Technical Brief

Engineered Algae Biorefinery

Turning CO_2 into Profitable Green Materials at Industrial Scale

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Overview

Aegis Laboratories is an advanced R&D and biomanufacturing company engineering algae to convert carbon dioxide (CO_2) into profitable, green materials. Our platform integrates high-productivity engineered algae, low-CAPEX open-pond cultivation, and an integrated waste-nothing biorefinery model to deliver scalable climate and industrial solutions with strong unit economics.

How the Technology Works

Engineered Algae

Aegis develops proprietary algae strains with **3–5× higher CO_2 utilization and biomass productivity** compared to conventional algae. Our metabolic pathways are precisely engineered to produce targeted outputs—oils, proteins, enzymes, and functional biomolecules—while remaining robust in open-pond environments.

Key features:

- Rapid growth kinetics enabling shorter cultivation cycles
- Enhanced CO_2 fixation and photosynthetic efficiency through engineered photorespiratory and respiratory bypass pathways.
- Targeted biosynthesis of high-value compounds (spectrum of tunable hydrocarbon, industrial enzymes, protein).
- Optimized for robust performance across varied environmental conditions.

Open-Pond Cultivation

Rather than capital-intensive photobioreactors, Aegis employs optimized open-pond systems that deliver:

- **Low capital cost and rapid deployment** – Enabling fast scaling without prohibitive infrastructure investment

- **High areal productivity** – ≥40 g dry weight/m²/day at pilot scale, with potential for further optimization
- **Recycle water and nutrients** from algae harvesting and processing to achieve a circular production system
- **Operational simplicity** – Proven, manageable technology for distributed franchise models

This approach achieves industry-leading productivity while maintaining the economic advantages of simple, replicable infrastructure.

Integrated Algae Biorefinery

Nothing is wasted. Every fraction of harvested biomass is monetized to maximize value:

- **Natural oils** – Nutraceutical-grade omega-3 fatty acids, premium cosmetic oils, immersion cooling fluids for data centers and power management fluids
- **Enzymes** – Biocatalysts for food processing, textile manufacturing, pharmaceutical production, and specialty chemical synthesis (e.g., cold-water detergents, textiles, food).
- **Animal Feed**– High-quality protein and starch meal for aquaculture, animal feed, and emerging plant-based food applications
- **Waxes and functional ingredients** – Advanced materials for coatings, cosmetics, and next-generation biomaterials
- **Carbon credits** – Verified CO_2 capture monetized through environmental markets

This multi-product extraction strategy ensures **maximum economic value per unit biomass** while minimizing waste streams—the hallmark of profitable biorefinery operations.

Scaling Model: Algae-as-a-Service™

Aegis scales globally through a capital-light partnership model:

- **Partners finance and operate** cultivation ponds using standardized Aegis protocols
- **Aegis supplies** engineered strains, cultivation guidance, technical support, and quality assurance
- **Aegis guarantees offtake** of harvested biomass at fixed pricing, providing revenue certainty

Advantages:

- Rapid global expansion without massive company-owned capital expenditure
- Predictable margins and supply chain resilience
- Local job creation and community benefit
- Distributed risk across multiple partners and geographies

Why Aegis

Profitable, Scalable Green Materials & Climate Solution

Converts CO_2 into multiple high-margin products simultaneously—eliminating dependence on single commodities and creating resilient revenue streams.

Multi-Product Revenue Platform

Natural oils, proteins, enzymes, advanced materials, and carbon credits from one production system unlock value across nutrition, industrial chemicals, biotechnology, and environmental markets.

Low-CAPEX, High-Margin Economics

Open-pond cultivation with engineered strains delivers productivity gains without the capital burden of closed-loop systems, enabling faster payback and superior returns.

Adaptable Across Industries

Food and nutrition, industrial biotechnology, specialty chemicals, cosmetics, pharmaceuticals, climate solutions, and emerging bioeconomy markets all represent addressable segments.

Our Vision

Aegis Laboratories is pioneering a scalable algae biorefinery platform that transforms captured CO_2 into high-value renewable products—redefining industrial sustainability through superior performance, lower costs, and verifiable climate impact.

Contact

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