food algae production

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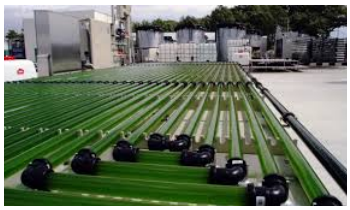
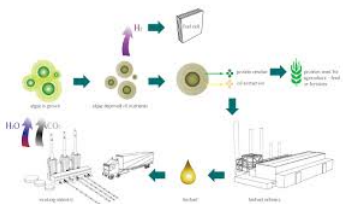
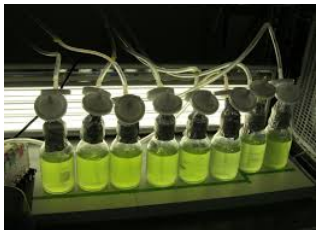
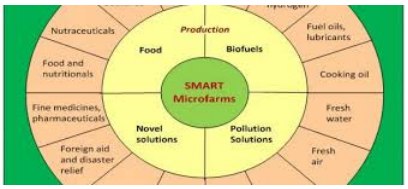


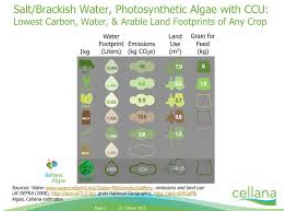


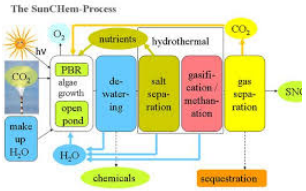




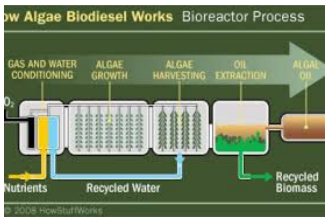



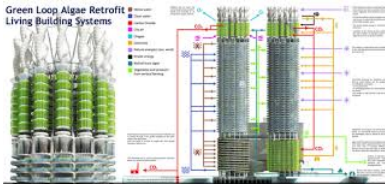






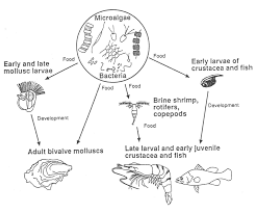







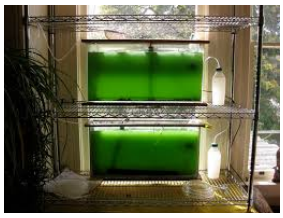


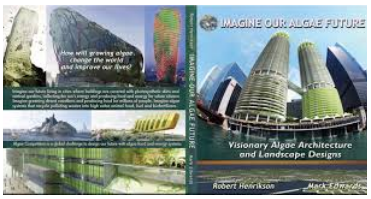








Algae in Products Today

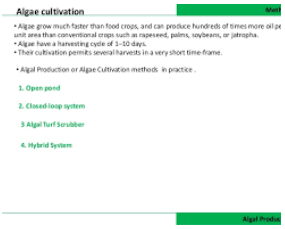
Previews of Algae Food Development and Recipes
Spirulina Pesto Pizza
Korean Style Algae Pancake
Algae con queso
spirulina tofu
Chlorella Sherbet


Green Jet Fue

IMAGINE OUR ALGAE FUTURE
How will growing algae change the world - and improve our lives?
Visionary Algae Architecture and Landscape Designs
Robert Henrikson
Mark Edmundson


SKYLINE
SKYLINE
SKYLINE

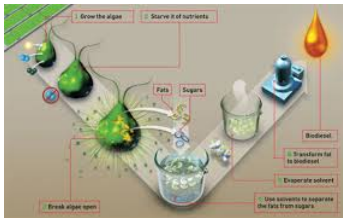
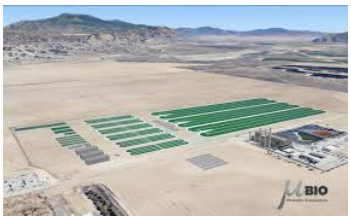
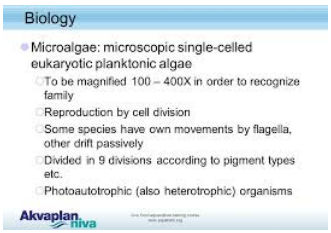

Detailed Parts List

BIOFUELS
10
B20
E85
E10



Algae cultivation
• Algae grow much faster than food crops, and can produce hundreds of times more oil per unit area than conventional crops such as rapeseed, palms, soybeans, or jatropha.
• Algae have a harvesting cycle of 1–10 days.
• Their cultivation permits several harvests in a very short time-frame.
• Algal Production or Algae Cultivation methods in practice .
1. Open pond
2. Closed-loop system
3 Algal Turf Scrubber
4. Hybrid System

Adaptability to a range of environment
Grown under conditions which are unsuitable for conventional crop production
(marine water, wastewater, open ponds)




Grow the algae
Starve it of nutrients
Fats
Sugars
Biodiesel
Break algae open

BIO

Biology
Microalgae: microscopic single-celled eukaryotic planktonic algae
To be magnified 100 – 400X in order to recognize family
Reproduction by cell division
Some species have own movements by flagella, other drift passively
Divided in 9 divisions according to pigment types etc.
Photoautotrophic (also heterotrophic) organisms
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PASCAL GOETGHELUCK

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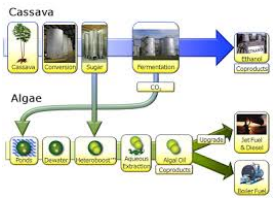
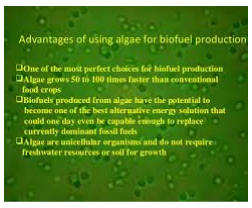
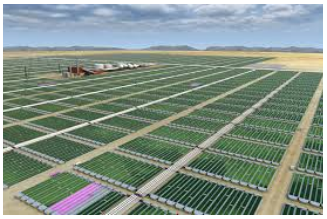
Indoor algae controlled cultivation using artificial lights

Cassava
Cassava
Conversion
Sugar
Fermentation
Ethanol
Coproducts
CO2
Algae
Ponds
Dewater
Heterotrophic
Aqueous Extraction
Algal Oil
Coproducts
Upgrade
Jet Fuel & Diesel
Boiler Fuel

Advantages of using algae for biofuel production
One of the most perfect choices for biofuel production
Algae grows 50 to 100 times faster than conventional food crops
Biofuels produced from algae have the potential to become one of the best alternative energy solution that could one day even be capable enough to replace currently dominant fossil fuels
Algae are unlike other organisms and do not require freshwater resources or soil for growth

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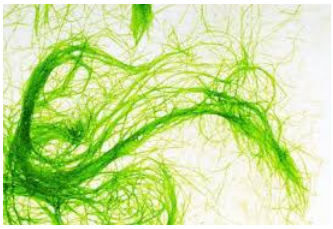
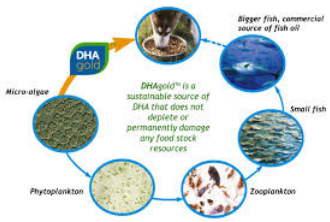


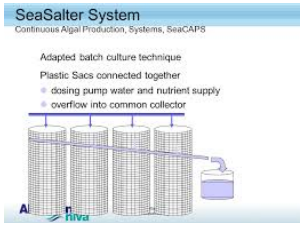
Algae-to-Product Process
Algae Biorefinery
Oil
Biomass
Biofuel




DHA gold
Bigger fish, commercial source of fish oil
Micro-algae
Small fish
Phytoplankton
Zooplankton
DHAgold™ is a sustainable source of DHA that does not deplete or permanently damage any food stock resources


Algae

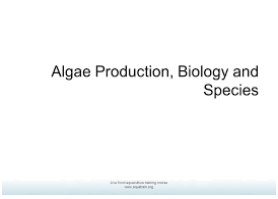

Main culture systems
Batch culture
300 or 500 litre sacs
D-ended tanks
Continuous culture
Connected sac system (SeaSalter)
Tubular fence (BioFence)
Tubular spiral (AddaVita)
heterotrophic production (Aqua Fauna)
Akvaplan niva

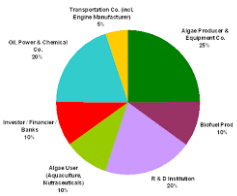

SeaSalter System
Continuous Algal Production, Systems, SeaCAPS
Adapted batch culture technique
Plastic Sacs connected together
dosing pump water and nutrient supply
overflow into common collector
niva


Future Food 1: Eating Down the Chain
Spotlight: ALGAE


Aaron Ramos - USA


Algitech
ALGAE

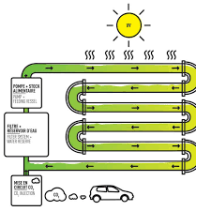

Algae Production, Biology and Species

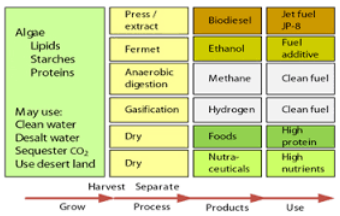



RESILIENCE & REGENERATION
LIVING FUTURE 13
MAY 15-17, 2013 SEATTLE, WA


Manual on the production and use of live food for aquaculture

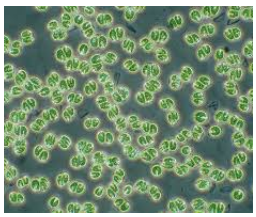

Spirulina greenhouse pond in Normandy, France at Eco-Domaine Ferme de Bouquetot

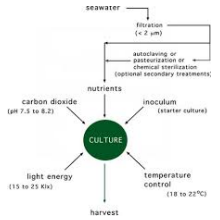



Algae
Lipids
Starches
Proteins
May use:
Clean water
Desalt water
Sequester CO_2
Use desert land
Press / extract
Biodiesel
Jet fuel JP-8
Fermet
Ethanol
Fuel additive
Anaerobic digestion
Methane
Clean fuel
Gasification
Hydrogen
Clean fuel
Dry
Foods
High protein
Dry
Nutra-ceuticals
High nutrients
Harvest
Separate
Grow
Process
Products
Use

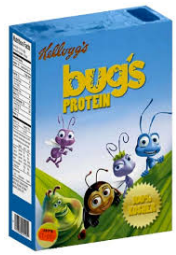

WINNAAR
INNOVATIE AWARD 2013

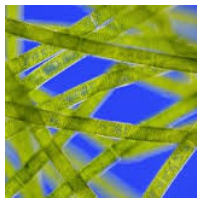

Algae Oil yield Compared to other Feedstocks
Comparative Yields
Soy Bean 50-65 Gallons Per Acre Per Year
Camelina 150-400 Gallons Per Acre Per Year
Palm 400-700 Gallons Per Acre Per Year
Algae 2,000 to 20,000+ 77 Gallons Per Acre Per Year

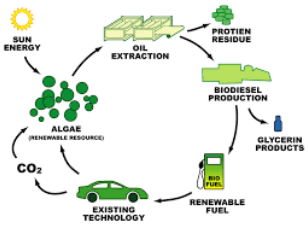


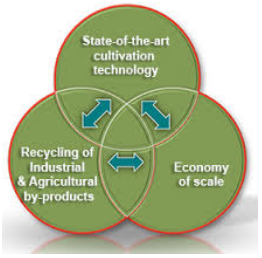


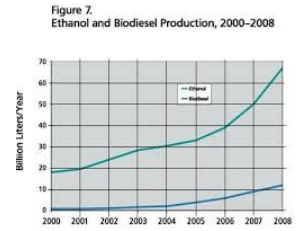
Algae – its role, species and production requirements



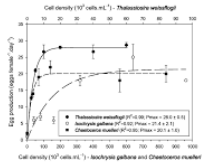


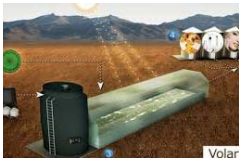


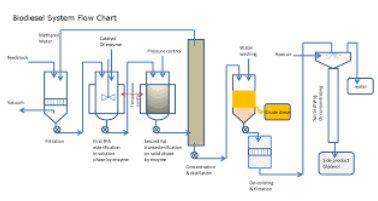




Diversified food sources
- Algae
- Insects
- Edible plants not currently used for food







Role of algae in aquaculture
- First link in the chain of live food manufacture and nutrition.
  - Culture diet for rotifers
  - Enrichment diet for rotifers
- Green water technique
  - Provides a direct source of nutrition for larvae
  - Provides background rotifer feeding
  - Other zootechnical benefits

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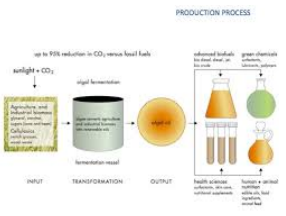
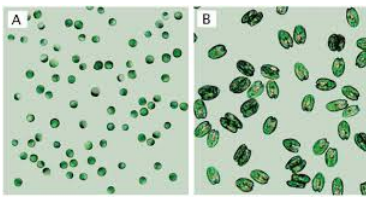
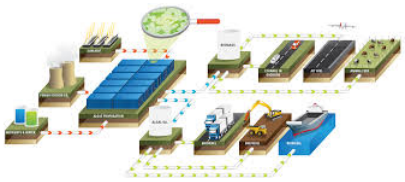

PRODUCTION PROCESS

A
B


Algae as human food
Annual value is about US$6 billion
Main market and production area is Asia
"Mariculture" has become very important
Main high-value species are 'Nori', 'Kombu' and 'Wakame' (Porphyra, Laminaria and Undaria)
Mainly used as a subsidiary food: adding relish, taste and 'feel' to food
European and North American market presently very small but has potential

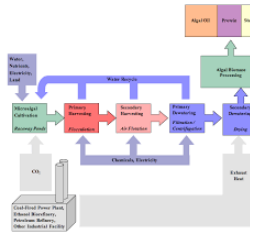


THE BRUNEI TIMES

The Future of Farming
Click here to view the presentation

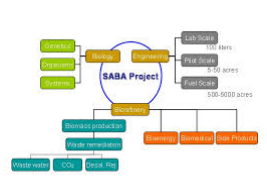


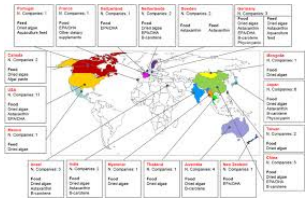


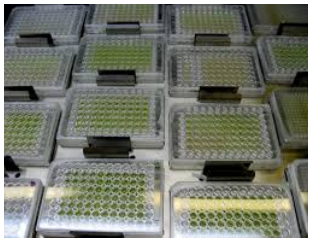


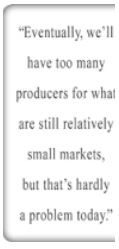

picture I.A. Melnikov

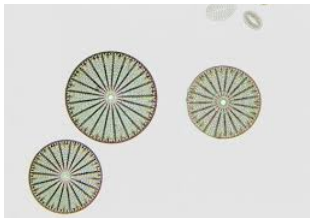


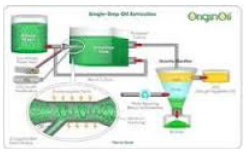
Uses of Seaweeds
Present
Food
Hydrocolloids and some chemical substances
Fertilizers
Potential
Source of energy/compost by digestion
Waste-water treatment

SABA Project



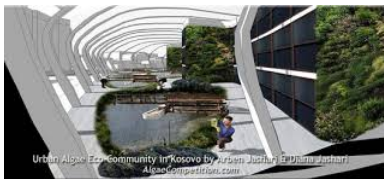

INTRODUCTION
Algae are simple organisms that typically produce their own food through photosynthesis.
The difficulties in efficient biodiesel production from algae lie in finding an algal strain with a high lipid content and a cost-effective cultivation system that is best suited to that strain.
There is also a need to provide concentrated CO2 to turbocharge the production.

"Eventually, we'll have too many producers for what are still relatively small markets, but that's hardly a problem today."

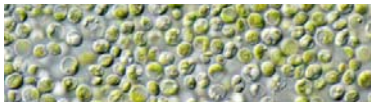


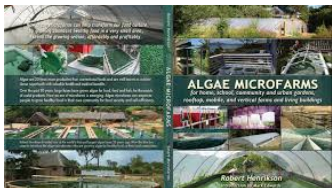

OriginOil

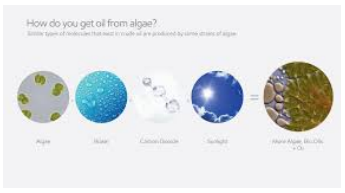

Why are algae important?
• Primary producers, basis of food webs, "FORESTS/GRASSES OF THE SEA"
• Pioneer Species: on rocky shores, mudflats, hot springs, lichen communities, 'snow algae'
• O2 production and carbon fixation in aquatic habitats.
• Rare autotrophic organisms in extreme habitats.

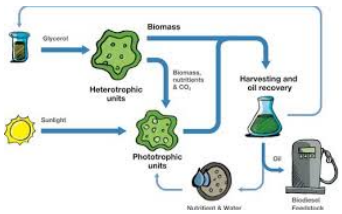

2011 International Algae Competition






ALGAE MICROFARMS


How do you get oil from algae?


Biomass
Glycerol
Heterotrophic units
Harvesting and oil recovery
Sunlight
Phototrophic units
Nutrients & Water
Biodiesel Feedstock

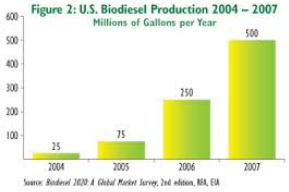
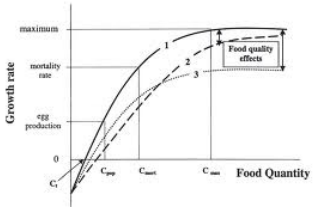
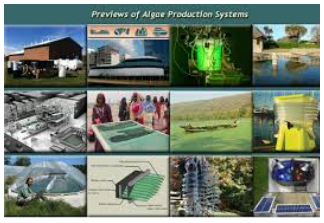


Figure 2: U.S. Biodiesel Production 2004 – 2007
Millions of Gallons per Year
25
75
250
500
2004
2005
2006
2007


Earthrise Nutritionals
Imperial Valley California
Cyanotech
Big Island Hawaii


Aytech
ALGAE


maximum
mortality rate
egg production
0
Growth rate
Food quality effects
1
2
3
Food Quantity

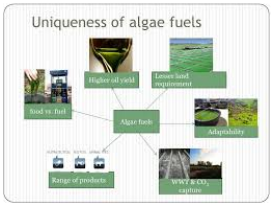

Previews of Algae Production Systems

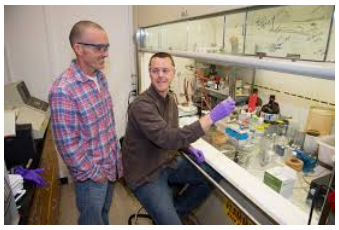
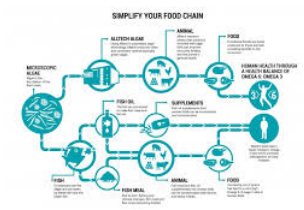
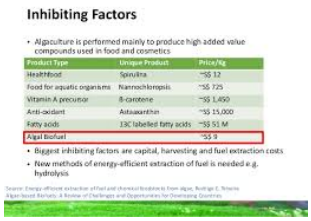
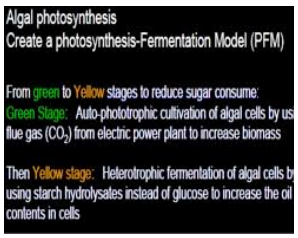

AzCATI's Tube and Bag algae photobioreactors


FIRST PRIZE
Algae Production System

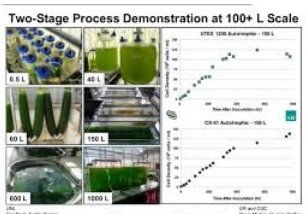

OMEGA System
Solar Energy
Oxygen
Forward Osmosis
Clean Water Released
Aquaculture
Marine Habitat
Treated Wastewater/CO2
Pollution Prevention

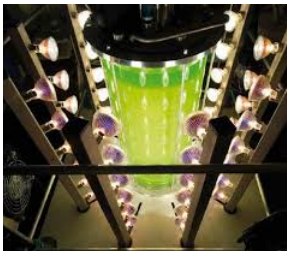
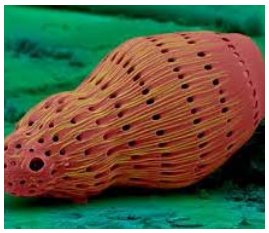


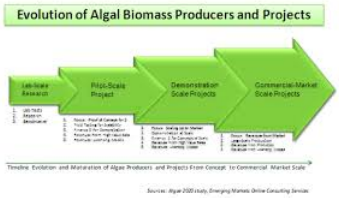


Uniqueness of algae fuels
Algae fuels
Adaptability
Range of products

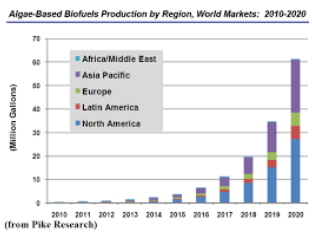
ASU
heliae
SCRIPPS


SIMPLIFY YOUR FOOD CHAIN

Inhibiting Factors
Algal Biofuel

Algal photosynthesis
Create a photosynthesis-Fermentation Model (PFM)
From green to Yellow stages to reduce sugar consume:
Green Stage: Auto-pholotrophic cultivation of algal cells by us
flue gas (CO_2) from electric power plant to increase biomass
Then Yellow stage: Heterotrophic fermentation of algal cells b
using starch hydrolysates instead of glucose to increase the oil
contents in cells

HUAKANG BIOTECHNOLOGY
Professional Plant Extract Manufacturer

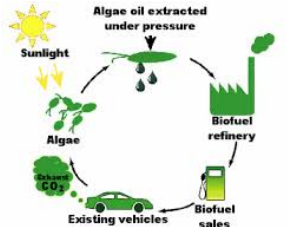

Two-Stage Process Demonstration at 100+ L Scale
Phase 1: Photoautotrophic Scale-Up

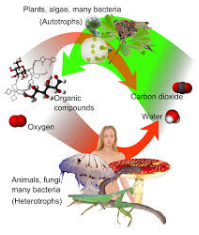



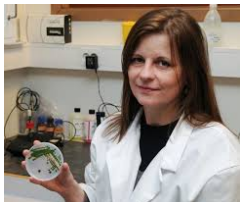
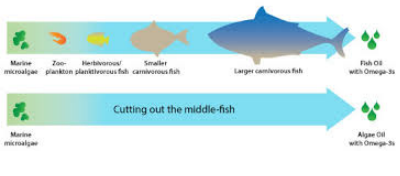
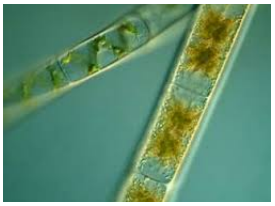

Why Microalgae?
Slow growth of higher plants
High fresh water requirement of higher plants
High cost of land for growing higher plants
No competition with food supply

Evolution of Algal Biomass Producers and Projects
Lab-Scale Research
Pilot-Scale Project
Demonstration Scale Projects
Commercial-Market Scale Projects

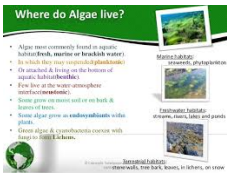

Algae-Based Biofuels Production by Region, World Markets: 2010-2020
(Million Gallons)
Africa/Middle East
Asia Pacific
Europe
Latin America
North America
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
(from Pike Research)

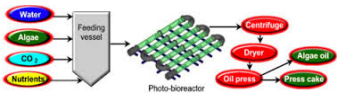


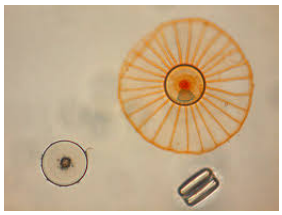

Algae oil extracted under pressure
Sunlight
Algae
Biofuel refinery
Exhaust CO_2
Existing vehicles
Biofuel sales


Plants, algae, many bacteria
(Autotrophs)
Organic compounds
Carbon dioxide
Water
Oxygen
Animals, fungi, many bacteria
(Heterotrophs)


Manufec
AQUACULTURE NUTRIENTS


Marine microalgae
Zoo-plankton
Herbivorous/ planktivorous fish
Smaller carnivorous fish
Larger carnivorous fish
Fish Oil with Omega-3s
Cutting out the middle-fish
Marine microalgae
Algae Oil with Omega-3s




Where do Algae live?

Food & Fuel
for the 21st Century

Water
Algae
CO2
Nutrients
Feeding vessel
Photo-bioreactor
Centrifuge
Dryer
Algae oil
Oil press
Press cake



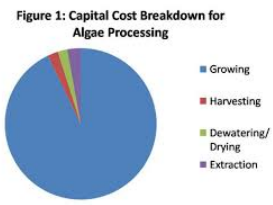


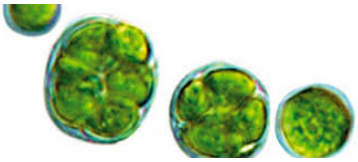
Figure 1: Capital Cost Breakdown for Algae Processing
Growing
Harvesting
Dewatering/ Drying
Extraction

Alga: Latin "Seaweed"
Aquatic organisms that contain chlorophyll and other pigments and can carry on photosynthesis

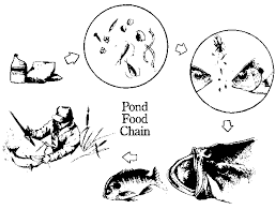

AlTech
ALGAE

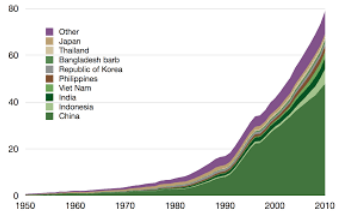
Modular ingredient design.
Each ingredient plays a specific role in whole-body nutrition.

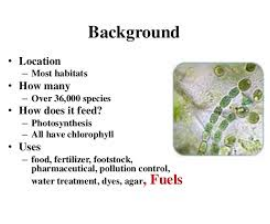


Overview: FDA Biotechnology Regulations
• Engineered algae used for food, food additive, pharmaceutical production would be subject to FDA product-specific regulations.
• These regulations focus more on safety, efficacy of end product, and less on risks of production organism.
• Algae used for an FDA-regulated purpose would likely be exempt from EPA oversight under TSCA.

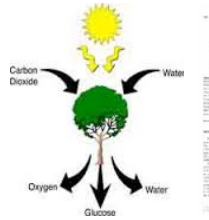

Pond
Food
Chain

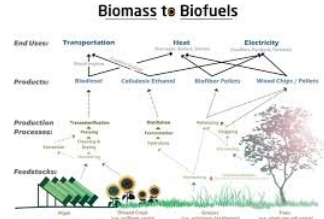


Other
Japan
Thailand
Bangladesh barb
Republic of Korea
Philippines
Viet Nam
India
Indonesia
China
60
40
20
0
1950
1960
1970
1980
1990
2000
2010


Background
• Location
– Most habitats
• How many
– Over 36,000 species
• How does it feed?
– Photosynthesis
– All have chlorophyll
• Uses
– food, fertilizer, footstock, pharmaceutical, pollution control, water treatment, dyes, agar, Fuels

Algae (bioplastic)
Algae (food)



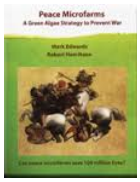

Carbon Dioxide
Water
Oxygen
Water
Glucose

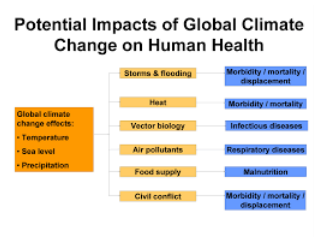


Biomass to Biofuels
End Uses:
Transportation
Heat
Electricity
Products:
Biodiesel
Cellulosic Ethanol
Biofiber Pellets
Wood Chips / Pellets
Production Processes:
Feedstocks:



ReNew Algae
ReNew Fuel
ReNew Feed
ReNew Omega-3

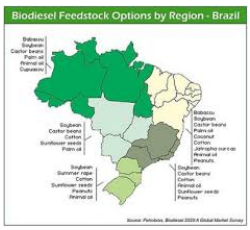
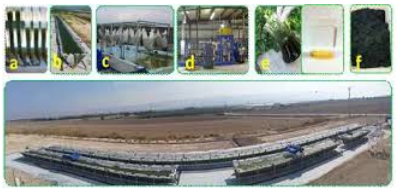


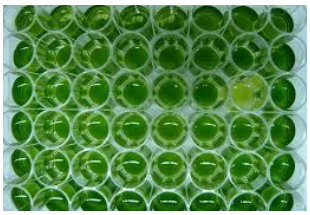
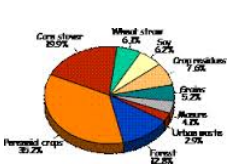


Peace Microfarms
A Green Algae Strategy to Prevent War


Potential Impacts of Global Climate Change on Human Health
Global climate change affects:
- Temperature
- Sea level
- Precipitation
Storms & flooding
Heat
Vector biology
Air pollutants
Food supply
Civil conflict
Morbidity / mortality / displacement
Morbidity / mortality
Infectious diseases
Respiratory diseases
Malnutrition
Morbidity / mortality / displacement

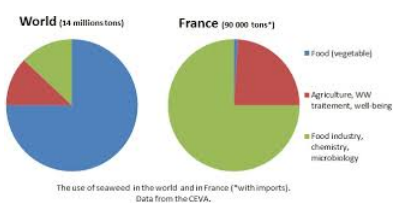

Algae Alliance.com

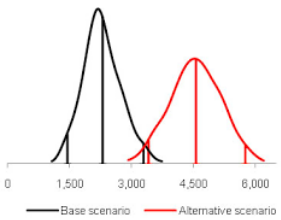
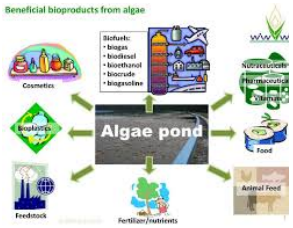
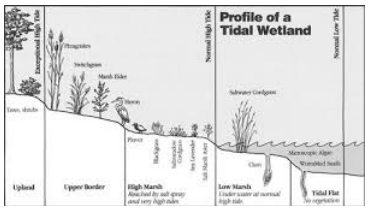



Biodiesel Feedstock Options by Region - Brazil





Corn straw 15.9%
Wheat straw 6.8%
Soy 6.2%
Crop residues 7.0%
Grains 5.2%
Manures 4.1%
Urban waste 2.0%
Forest 12.8%
Perennial crops 39.2%

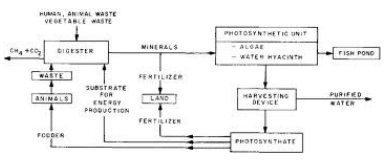
Freedom Foods

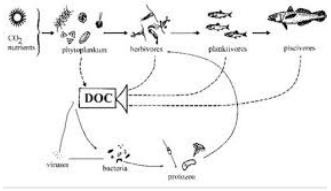

World (14 millions tons)
France (90 000 tons*)
Food (vegetable)
Agriculture, WW traitement, well-being
Food industry, chemistry, microbiology
The use of seaweed in the world and in France (*with imports).
Data from the CEVA.


0
1,500
3,000
4,500
6,000
Base scenario
Alternative scenario

Beneficial bioproducts from algae
Algae pond
Cosmetics
Food
Animal Feed
Feedstock
Fertilizer/nutrients

Profile of a Tidal Wetland
Upland
Upper Border
High Marsh
Low Marsh
Tidal Flat



Biofuels

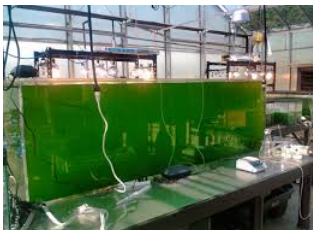

Microfarms: Raceways, PhotoBioreactors, Bags, Plates and Tubes

DIGESTER
WASTE
ANIMALS
FODDER
MINERALS
FERTILIZER
LAND
SUBSTRATE FOR ENERGY PRODUCTION
PHOTOSYNTHETIC UNIT
ALGAE
WATER HYACINTH
FISH POND
HARVESTING DEVICE
PURIFIED WATER
PHOTOSYNTHATE


DOC

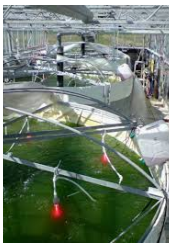

oilgae
Comprehensive Report on Attractive Algae Product Opportunities
Updated FEBRUARY 2015
Download Free Preview of the Report

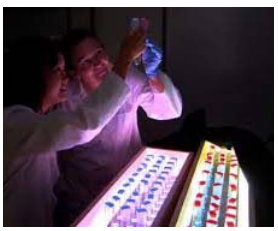

SPRING VALLEY
Fish, Flax & Borage Oil
contains Omega 3-6-9
HEART HEALTH*
120 SOFTGELS

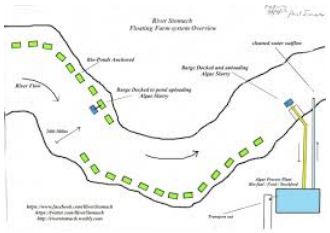

InteSusAl
Integrated Sustainable Algae

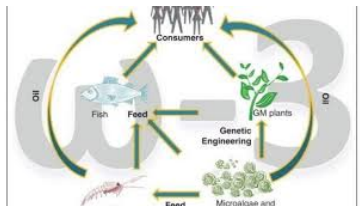


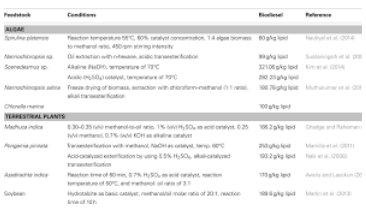

BREAKTHROUGH BIOTECHNOLOGY PLATFORM
FLEXIBLE INPUT
MULTIPLE HIGH-VALUE MARKETS
HIGHLY PRODUCTIVE MICROALGAE
OIL DESIGNED TO SPECIFICATION



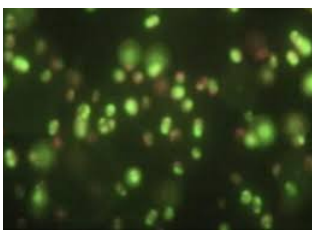




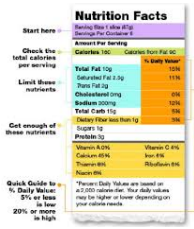
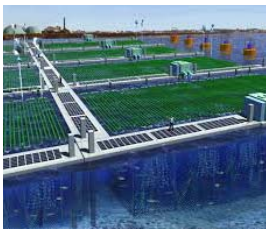

Consumers
Oil
Fish
Feed
GM plants
Oil
Genetic Engineering




Fermentation Tanks
Closed Photobioreactors
Open Ponds







Nutrition Facts


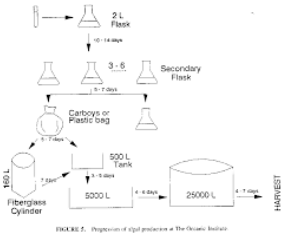
soylent

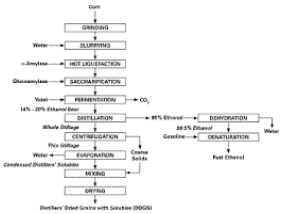


OriginOil

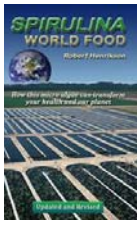
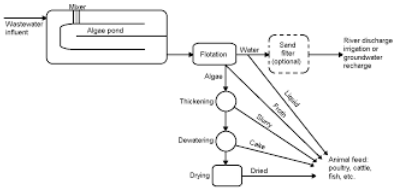
SOLARLAST
2022



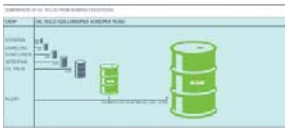

2 L
Flask
3 - 6
Secondary
Flask
Carboys or
Plastic bag
500 L
Tank
160 L
Fiberglass
Cylinder
5000 L
25000 L
HARVEST



Corn
GRINDING
Water
SLURRYING
HOT LIQUEFACTION
SACCHARIFICATION
Yeast
FERMENTATION
DISTILLATION
95% Ethanol
DEHYDRATION
Gasoline
DENATURATION
Water
Fuel Ethanol
CENTRIFUGATION
Whole Stillage
Water
EVAPORATION
Coarse Solids
MIXING
DRYING
Distillers' Dried Grains with Solubles (DDGS)

a
b
c
d
e
f


SPIRULINA
WORLD FOOD

Mixer
Wastewater influent
Algae pond
Flotation
Water
Send filter (optional)
River discharge irrigation or groundwater recharge
Algae
Thickening
Liquid
Foam
Slurry
Dewatering
Cake
Drying
Dried
Animal feed: poultry, cattle, fish, etc.


Ethanol
Biodiesel

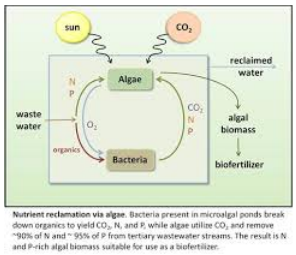
Algae Industry Magazine.com
SCALABLE ALGAE MICROFARMS


Protecting the soil and growing crops with sustainable agriculture

HORIZON
ORGANIC
DHA Omega-3

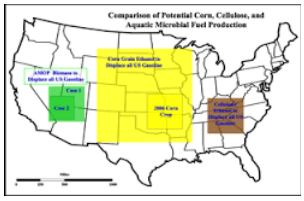
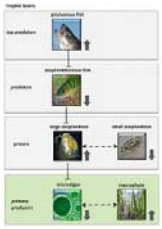
Open Pond

300×300


sun
CO_2
reclaimed water
Algae
N
P
CO_2
N
P
waste water
O_2
algal biomass
organics
Bacteria
biofertilizer
Nutrient reclamation via algae. Bacteria present in microalgal ponds break down organics to yield CO_2, N, and P, while algae utilize CO_2 and remove ~90% of N and ~ 95% of P from tertiary wastewater streams. The result is N and P-rich algal biomass suitable for use as a biofertilizer.

Spirulina
Superior to all other Plant Protein supplements


400
200
100
25
200
150
100
50

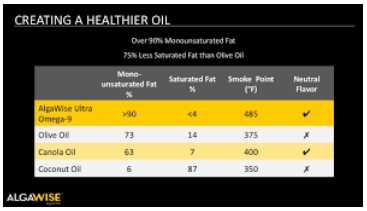
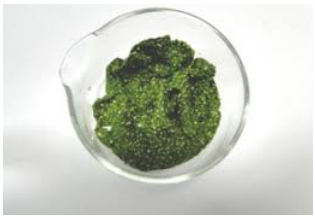

Comparison of Potential Corn, Cellulose, and Aquatic Microbial Fuel Production




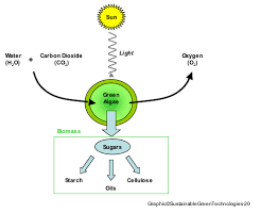


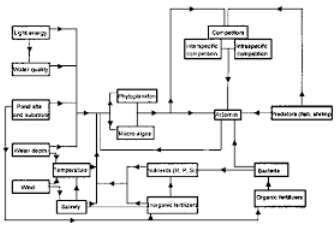
AlgiSys

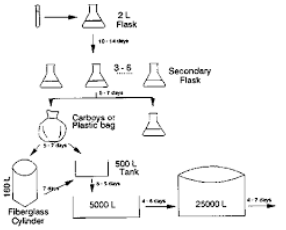
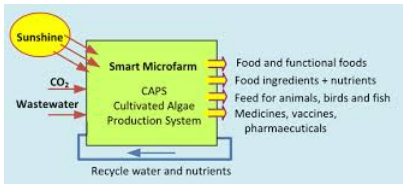
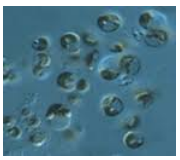
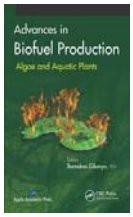
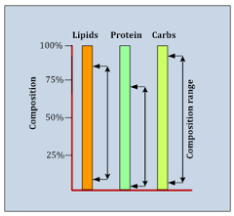




CREATING A HEALTHIER OIL
Over 90% Monounsaturated Fat
75% Less Saturated Fat than Olive Oil
Mono-unsaturated Fat %
Saturated Fat %
Smoke Point (°F)
Neutral Flavor
AlgaWise Ultra Omega-9 >90 <4 485 ✔
Olive Oil 73 14 375 ✗
Canola Oil 63 7 400 ✔
Coconut Oil 6 87 350 ✗
ALGAWISE




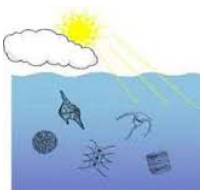
Sustainable Development & GM Food: An analysis of the relationship between the genetic modification of crops and the varieties of sustainable development

Sun
Light
Water (H2O)
Carbon Dioxide (CO2)
Oxygen (O2)
Green Algae
Biomass
Sugars
Starch
Oils
Cellulose


Competitors
Interspecific competition
Intraspecific competition
Light energy
Water quality
Phytoplankton
Predators (fish, shrimp)
Micro algae
Pond site and substrate
Water depth
Temperature
Wind
Salinity
Bacteria
Organic fertilizers

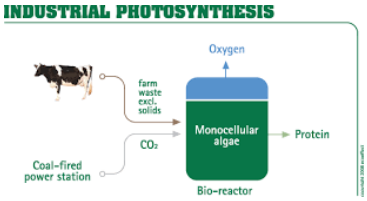

2 L Flask
10 - 14 days
3 - 5
Secondary Flask
5 - 7 days
Carboys or Plastic bag
3 - 7 days
500 L Tank
5 - 5 days
160 L
Fiberglass Cylinder
7 days
5000 L
4 - 6 days
25000 L
4 - 7 days

Sunshine
CO2
Wastewater
Smart Microfarm
CAPS
Cultivated Algae
Production System
Food and functional foods
Food ingredients + nutrients
Feed for animals, birds and fish
Medicines, vaccines, pharmaceuticals
Recycle water and nutrients


Advances in
Biofuel Production
Algae and Aquatic Plants

Lipids
Protein
Carbs
100%
75%
50%
25%
Composition
Composition range

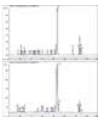


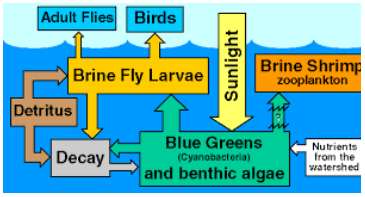
CHLORELLA CRISPIES

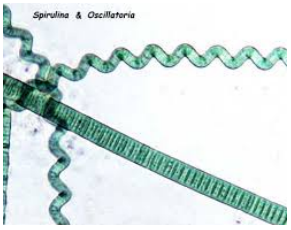



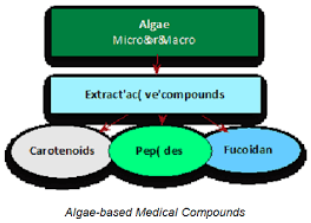
SMART MICROFARMS











Algae-based Medical Compounds

Show more results