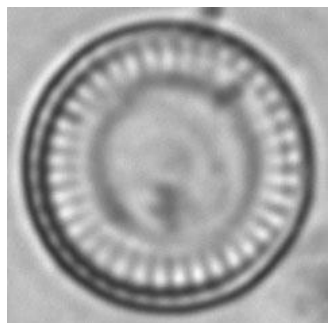


Controlled Photosynthesis in Large Waterways to grow Diatom Algae using

Nualgi™



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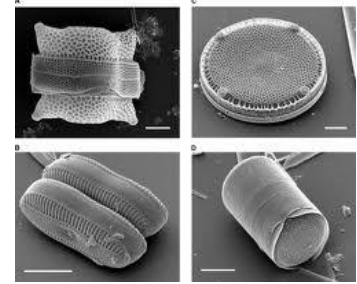


Company Purpose

To grow enough **Diatom Algae**

using **Nualgi**,

in ponds, lakes, rivers, estuaries, oceans, etc.,
to consume **ALL** Nutrient, N and P, input into water &
ALL anthropogenic CO2 emissions



The Problem	The Solution
<p>In the 20th Century Carbon Cycle [fuel] and Nitrogen Cycle [food] speeded up; & Green Revolution took place.</p>	<p>In the 21st Century Silicon Cycle [Diatom Algae] should be speeded up, to enable a Blue Revolution.</p>
<p>Gross Photosynthesis on Earth : 105 GtC / yr Anthropogenic Carbon emissions: 10 GtC / yr Agriculture : 8 GtC / yr</p>	<p>Natural Diatom production : 23 GtC / yr We propose to increase this by : 10 GtC / yr</p>
<p>Petroleum : 30,000 million barrels / yr Coal : 7,700 million tonnes / yr Urea : 100 million tonnes / yr</p>	<p>Nualgi™ required : 10 million Kilo Liters / yr</p>

The Problem – CO₂, N and P

CO₂ in air and oceans and Nitrogen and Phosphorus in water are regarded as problems.

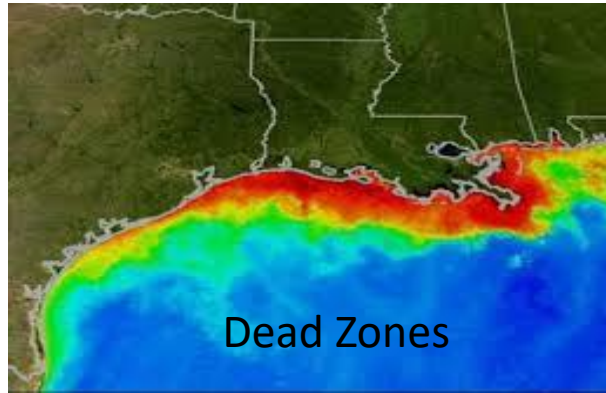
Climate Change:

- Anthropogenic Carbon emissions are ~10 GtC / yr, due to burning of fossil fuels, petroleum and coal. Petroleum is from phytoplankton, mainly Diatoms and coal is from trees.
- Ocean Acidification is due to dissolution of CO₂ into Oceans.

Nutrient, N and P, pollution of waterways :

- Dead Zones in Oceans increased to ~ 500 in past 50 years .
- Eutrophication of lakes, rivers, estuaries and oceans resulting in algal blooms, decline in fish, mass fish kills, etc.
- Fish, Corals, Oysters, etc., are declining in Lakes & Oceans.

The Solution - Diatom Algae - **Nualgi**TM



The Solution - Diatom Algae

- Diatoms consume CO₂, N and P and produce Oxygen.
- Diatoms are consumed by Zooplankton and these by Fish.
- So the Carbon, N and P goes up the food chain and Oxygen remains in the water.
- Cyanobacteria are not consumed by Zooplankton, due to their cellulose cell wall.
- Cyanobacteria are prokaryotes, Zooplankton are eukaryotes, prokaryotes are perhaps not food for eukaryotes.
- Dead Cyanobacteria are decomposed by bacteria, these consume the oxygen produced by the Cyanobacteria, so there is no net Oxygen output.
- Green Algae, Dinoflagellates, etc., are consumed by some Zooplankton and fish but not to the same extent as Diatom Algae.

The Solution -

- Nualgi was invented by Mr. Sampath Kumar Thothathri of Bangalore, India over 10 years of research from 1994 to 2004 and is in commercial use since 2005.
- Nualgi is patented in India, USA, UK and Germany.
- US Patent # 7585898 , 2007

‘Composition for growth of Diatom Algae’.

- Nualgi contains 10 micro-nutrients, adsorbed on Nano Silica. The micro-nutrients are Iron, Boron, Calcium, Cobalt, Copper, Magnesium, Manganese, Molybdenum, Sulfur, Zinc.
- It is a liquid in small plastic bottles, 500 ml and 1 liter.
- Normal dose is 1 liter in 10 million liters of eutrophic water.

The Solution -

- When Nualgi is poured into any nutrient rich water, such as aquaculture ponds, Tanks in Wastewater Treatment Plants, eutrophic lakes, oceans, etc.,
the native Diatoms in the water consume it and grow rapidly.
- Diatoms consume Nualgi and other algae do not consume it, since Diatoms require Silica, thus the micro-nutrients in Nualgi are delivered to Diatoms in large natural waterways that contain many types of phytoplankton such as Cyanobacteria / Blue Green Algae, Green Algae, Dinoflagellates, Coccolithophores, etc.
- Nualgi does NOT contain any Diatoms.

The Solution - [cont...]

1 Litre of Nualgi contains

- ~ 20 grams of Nano Silica,
- ~ 4 grams of 10 micro-nutrients put together,
- ~ 3 grams each of P and K.

It does not contain any Nitrogen or Carbon or Diatom Algae or Diatom Spores.

1 Litre of Nualgi is to be dosed into 10 million liters of eutrophic water or 2 million liters of raw sewage.

1 Litre of Nualgi enables growth of upto 1,000 kgs of Diatoms.

1,000 kgs of Diatoms consume 1,670 kgs of CO₂, 80 kgs of N and 11 kgs of P and produce 1,215 kgs of Oxygen.

1,000 kgs of Diatoms consumed by Zooplankton and Fish grow 100 to 250 kgs of Fish, Shrimp, Oysters, Krill, Whales, etc.

Nualgi™ story – 1994 to 2020


- Nualgi was invented by Mr. Sampath Kumar Thothathri of Bangalore, India over 10 years of research from 1994 to 2004 and is in commercial use since 2005.
- Kadambari Consultants Pvt Ltd acquired the worldwide marketing rights in 2010.
- We have a distributor in USA, since 2011, they sell a few thousand liters per year, to private ponds i.e., Golf Course Ponds, Koi fish hatcheries, etc., but do not sell to wastewater treatment plants and waterways regulated by State and Federal agencies.

Market Size - Global

Parameter	100 years ago	Now	Change
Population	2 Billion	7 Billion	~350 %
Production:			
Agriculture	2 GtC / yr	8 GtC / yr	~350%
Urea	Nil	100 million tonnes / yr	
Diatom	?	23 GtC / yr	Declined?
Fish	?	?	Declined?

- We need to promote controlled photosynthesis in water, to increase Diatom production by ~ 10 GtC / year i.e., ~ 40% , in the next few decades to clean up all waterways including oceans, to grow fish, corals, oysters, etc., & to sequester carbon in Oceans.
- This requires about 10 Million Kilo Litres of Nualgi, this is about ~ 10% of Urea production.
- **At \$ 100 per Litres, total potential is \$ 1 Trillion per year.**

Market Size - USA

Location	Current Cost and results	 Cost and results
Target Nutrient reduction ->	~25 % in 5 years	80 % in 5 years
Chesapeake Bay	\$1,900 m/yr	~\$ 500 m/yr
Mississippi River / Gulf of Mexico	\$250 m/yr by each of the 12 states Total \$3,000 m/yr	Total ~ \$ 2,000 to \$3,000 m/yr
Lake Erie	\$300 m/yr	~ \$ 200 m/yr
Florida	\$ 650 m/yr Including of C4 reservoir in Lake O watershed.	~ \$ 60 m/yr

Market potential by Segment

Market	Details	Sales \$Billion/yr
Fresh Water		
Aquaculture	Ponds, Tanks, RAS, Shrimp, Fish, Crustaceans, etc.	10
Wastewater Treatment	~8 Billion population, 100 LPD per head	5
Eutrophication:		
USA	Chesapeake Bay, Lake Erie, Mississippi River, Lake O, etc.	2
Rest of World [Europe, China, India, etc]	Yangtze, Lake Tai, Ganga, etc.	3
Total c/f		20

Market potential by Segment [cont..]

Market	Details	Sales \$Billion/yr
Total b/f		20
Sea / Ocean:		
Mariculture	Cages, etc.	5
Coastal Fisheries	Creeks, fjords, etc.	5
Coastal Waters / Territorial Waters	Restoration of Fisheries, Corals, etc. Eutrophication, Hypoxia.	70
Exclusive Economic Zone	Fisheries, Corals, Whales, etc., Eutrophication & Hypoxia, Acidification & CDR	400
International Waters	Restoration of Whales, Acidification & CDR	500
Total		1,000

Other uses of Diatom Algae

- Diatoms can also be grown in Tanks, Ponds, Raceway ponds, Photobio Reactors, etc., & harvested and processed for various products, applications.

Products	Sales Gt / yr	Gross Sales \$ Billion / Yr
Nutraceutical	0.05	67
Aquafeed	0.10	67
Biofuel	3.85	770
Total	4.00	903

- High cost of production, due to high cost of harvesting, is the main constraint.
- We propose to develop low cost solutions based on the unique features of Diatoms.

The Competition

- There is no direct competition [unfortunately], even after 15 years, 2005 to 2020, no one has copied Nualgi.

There are many indirect competitors, to each of the problems solved by Diatoms:

- Carbon Capture and Sequestration technologies,
- Ocean Alkalization solutions for Ocean Acidification,
- Aeration – mechanical and chemical, nano bubble technologies for Hypoxia, Nitrogen removal, etc.
- Innovative feed technologies for fish feed,
- Algicides to kill Harmful Algae,
- Phosphorus removal solutions such as Alum, Aluminium Chloride, Clay, etc.,
- Oyster, Coral, Fish, Whale, etc., restoration initiatives.

None of these solve all the problems i.e.,

CO₂, N and P consumption and Oxygen and food production, each one solves only one or two problems.

Business Model

- Nualgi is manufactured by M/s. Nualgi Nanobiotech, Bangalore, India .
- KCPL has obtained marketing rights for it in 2010.
- KCPL proposes to set up a subsidiary or JV in USA.
- KCPL will set up subsidiaries or JVs in major countries and appoint distributors in other countries.
- Nualgi for Aquariums is available on Amazon.com.
- Nualgi is a consumable and needs to be used regularly, proportionate to the nutrients, N and P, input into water.
- **So as long as humans and animals eat and defecate, Nualgi should be deployed.**
- The CapEx to customer to use Nualgi is very low, since dosing is a simple process and special tanks, equipment, etc., are not required.
- First time users require handholding since few are aware of Diatoms and water ecology.
- Nualgi is packed in plastic bottles of 500 ml and 1 litre and these in cardboard cartons of 10 litres and 12 litres.
- There are no special requirements for storage, transport or handling.
- It is shipped by Road, Air and Sea.
- Nualgi is classified as a fertilizer and is a 'product known to be safe'.

Team

Mr. Bhaskar V Mallimadugula

Founder and Director,
Kadambari Consultants Pvt Ltd
Chartered Accountant, age 56.
Left accountancy career to market Nualgi on
a full time basis since 2012.
Has developed extensive contacts with
experts in the field of wastewater treatment,
eutrophication, CDR, etc.
Co-Authored a few papers with Dr Marella
<https://www.linkedin.com/in/bhaskarmv>

Dr Thomas Kiran Marella

Algae Biomass Energy Center (ABES),
University of Tsukuba, Tsukuba, Japan.
Chief Technology Officer of KCPL from 2011
PhD thesis is on Diatoms, awarded in 2018
ICRISAT, Hyderabad from 2017 to 2020.
<https://www.linkedin.com/in/thomas-kiran-marella-71213422/>

Mr Sampath Kumar Thothathri

CEO, Nualgi Nanobiotech, Age 65
Bangalore, India ;
Inventor and manufacturer of Nualgi.
He is a Chartered Accountant and
is self taught in chemistry.
He started a shrimp hatchery in 1994 and
grew diatoms in the conventional manner
and then sought to develop a better solution
to grow them in large waterbodies.
<https://www.linkedin.com/in/sampath651/>

Mr Anil Nanda

CEO of Nualgi America Inc.,
Ex Vice President Marketing in Unilever Ltd.
Distributor for Nualgi in USA,
Selling mainly to private ponds.
<https://www.linkedin.com/in/anil-nanda-346806a1/>

Nualgi™ i on the Internet

Videos:

Sampath Kumar's Presentation:

https://www.youtube.com/watch?v=o_9JlkqRoCo&t=11s

'Power of Shunya' on Times Now:

<https://www.youtube.com/watch?v=htrpCK-O8DU>

Diatom Story :

Part 1 <https://www.youtube.com/watch?v=r8M6eV9-7OA>

Part 2 <https://www.youtube.com/watch?v=xp7KV310sII>

Websites:

Manufacturer:

<http://www.nualginanobiotech.online/nualgi-lakes-5126484.html>

US Distributor, Nualgi America Inc.:

Lakes : <https://www.nualgilakes.com/testimonials/>

Ponds : <https://nualgiponds.com/case-studies/>

Aquariums : <https://nualgiaquarium.com/>

Closing Thoughts

Controlled photosynthesis in large natural waterways to grow a specific type of phytoplankton has not been attempted by anyone.

- Dr William Oswald, 1962: ***'Coming industry of controlled photosynthesis'***
He only suggested growing any type of algae in small ponds, etc.

No one else has even attempted to identify the most beneficial phytoplankton to grow.

- Dr Thurlow Nelson, 1924 : **"Million dollar Diatom"**
- Dr Albert Mann, 1928 : **"No diatoms, no hake"**
- Dr Bostwick Ketchum, 1940s : **"All fish is Diatom"**
- Mr Bartholomew, 1948 : **"no diatoms , no oysters"**
- Dr Victor Smetacek, 2006 : **Diatom – Krill – Whales**
"Food chain of the Giants"
- Dr Carmen Aguilar, 2009 : **"Compared to other phytoplankton, diatoms are like juicy steaks,"**
* * *
- Nualgi is also used as a Foliar Spray on all crops in agriculture, since the micro-nutrient requirement of plants and Diatoms is similar and plants too benefit from silica.

Video : <https://www.youtube.com/watch?v=YMIGFQwUQSc&t=5s>

Controlled Photosynthesis

in

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to grow

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NANOLAND
GLOBAL



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Algal bloom in Lake Erie

