

CO-SPONSORSHIP OF “SECOND INTERNATIONAL WORKSHOP ON THE CULTIVATION AND BIOTECHNOLOGY OF MARINE ALGAE: AN ALTERNATIVE FOR SUSTAINABLE DEVELOPMENT IN LATIN AMERICA AND THE CARIBBEAN”

Production System Design and Best Management Alternatives/ Activity/ 07BMA03UA

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ABSTRACT

At the 2009 World Aquaculture Society Meetings in Veracruz Mexico, we organized and co-chaired a workshop the - Second International Workshop on the Cultivation and Biotechnology of Marine Algae. As part of our support for this workshop, we provided transportation and registration funding for four participants in the workshop. The workshop itself included nine presentations and a panel discussion. As a follow-up to the workshop we collected the Presentations and converted to PDF's for posting on a conference website.

INTRODUCTION

Seaweeds and other algae are widely recognized as one of the most important sectors of the aquaculture industry. Many algae species are consumed directly by humans, especially in Asia, where they contribute significantly to general nutrition (Figure 1.). An even larger industry exists culturing seaweeds for processing with some of the constituents used as functional ingredients in all types of processed foods. Alginates, agar, and carageenan are the most common ingredients. Algae are critical components of developing sustainable integrated aquaculture systems, as important nutrient sources for rearing aquatic animals and to absorb their wastes (Figure 2 and 3). Multi-trophic aquaculture systems will address many of the complaints leveled at current aquaculture practices and generate an additional marketable crop (Figure 4). Algae also predominate in many of the second generation biofuel plans that endeavor to create sustainable sources of fuel that will also remove large quantities of carbon dioxide from the atmosphere. Currently, virtually all of the economically successful algae businesses are part of the aquaculture industry. The community interested in utilizing algae for biofuels has much to learn from aquaculture practitioners who have many years experience.

Our goal in sponsoring the workshop was to increase awareness and to begin sharing with a wider community the skills and experience from the aquaculture industry. We invited both established practitioners of algae production for human consumption, commercial producers of phytoplankton used in fish and shrimp hatcheries, researchers producing micro-algae for biofuels and students presenting their research results.

Conference highlights

The session included:

09:00 Mauricio Ondarza

ALGAE AS A SUSTAINABLE FEEDSTOCK ALTERNATIVE FOR BIOFUELS

09:20 Koen Vanhoutte, Victor Chepurnov, Luc Roef

A REVIVAL OF INDUSTRIAL APPLICATIONS OF MICRO-ALGAE IN AQUACULTURE

09:40 Kim Falinski, Charles Laidley, Michael Timmons, Leonard Lion

EFFECTS OF DIFFERENT AERATION CONDITIONS ON *Isochrysis galbana* (T-ISO) CCMP 1324 IN A BENCH-SCALE PHOTOBIOREACTOR

10:00 Simon Chung, Kao Chung Wang, Ping Hua Teng, T. M. Lee, Anne T. J. Chow

GENETIC MODIFICATION OF MICROALGAE FOR ANTI-MICROBIAL ACTIVITIES

11:10 Julieta Munoz, Ravi Fotedar

BASIC BIOLOGY OF THE AGAROPHYTE *Gracilaria cliftonii* FROM WESTERN AUSTRALIA

11:30 Abdollah Haghpanah, Lalik Sarikhani, Yousef Iri, Behrooz Gharavy

COMPARISON OF EXTRACTED ALGINIC ACID IN BROWN ALGAE; *Sargassum illicifolium*, *Cystoseira indica* AND *Nizimuddiniana zanardini* IN THE OMAN SEA (CHABAHAR)

11:50 Raul Rincones, Daniel Robledo

THE INTRODUCTION AND CULTIVATION OF THE RED ALGA *Kappaphycus alvarezii* FOR THE PRODUCTION OF CARRAGEENAN IN THE CARIBBEAN AND THE WESTERN ATLANTIC: AN ALTERNATIVE LIVELIHOOD FOR COASTAL COMMUNITIES

12:10 Kevin Fitzsimmons, Anicia Hurtado, Michael Rimmer, Nelson Golez, Hasan Hasanuddin

Gracilaria AND *Euchuma* PRODUCTION IN TSUNAMI AFFECTED AREAS OF BANDA ACEH, INDONESIA

12:30 Rafael Martinez-Garcia, Stephen Nelson, Brendan Ambrose, Edward Glenn, Kevin Fitzsimmons

BIOMASS PRODUCTION, SEED YIELD, AND TISSUE OSMOLARITY OF
Salicornia bigelovii Torr. (Chenopodiaceae) IN RELATION TO IRRIGATION
SALINITY

Workshop Posters

This poster was presented with partial travel support provided to graduate student Michael Mason. The research conducted by Michael was also partly supported by AquaFish CRSP funds.

Michael J. Mason, Joel Cuello
MICROALGAL PRODUCTION IN CLOSED SYSTEM BIOREACTORS BASED ON
MIXING AND RESIDENCE TIME

The following poster was presented the second place student award by the AquaFish CRSP.

Socorro Jiménez-Valera, M. del Pilar Sánchez-Saavedra
EVALUATION OF GROWTH AND NUTRIENT REMOVAL OF MIXED
PHYTOPLANKTON CULTURES

The other algae posters included:

Jeane Rimber Indy, Lenin Arias Rodriguez, Hajime Yasui
INDONESIAN SEAWEED BIODIVERSITY

Lúcia Helena Sipaúba Tavares, Rodrigo Ney Millan, Flávia de Almeida Berchielli
USE OF ALTERNATIVE MEDIUMS AND DIFFERENT TYPES OF RECIPIENTS IN
THE LABORATORY CULTURE OF *Ankistrodesmus gracilis* (REISCH) KORSIKOV
(CHLOROPHYTA)

Abdollah Haghpanah, Lalik Sarikhani, Yousef Iri, Behrooz Gharavy
CULTURE OF *Gracilaria corticata* IN THE EARTHEN PONDS OF BERIS SESSION
(CHABA HAR)

Abdollah Haghpanah, Lalik Sarikhani, Yousef Iri, Behrooz Gharavy
CULTURE OF *Gracilaria corticata* IN THE EARTHEN POND AND SEA
(CHABA HAR)

Antonio López, Norma Garcia, Anselmo Miranda, Nolberta Huerta, Antonio García
GROWTH AND BIOCHEMICAL COMPOSITION OF THE MICROALGAE
Thalassiosira pseudonana AT 6 SALINITIES IN 3 GROWTH PHASES

Daniel Robledo, Eucario Gasca-Leyva, Roger Domínguez May
GROWTH MODEL FOR *Kappaphycus alvarezii* 'COTTONI'

Marcelo Shei, Marcelo Shei, Talia Bonfante, Oscar Barreto, Gastão Bastos
PRODUCTION AND COSTS OF THE MARINE DIATOM *Chaetoceros calcitrans*
USING DIFFERENT BRANDS OF ARTIFICIAL SEAWATER

CONCLUSIONS

The workshop was very well attended and generated considerable discussion. The World Aquaculture Society has since followed-up our workshop with a similar session at the Asia-Pacific Aquaculture Meeting in Kuala-Lumpur, Malaysia in November 2009 (Figure 5). As we gather the final PDF's for the website and provide links and publicize the site we expect to garner a significant amount of web traffic. We also plan to build upon the linkages generated at the meeting. Raul Rincones from Venezuela has offered to assist with a workshop in Guyana. He has also been in correspondence with our Mexican colleagues. We hope to further expand these links with others we met at the Kuala Lumpur conference who have developed method to create high quality white paper from red algae.

Figure1: Raul



Figure 2. Algae Biofilters

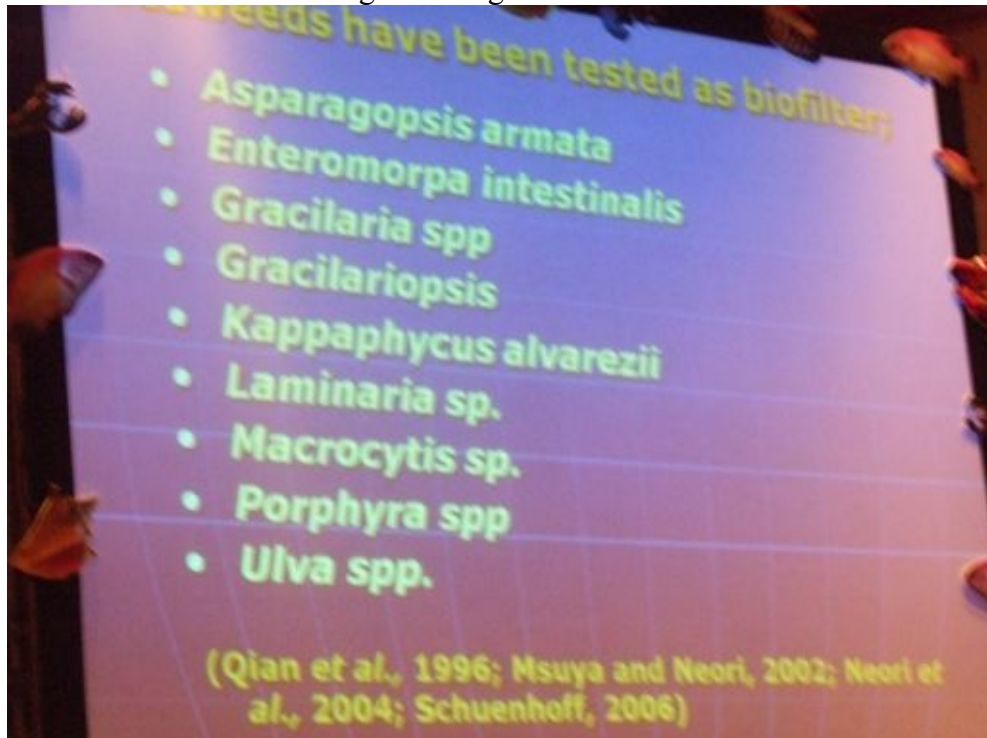


Figure 3. Larviculture algae

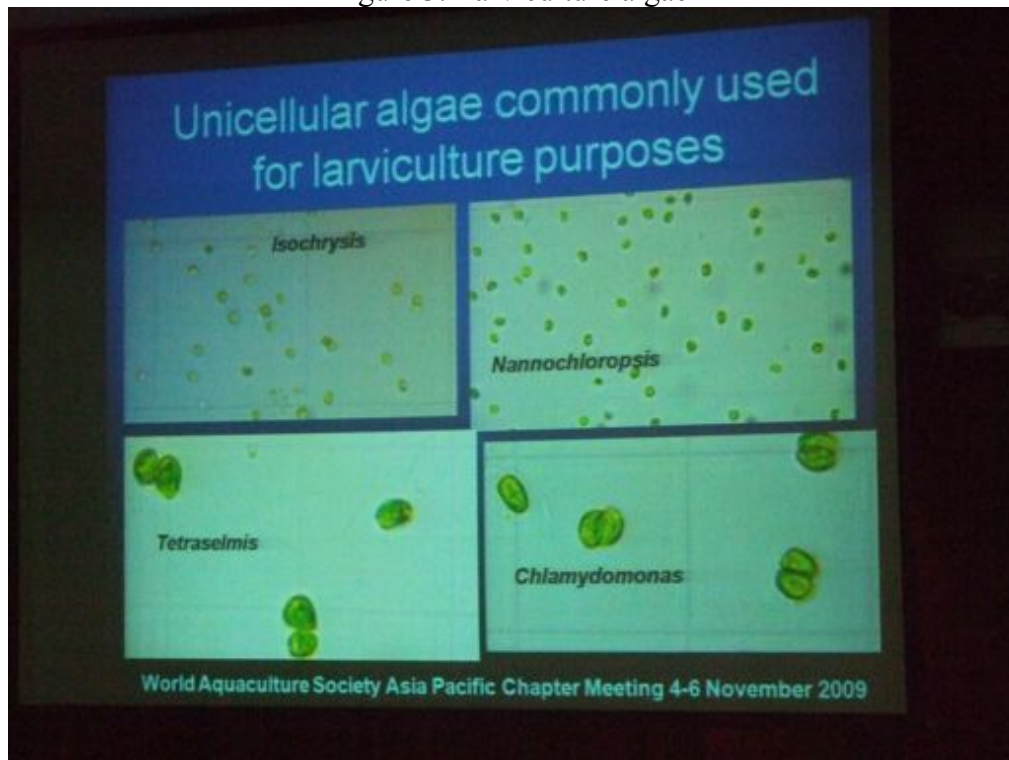


Figure 4. Seaweed Shrimp

CULTURE OF GRACILARIA IN SHRIMP POND EFFLUENT

- Three species of *Gracilaria* (*G. changii*, *G. edulis*, *G. tenuistipitata*) which grow abundantly in the mangroves, where shrimp ponds are located, can grow in the shrimp pond effluent.
- Of the three seaweeds, *G. edulis* and *G. tenuistipitata* grew better in the shrimp pond effluent. Relative growth rates average 3% day⁻¹.
- Nitrogen and phosphorus may be limiting in the effluent. Supplementation with ammonium chloride and urea, showed that *G. edulis* grew better on ammonium chloride while *G. tenuistipitata* grew better on urea.
- In general, the seaweed cultures were able to reduce the nitrogen, phosphorus and organic carbon levels from between 67 to 98% for NH₄-N, 88 -98% for PO₄-P and 71 to 80% for COD, without nutrient supplementation.

Figure 5. Seaweed Farms Malaysia

Seaweed Cultivation In Malaysia

- Mass cultivated in Sabah
- 2 main species cultivated:
 - *Kappaphycus alvarezii* (or *Euचेuma cottonii*)
 - *Euचेuma denticulatum* (or *Euचेuma spinosum*)
- Cultivation systems used:
 - Stake system
 - Long line system
 - Raft system

Three factories in Sabah producing carrageenan:

Two are producing semi-refined carrageenan and chips
The newest factory is producing refined carrageenan

