Microalgae: Future food for thought

February 28 2020, by Silvia Dropulich

Growth industry: Microalgae such as spirulina can be farmed. Credit: Monash University

They're responsible for more than 75 percent of the Earth's oxygen supply, but often get no credit for it.

Microalgae are single-celled organisms that photosynthetically convert carbon dioxide and sunlight into useful biochemical products, with oxygen as a byproduct. Microalgae form the foundation of the aquatic

life, enabling water bodies to support life.

To the untrained eye, microalgae look like unattractive green pond scum. Still, for Monash University Malaysia School of Science lecturer Dr. Foo Su Chern, it was the intricacy and obscurity of these microorganisms that sparked her interest to study them further.

Although there are more than 100,000 species of microalgae that have been documented, there are far more that are yet to be discovered, said Dr. Foo. The more commonly known examples include spirulina, chlorella and dunaliella, which are used in the nutraceutical food supplements.

With nutraceutical properties such as beta carotene, chlorophyll and polyunsaturated fatty acids that benefit human and animal health, microalgae have been feted as the superfood of the future, and are ideal vegan protein substitutes.

With the escalation of climate change, there's a great need for solutions to reduce carbon in the atmosphere.

Dr. Foo believes microalgae could be of benefit in the face of climate change:

- they grow in freshwater or seawater bodies
- they also have a high yield
- they have a smaller carbon footprint compared to other crops.

Growing microalgae is more sustainable as a crop, as it has a smaller carbon footprint than rice. The former produces 0.3612kg of carbon dioxide (CO_2) per kilogram of biomass, compared with 0.769kg of CO_2 per kilogram of rice.

In terms of oil yield, microalgae produce 2000 gallons of oil per acre, compared with palm oil's 653 gallons per acre.

Nutritious: Spirulina is used by ethnic minorities as a vegetable for meals. Credit: Monash University

Microalgae can be grown anywhere—even indoors—as they don't require arable land for cultivation.

With a tropical climate and consistent sunshine throughout the year, Malaysia has great potential for microalgae cultivation. With high photosynthetic capacity and requiring only seven days to mature, microalgae can be grown as an alternative biomass source to complement the existing palm oil in the country, as well as provide feedstock for value-added products, food and feed, she said.

"Different microalgae species have different potential. We want to bioprospect and identify microalgae species that are not only unique, but to leverage on each species' strength to resolve pressing problems such as climate change through carbon capture, and at the same time use microalgae biomass in various biotechnological applications," she said.

For her current research project, Dr. Foo will be bioprospecting for tropical microalgae species found in Sunway's South Quay lake, with the aim of furthering carbon capture and producing valuable compounds.

Funded by Sunway Group's Sustainable Community Grant Scheme, the project is multidisciplinary, focusing on biological resources for carbon capture. It's 60 percent focused on microalgae (aquatic), while 40 percent centres on trees (terrestrial).

The tree campaign, headed by Dr. Foo's counterpart, School of Science lecturer Dr. Holly Barclay, focuses on identifying green spaces in Subang Jaya. Proposals for plot locations will then be recommended to relevant parties such as local municipal councils.

Dr. Foo's team aims to identify a species that can swiftly capture carbon, converting it into biochemical products useful as a superfood for humans.

In the initial phase, Dr. Foo and her team have targeted one species, following experiments on different species' growth rates. A faster growth rate will allow the team to produce more biomass in the short term, she said.

For the second phase, a Monash Malaysia School of Engineering lecturer and a master's student are building a cost-effective photobioreactor to grow the microalgae biomass via photosynthesis at a larger scale.

A closed photobioreactor system is required to produce monoculture microalgae of more than 80 percent purity, particularly if the end goal is to produce supplements in a sustainable, standardised manner, Dr. Foo explained.

Nutritious: Spirulina is used by ethnic minorities as a vegetable for meals. Credit: Monash University

"We're planning for a 50-litre flat-panel bioreactor. It will look like a small sealed 'aquarium' filled with bright-green water illuminated by energy-efficient LED lights with a gas distributor to aerate the culture."

Growing microalgae is more sustainable as a crop, as it has a smaller carbon footprint than rice.

In the third phase, the biomass will be harvested, and ionic liquids will

be used to extract bioactives such as antioxidants from the microalgae cells.

The challenge is in lowering the cost of the bioreactor to promote a higher take-up rate. "We want to introduce microalgae usage into homes and businesses, but bioreactors in the market are typically unaffordable," Dr. Foo said.

Currently, about RM60,000 to RM70,000 (A$21,000 to $26,000) has been allocated for the design and fabrication of the bioreactor. "A huge chunk of money goes into installing sensors to calculate carbon capture," Dr. Foo said, adding that the research's initial findings will be published by March 2020 in hopes of attracting further funding.

In terms of potential applications, bioreactor panels have been used in countries such as Germany to complement the external facade of their green buildings. "Besides architectural aesthetics, energy produced by microalgae can power the whole building," she said. Other options include introducing algae domes in public parks to utilise natural sunlight for microalgae growth.

Dr. Foo and her team plan to present their findings at the Green City Forum in June 2020. "We will also present our findings to the Sunway Group to see if they would be keen to implement the microalgae bioreactors in their malls or commercial buildings," she said.

Moving forward, Dr. Foo plans to start a microalgae culture collection in Monash University Malaysia, and introduce easy-to-use microalgae photosynthesis school kits.

"We hope to pursue more research opportunities and promote microalgae as a sustainable resource in the Southeast Asian context. We need to understand that microalgae are very useful. My ultimate goal is

to make microalgae more accessible to the public, so I hope to resolve pressing bottlenecks in this growing area," she said.

Provided by Monash University

Citation: Microalgae: Future food for thought (2020, February 28) retrieved 7 June 2023 from https://phys.org/news/2020-02-microalgae-future-food-thought.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.