlab Co., Ltd.
- 2020. 12. Raised 100 million KRW in seed funding.
- 2021. 04. Technology transfer of 2 patents related to microalgae cultivation
- 2021. 07. Completed technology evaluation of "Rose Max Continuous Circulation Bioreactor (Patent No. 10-1970135)."
- 2021. 12. Registered as a research institute company with the Korea Institute of Maritime Science and Technology.
- 2022. 01. Established Brootlab Jeju Research Center.
- 2022. 04. Raised 400 million KRW in bridge funding.
- 2022. 09. Accreditation of company-affiliated research institute, registration of food manufacturing and processing business, registration of health supplement sales business and cosmetics responsible sales business
- 2023. 01. Developed PureOn spirulina ingredient prototype.
- 2023. 05. Built pilot-scale large-volume microalgae cultivation system (8 tons).
- 2024. 05. Succeeded in material diversification_ established 1-ton scale-up cultivation systems for Coelastrella and Haematococcus.
- 2024. 07. Developed stick jelly product "SEATRUS" using spirulina extract.
- 2024. 07. Developed functional cosmetic product for wrinkle improvement using Coelastrella (completed human clinical trial)
- 2024. 12. Registered patent for "Air-lift type microalgae photobioreactor and cultivation system incorporating it."
- 2024. 11. Transferred patents related to functional ingredients derived from microalgae.
- 2025. 03. Raised 1.7 billion KRW in Pre-Series A funding.
- 2025. 05. Relocated and expanded Brootlab Jeju Research Center.
- 2025. 07. Cultivated new microalgae strain (Coelastrella thermophila) and filed 2 original patents for the technology.

Certifications and intellectual property status (registered patents)



- Culture medium for microalgae cultivation containing lava seawater and cultivation method of microalgae using the same
- Rose Max continuous circulation bioreactor
- Air-lift type microalgae photobioreactor and cultivation system incorporating it
- Liposome comprising chitosan coating and encapsulated phycocyanin, and pharmaceutical composition for nasal administration for the treatment of brain diseases comprising the same



Design a new future with BROOTLAB

Brootlab Co., Ltd.

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