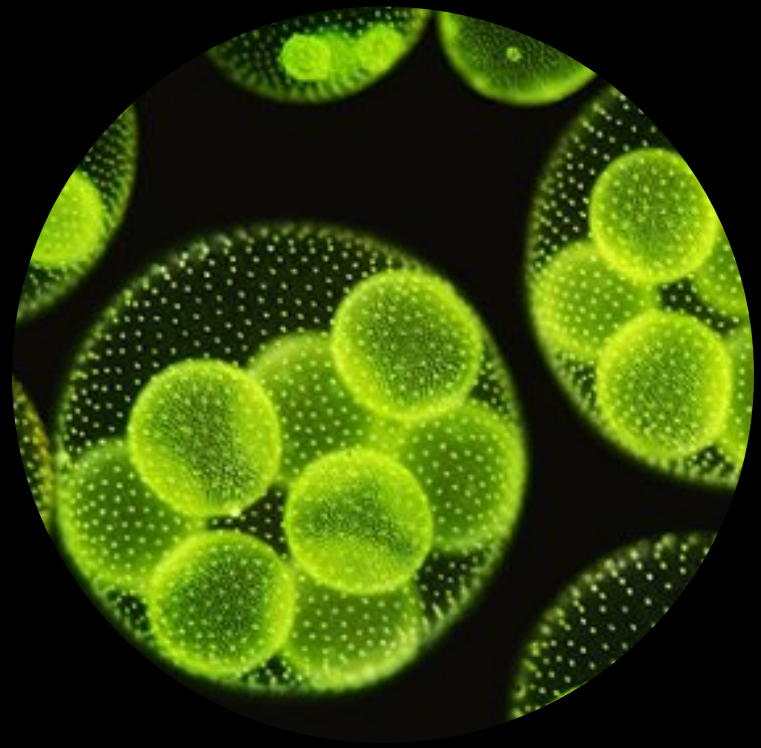
ALGAL TECHNOLOGY
for the Blue Bioeconomy

FUTURE IS MADE IN FINLAND WEBINAR SERIES

EPISODE II: BIOECONOMY DEFINES THE FUTURE



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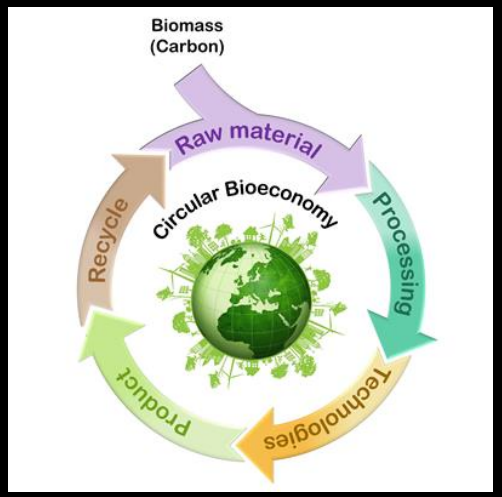
WHAT IS BIOECONOMY?

- According to the European Commission:

A bioeconomy can be defined as the *"production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy* (European Commission, 2012)*."*



- The basic bioeconomy principles:
  - Circular (reduce, reuse, recycle)
  - ***A closed waste-to-product loop, instead of a linear chain***
  - Resilient
  - Sustainable

- The **Blue Bioeconomy**:
  - Focused on resources derived from freshwater and marine environments
  - Includes industries like fishing, aquaculture, and water treatment

https://ec.europa.eu/research/bioeconomy/index.cfm

https://www.luke.fi/en/research/blue-bioeconomy/

https://doi.org/10.1016/j.rcrx.2019.100029

Blue Bioeconomy and Micro(algae)

LUT University

MARITIME FORUM

European Commission

Tiny algae get set for big things in blue bioeconomy

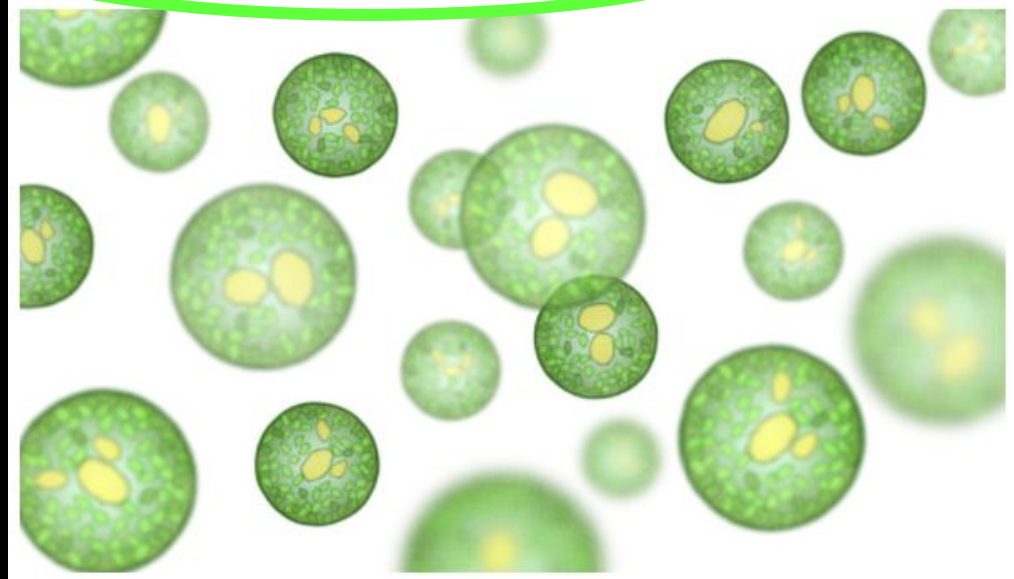
I like it

Published on: Fri, 21/09/2018 - 16:20 | A A | View as pdf | 14 views

Microalgae, which play a vital role in ocean ecosystems, are being heralded as a sustainable raw material in food, supplements, animal feed, and a range of non-food uses including bioplastics.

https://webgate.ec.europa.eu/maritimeforum/en/node/4214

Algae, the next big thing in the blue bioeconomy



https://www.emodnet-humanactivities.eu/blog/?p=895

Home › Technology › Biomass › The green revolution will be blue: Harvesting algae for the bio-economy.

Biomass | Products | Technology

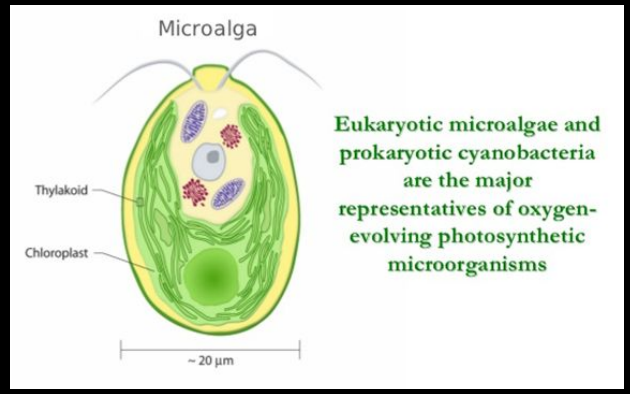
The green revolution will be blue: Harvesting algae for the bio-economy.

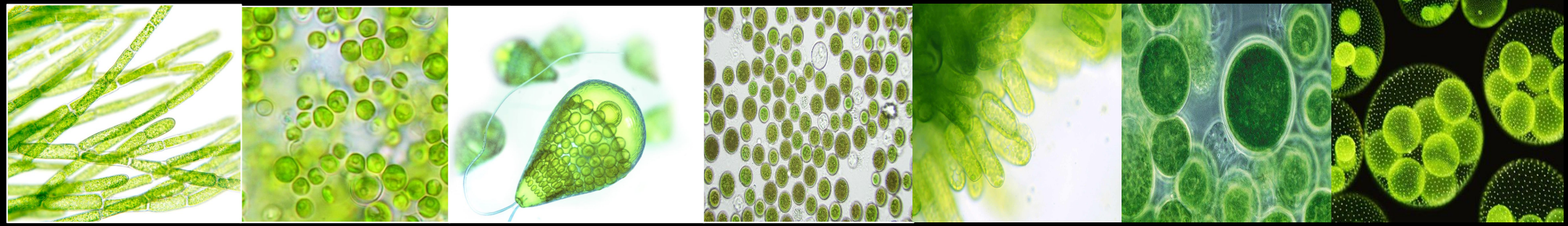
by Liz Gyekye 8th February 2019 0 2663

https://biomarketinsights.com/the-green-revolution-will-be-blue-harvesting-algae-for-the-bio-economy/

WHAT ARE MICROALGAE?

- Simple plant body: not differentiated into roots, stem and leaves
- Contain chlorophyll a
- Primary producers
- Unicellular
- Microalgae are highly diverse, in form and function

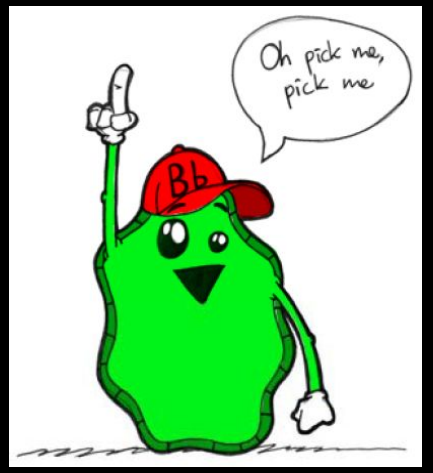




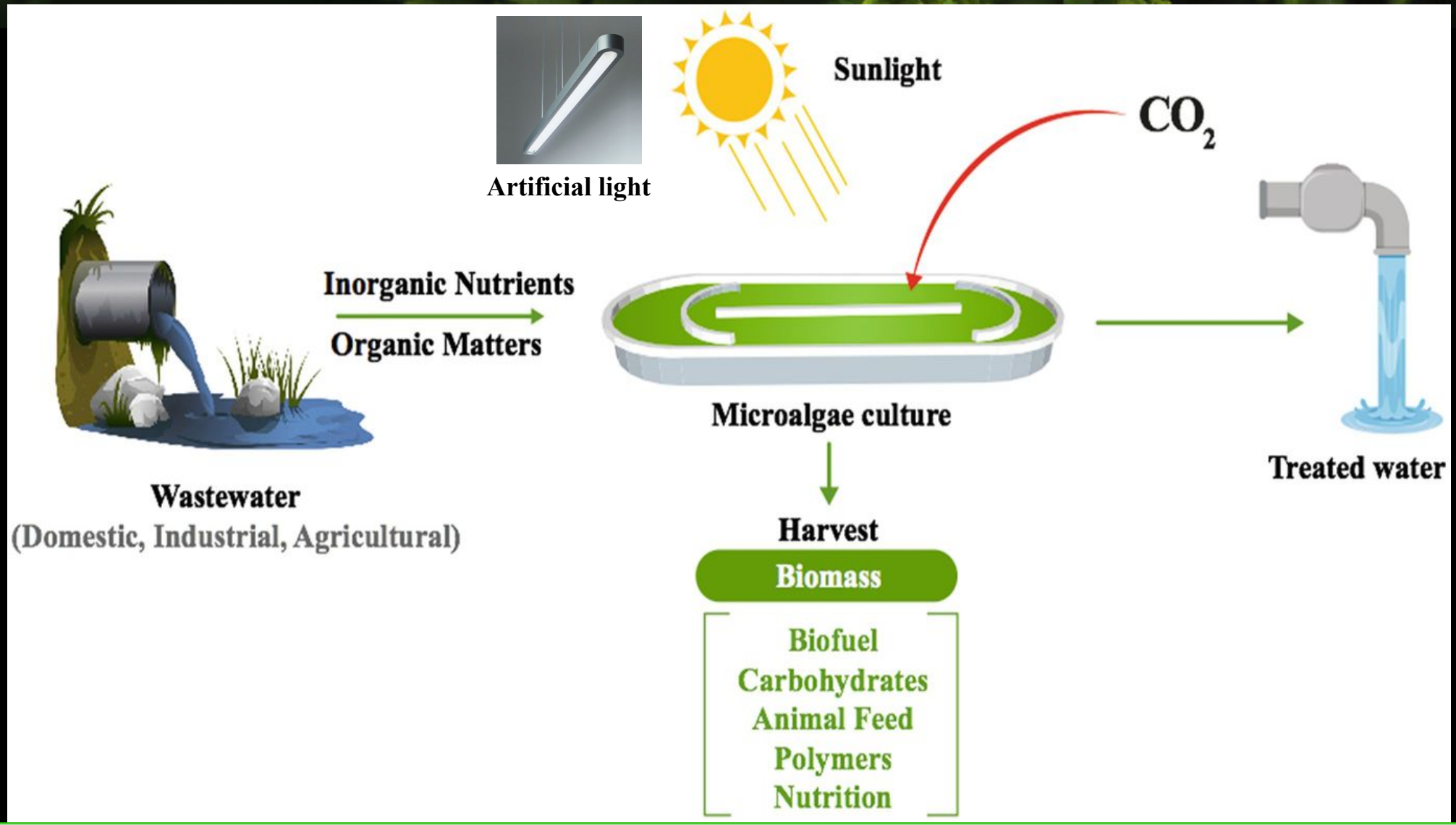
https://www.journals.elsevier.com/algal-research/

Why Microalgae?

- High growth rate and yield
- Non toxic and highly biodegradable
- Do not require soil for growth
- Can be cultivated in different types of wastewaters
- Require less water than terrestrial crops for growth
- Capture CO_2 via biofixation (high CO_2 -> global warming, climate change)
- High biochemical composition



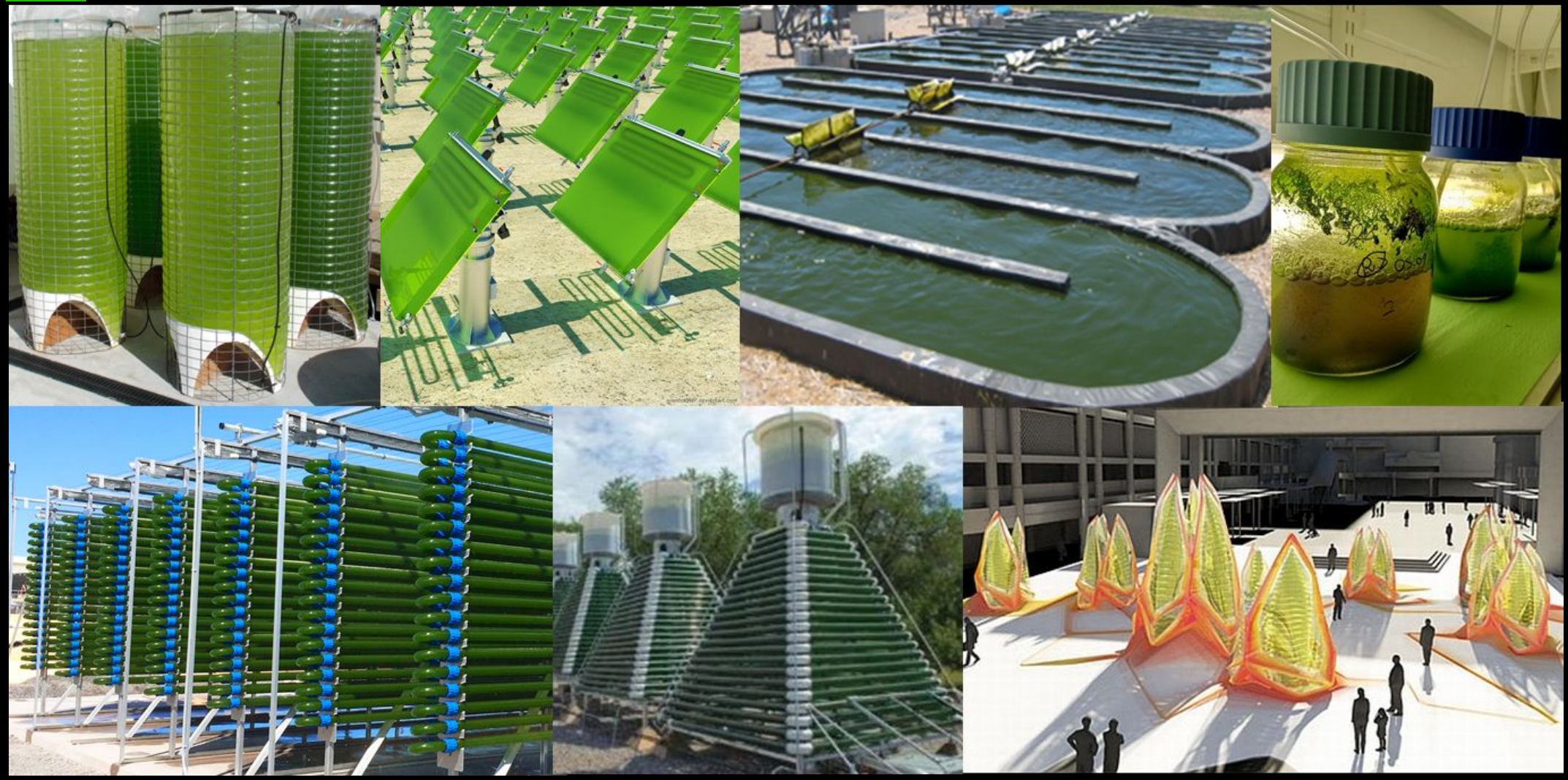
Microalgae – green gold



Hitting 2 birds with 1 stone: (i) wastewater & CO_2 problems are addressed with green and inexpensive technology using microalgae, and (ii) many valuable green chemicals / materials are produced from the harvested microalgae.

Zerrouki D., Henni A. (2019) Outdoor Microalgae Cultivation for Wastewater Treatment. In: Gupta S., Bux F. (eds) Application of Microalgae in Wastewater Treatment. Springer, Cham

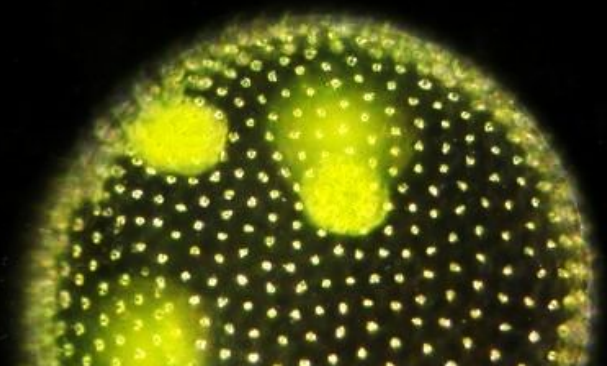
Microalgae cultivation



WHAT CAN MICROALGAE DO?

Via photosynthesis, microalgae can:

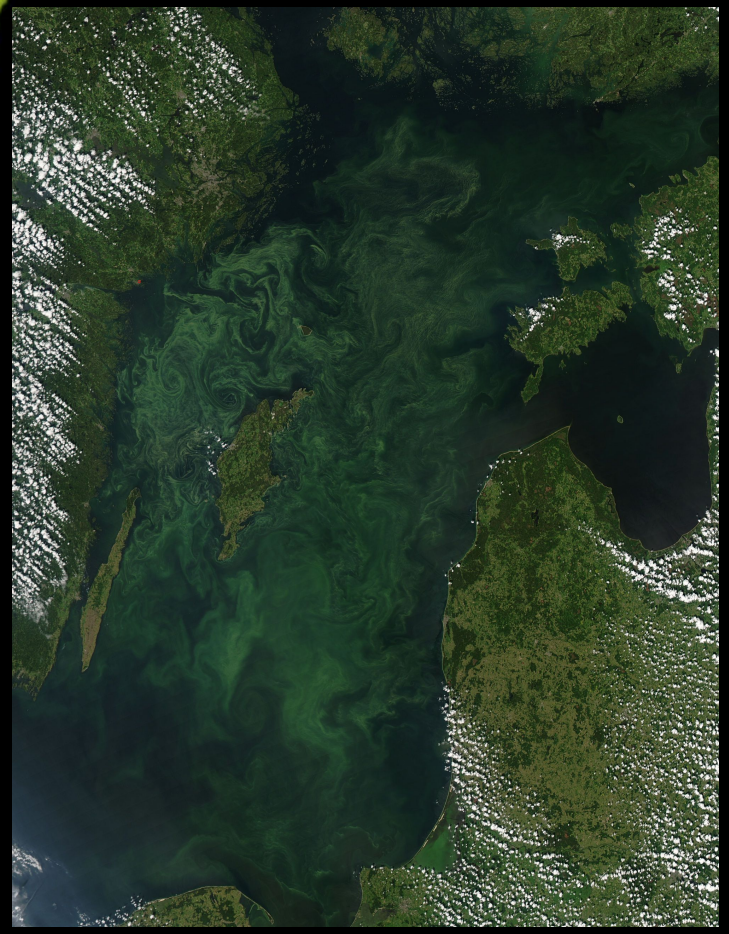
- Sequester carbon dioxide and other carbon sources – responsible for 50% of global CO_2 fixation!
- Clean up nutrient pollution like nitrogen and phosphorus
- Produce compounds useful for bioenergy
  - Lipids for biofuels, e.g. biodiesel
  - Carbohydrates for biogas or bioethanol production
- Co-generate other value-added products (VAPs)
  - Proteins for human or animal consumption
  - Polymers for bioplastics
  - Pigments for nutritional supplements
  - Other compounds used in cosmetics, as food additives, etc.



WHERE DO MICROALGAE FIT INTO THE BLUE BIOECONOMY?

Example 1:

- Aquaculture industries (fisheries, fish and shellfish farms, etc.) create nutrient pollution, which causes a serious problem (called **eutrophication**) in natural aquatic ecosystems
- Microalgae naturally use this nutrient pollution to grow
- Aquaculture wastewater can be recycled as growth medium for microalgae
- This prevents pollution
- Low cost // low energy process!



A harmful cyanobacterial bloom caused by nutrient pollution-related eutrophication in the Baltic Sea

https://visibleearth.nasa.gov/images/73012/summer-bloom-in-the-baltic-sea

WHERE DO MICROALGAE FIT INTO THE BLUE BIOECONOMY?

Example 2:

- Using aquaculture wastewater to grown microalgae significantly reduces the cost of cultivation
- Microalgal biomass is naturally rich in proteins, healthy fats, and micronutrients
- Microalgae can replace fish meal (currently used) as the main source of protein in fish feed
- This saves costs associated with feed, as well as with wastewater treatment, and it makes healthier fish!

ALGAE FOOD AND FEED

THE AQUACULTURE INDUSTRY IS TRYING TO TAKE FISH OUT OF FISH FOOD. ARE MICROALGAE THE SOLUTION?

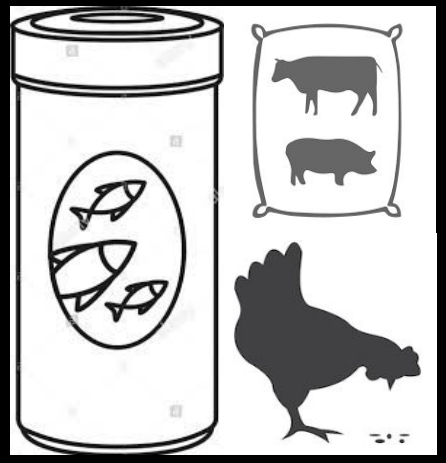
MAY 26, 2019 ALGAEWORLDNEWS LEAVE A COMMENT

[Global] A NASA-developed technology originally meant to sustain astronauts is changing the way farmed fish are fed—and may help aquaculture overcome a surprising environmental liability.

https://news.algaeworld.org/2019/05/the-aquaculture-industry-is-trying-to-take-fish-out-of-fish-food-are-microalgae-the-solution/

WHAT ELSE CAN WE MAKE WITH MICROALGAE?

- In food and feed
- Health and skin-care products (vitamins, omegas, and high-quality protein)
- Cosmetic products
- Eco-friendly polymers and bioplastics
- Biofuels

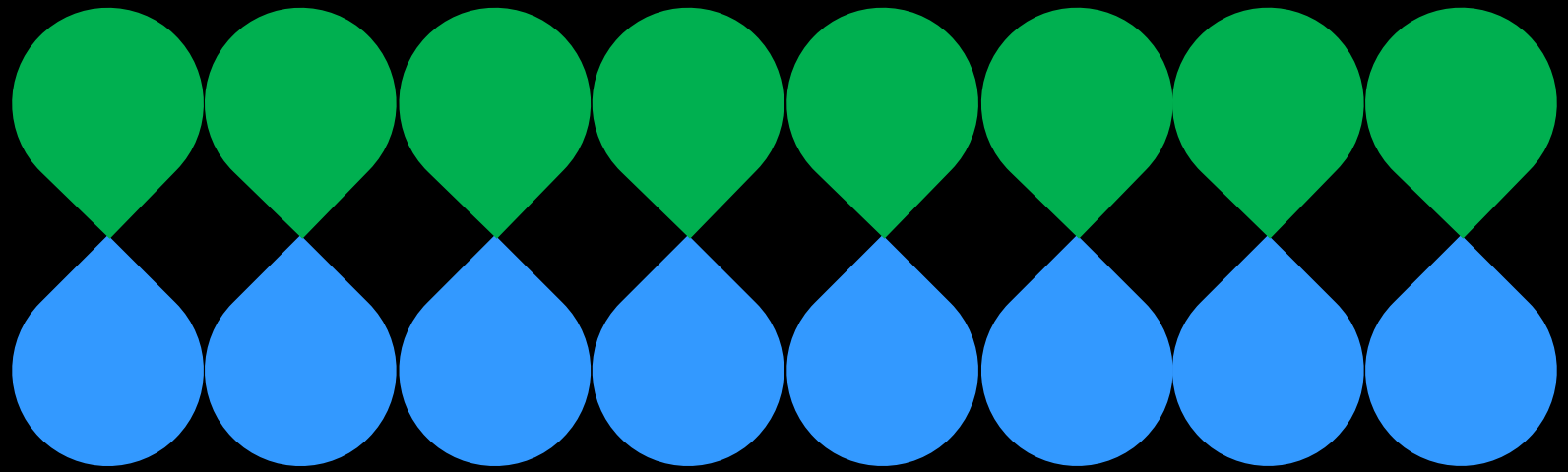


Microalgae & UN SDGs

THE BIG PICTURE

Microalgal biorefineries:

- Mitigate pollution
- Convert waste into resources (€€)
- Pillar of blue bioeconomy and sustainability.



Thank you!