CONDUCTOR LABS

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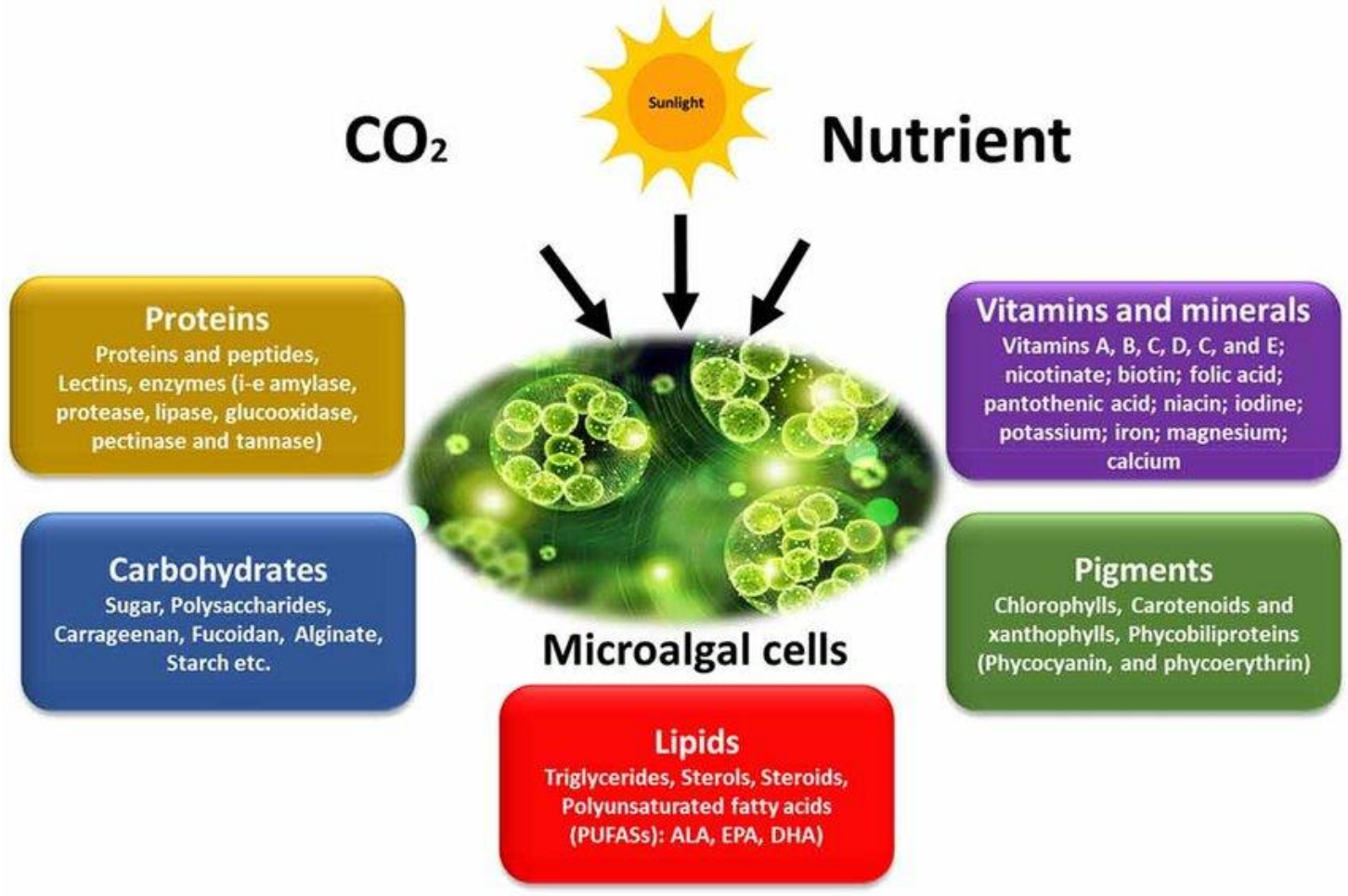
CASE STUDY

SYNECHOCOCCUS CYANOBACTERIA



Novel Genetic Engineering Technology: 2-3x Biomass Productivity

Figure Source: http://dx.doi.org/10.1080/21655979.2022.2061148

FACTORS IMPACTING PRODUCTION OF DIFFERENT PRODUCTS

- Nutrients like nitrogen, phosphorus
- Light intensity
- pH
- Temperature
- CO_2

GUIDELINES

- What factors enhance the production of your desired products?
- How do you enhance the factor at scale?
- How do you go from microalgae to the product?
- What are the implications on CAPEX, OPEX

INDIA SPECIFIC DATA SOURCES

- https://www.indiastat.com
- https://www.data.gov.in
- https://iced.niti.gov.in
- https://beeindia.gov.in/en
- https://www.mospi.gov.in/
- https://www.ibef.org
- https://etenders.gov.in/eprocure/app?page=WebTenderStatusLists&service=page
- Equipment
  - https://www.orixindia.com/equipment-leasing.php
  - https://www.industrybuying.com
  - https://www.equipmentrentalsindia.com
- Others
  - https://www.tradeindia.com
  - https://www.indiamart.com

OBJECTIVE 1: ASSESS THE MARKET OPPORTUNITY

- The first step is to identify compelling markets for your high-productivity Synechococcus strain. With a 2-3x productivity boost, new market segments or existing ones at a more competitive price point might be accessible.
- Your Task:
  - Identify 2-3 Potential Markets: Propose and briefly describe 2-3 distinct markets that could be attractive targets for this enhanced Synechococcus strain. Consider both high-value, niche applications and larger, commodity-scale opportunities.
    - (Illustrative Assumption: The genetic engineering technique allows for efficient production of a valuable carotenoid like astaxanthin, or significantly enhances lipid production for biofuels/biochemicals, or simply leads to much cheaper biomass for food/feed applications.)
  - Define Evaluation Criteria: List and explain at least four key criteria that the team should use to evaluate and prioritize these (and other potential) markets. These criteria should help in making a strategic decision about where to focus commercialization efforts.

OBJECTIVE 2: BUILD THE PROCESS FLOW DIAGRAM (PFD)

- To understand the costs and complexities of deploying this technology at scale, a conceptual process flow diagram is essential. This PFD will outline the major steps involved in producing a marketable product from your engineered Synechococcus.
- Your Task:
  - Develop a 5-7 Unit Operation Process Flow Diagram: Create a block flow diagram illustrating the key unit operations required to cultivate, harvest, and process the Synechococcus to a desired primary product. Aim for 5-7 major unit operations.
    - (Illustrative Assumption: The primary product could be dried biomass, a specific extracted compound, or a biofuel precursor.)
    - You can use PowerPoint to draw the diagram of unit operations and arrows.
  - Identify Major Inputs and Outputs: For the overall process, and where relevant for key unit operations, list the major inputs (e.g., raw materials, utilities) and outputs (products, co-products, waste streams).

OBJECTIVE 3: CREATE A SIMPLE TEA FRAMEWORK

- **With a potential market and a conceptual process in mind, the next step is to consider the economics. This initial TEA will be simple, focusing on identifying major cost drivers and areas of high sensitivity.**
- **Your Task:**
  - **Identify Major Cost Drivers: Based on your PFD and understanding of microalgae production, list and briefly explain at least five major categories of capital expenditure (CapEx) and operational expenditure (OpEx) that you anticipate will significantly influence the production cost.**
  - **Identify Highly Sensitive Drivers: From your list of cost drivers and considering the novel nature of the technology (2-3x productivity), identify at least three factors or assumptions in your conceptual TEA that are likely to be highly sensitive. Explain why changes in these drivers could have a disproportionately large impact on the overall economic viability.**
    - **(Illustrative Assumption: The 2-3x productivity increase is robust and scalable, but factors like nutrient costs, harvesting efficiency, or the achievable market price of the end-product could still be highly sensitive.)**

DELIVERABLES

- **A 3-Slide PowerPoint Presentation:**
  - **Slide 1: Focus on Market Opportunity Assessment. Identify 2-3 compelling markets for the high-productivity Synechococcus and outline at least four key criteria for evaluating market attractiveness.**
  - **Slide 2: Detail the Conceptual Process Flow Diagram (PFD). Illustrate a 5-7 unit operation PFD for deploying this technology at scale and list the major inputs and outputs for the overall process.**
  - **Slide 3: Outline a Simple Techno-Economic Analysis (TEA) Framework. Identify at least five major CapEx and OpEx drivers and discuss at least three factors or assumptions likely to be highly sensitive in the TEA.**
- **A Lightweight Techno-Economic Analysis (TEA) in Excel:**
  - **The model should include sheets for:**
    - **Key Assumptions (e.g., plant capacity, productivity, yields, pricing, economic parameters).**
    - **Estimated Capital Expenditures (CapEx).**
    - **Estimated annual Operational Expenditures (OpEx).**
    - **A basic Revenue & Profitability projection (e.g., for a few years or a snapshot).**
  - **Clearly state all your assumptions and provide brief justifications or notes for your estimations. The goal is to demonstrate an understanding of how to structure a TEA and identify key economic levers, rather than to achieve perfect accuracy at this stage.**