

"CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY"

February 17th -21st 2020 // INECOL, Xalapa, México

TRAINING COURSE ORGANIZED BY SOLABIAA AND INECOL (Sociedad Latinoamericana de Biotecnología Ambiental y Algal) FUNDED BY ISAP (International Society for Applied Phycology)

1) Background information

SOLABIAA and INECOL presented a proposal to the call issued by ISAP in relation to the organization of Training Courses in 2019. The main objective was to benefit the Latin American Region with a course involving large experienced lectures from Europe and México. When choosing the dates for the course to be held, the purpose was to include a one-day Workshop together with lecturers from the U.K. taking advantage of a previous joint project together with Membranology Ltd. and the University of Swansea at the U.K. The result was to include an interesting full day Workshop entitled "High value products from microalgae" including 8 lectures and experimental work. Such workshop was funded by the Newton Fund and the grant holder was Prof. Robert Lovitt from Membranology Ltd.

2) Programme (Annex 1)

The course included the participation of 13 professors from different institutions of Mexico, Italy, UK and Brazil, with a total of 18 lectures and one roundtable. Four sessions of experimental work were also carried out.

The programme was designed considering that the audience included persons of very different levels of knowledge in the field. Thus, the first lectures were dealing with general aspects of microalgae, photosynthesis and kinetics of growth. In subsequent





days, very diverse applications of microalgae were presented and extensively discussed. Such applications are very relevant and hot topics at the current moment in the field of applied phycology. The Workshop entitled "High value products from microalgae" included lectures explaining the objectives and results of the joint project INECOL-Membranology-University of Swansea. Also, it included a very useful presentation related to the Algae-UK network, which provides opportunity for further interactions among the audience and other researchers in the U.K.

3) Short biography of Lecturers (Annex 2)

The professors invited to lecture are experts in different areas of the applied phycology such as microalgae taxonomy, photosynthesis, algal culture, kinetics of growth, wastewater treatment using microalgae, high-value products from microalgae, microalgae-based biorefineries and soil and heavy metal recovery with microalgae. The course was very successful due to such a good number of very well-known experts in the field with a large experience for making very didactic presentations.

4) List of Participants (Annex 3)

The course had a high demand resulting in twenty-nine attendees from various countries: México, Colombia, Cuba, India, The Netherlands and Chile). They included undergraduate and postgraduate students, professionals from industry and researchers. It should be highlighted that some of the attendees came from various countries of the Latin American Region but also from Europe and India, an indication that the Programme was very attractive and included well known researchers as lecturers. Two researchers from México, two from Cuba and one from Colombia are considered as an important contribution to capacity building in the region in this field. Participants from the industry is also a good sign of academiaindustry collaboration.





5) Experimental work (Annex 4)

The experimental work included sessions about basic (isolation, identification of microalgae, etc.) and advanced topics (harvesting and concentration of biomass from raceways through membrane technology). The later work was linked to the workshop "High value products from microalgae" carried out jointly with Membranology Ltd and the University of Swansea. Actually, the attendees learned how to extract and purify phycocyanin with a special equipment using membranes of different sizes.

6) Round Table

During the last day of the course, a round table entitled "The future of Microalgae Biotechnology" was held. Prof. Roberto DePhilippis was the Chair and he gave at the beginning relevant information about ISAP. Later, he put forward very challenging questions and the audience had a very lively participation. There is the intention that the Professors that participated at the Round Table will write an article based on this discussion. It is expected to be published in the journal of SOLABIAA which is entitled Journal of Environmental and Algae Biotechnology (RELBAA in Spanish).

7) Production of *e-Book*

Another important product which could be derived from the training course is the publication of an e.book compiling the presentations of the various lecturers. They all agreed but need a time to produce a version without any figure or data that could be against the author's rights or the journals privileges. It is expected that such product could take at least 6 months to be produced since it requires an international number and the contributions from the authors. Dr. Eugenia J. Olguín has put forward the idea and she is willing to serve as Editor in Chief.





8) Final Remarks

The Course was a relevant activity serving not only the Latin American Region but also other countries. It reached all expected levels: undergraduate and postgraduate students, researchers and professionals from industry. The selected topics and lecturers were highly appreciated by the audience as they expressed at the closing ceremony chaired by the Director General of the Institute of Ecology.

9) Acknowledgements

The Organizing Committee acknowledges very much the financial support provided by ISAP

Dr. Eugenia J. Olguín Chair

Dr. Gloria Sánchez-Galván M.S. Nancy Ramos Mancilla Ing. Erik González-Portela



Group Image





"CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY" PROGRAMME

Monday, February 17

Timetable	Lecturer	Торіс
9:00-9:45	Registration of participants	
10:00-10:15	Introduction to the course and welcome	
10:15-11:15	Dr. Ma. Edith Ponce	What are algae? Generalities, where they live, importance, location and taxonomy
11:15-11:30	COFFEE BREAK	
11.30:13:30	Dr. Giuseppe Torzillo	Photosynthesis: basic principles to optimize growth of microalgae culture outdoors
13:30-14:30	LUNCH	
14:30-15:30	Dr. Guillermo Quijano	Kinetic characterization of microalgal cultures
15:30-15:45	COFFEE BREAK	
15:45-17:00	Experimental work	Preparation of inoculum for raceways in flat plate bioreactors (180 L)

Tuesday, February 18

Timetable	Lecturer	Торіс
9:00-9:45	Dr. Ma. Edith Ponce	Identification of Microalgae (theoretical part)
9:45- 11:45	Dr. Roberto De Philippis	Exploitation of cyanobacteria for soil rehabilitation
11:45-12:00	COFFEE BREAK	
12:00-13:00	Dr. Eugenia J. Olguín	Dual purpose systems for the production of microalgae and treatment of wastewater
13:00- 14:00	LUNCH	
14:00-15:00	Dr. Germán Buitrón	Microalgal-bacterial aggregates for wastewater treatment
15:00-17:00	Dr. Roberto De Philippis	Heavy metal bio-removal with exopolysaccharide-producing cyanobacteria
17:00-17:15	COFFEE BREAK	
17:15-18:00	Dr. Ma. Edith Ponce	Observation and identification of microalgae



Wednesday, February 19

Timetable	Lecturer	Торіс	
9:00-10:45	Dr. Ma. Edith Ponce	Preparation of permanent and semi- permanent preparations of microalgae	
10:45:11:45	Dr. Germán Buitrón	Obtaining hydrogen and methane from microalgal biomass	
11:45-12:00	COFFEE BREAK		
12:00-13:00	Dr. Eugenia J. Olguín	Microalgae-based biorefineries using agro- industrial wastewater and aquatic plants	
13:00-14:00	LUNCH		
14:00-16:00	Dr. Luis Fernández Linares	Various types of microalgae cultures and bioproducts	
16:00-16:15	COFFEE BREAK		
16:15-17:00	Dr. Ma. Edith Ponce	Cleaning and assembly of diatoms	
17:00-18:00	Experimental work	Cultivation of <i>A. maxima</i> in raceways (2,000 L)	

Thursday, February 20- WORKSHOP "HIGH VALUE PRODUCTS FROM MICROALGAE			
Timetable	Lecturer	Торіс	
9:00-9:30	Registration (tea and coffee)		
9:30-9:40	Dr Alla Silkina	Welcome and housekeeping	
9:40-10:00	Dr Claudio Fuentes- Grünewald/Prof Carole Llewellyn	Talk1 Phycopigments project (UK)	
10:00-10:20	Prof Eugenia J. Olguín	Talk2 Cultivation of <i>A. maxima</i> and production of phycocyanin (México)	
10:20-10:40	Dr. Giuseppe Torzillo	Talk 3 Purification of phycocyanin from <i>Arthrospira platensis</i> biomass using hydrophobic interaction membrane chromatography	
10:40-11:00	Prof Saul Purton	Talk 4 Algae-UK network	
11:00-11:20	ТВС	Talk 5 by somebody from CONACYT (México)(TBC)	



11:20-11:50	COFFEE BREAK AND NETWORKING	
11:50-12:10	Dr Roberto de Philippis	Talk 6 Exopolysaccharides of industrial interest from cyanobacteria
12:10-12:30	John McDonald	Talk 7 Algaecytes (UK)
12:30-12:50	Joe McDonald	Talk 8 PBR Varicon (UK)
12:50-13:10	Prof Carole Llewellyn	Talk 9 Circular economy, ALG-AD (UK)
13:10-14:00	LUNCH	
14:00-14:30	Demonstration of culture systems and separation-INECOL	
14:30-15:00	Dr Claudio Fuentes- Grünewald, Eduardo Rodríguez Verdú	Harvesting of biomass for Spirulina culture- (UK)
15:00-15:30	Eduardo Rodríguez Verdú	Phycocyanin separation demo (UK)
15:30-16:00	COFFEE BREAK	
16:00-16:45	Dr Alla Silkina	Roundtable on identification of good product systems for Mexico and routes to market
16:45-17:30	Networking	

Friday, February 21

Timetable	Lecturer	Торіс
9:00-10:00	Dr. Hugo Moreira	Trends and Tendencies in Bioprocess
	Soares	Engineering Applied to the Environment
10:00-12:00	Dr.Eugenia J. Olguín	ROUND TABLE- The future of Microalgae
	(Chair)	Biotechnology
	Dr. Germán Buitrón	
	Dr. Roberto de	
	Philippis	
	Dr. Guillermo Quijano	
	Dr. Giuseppe Torzillo	
12:00-12:15	COFFEE BREAK	
12:15-13:00	Dr. Eugenia J. Olguín	Information about SOLABIAA
	Dr. Hugo Soares	
	Dra. Gloria Sánchez	





TRAINING COURSE: "CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY" Short Biography of Lecturers



Prof. Eugenia J. Olguín received her PhD in Biochemical Engineering from the University of Birmingham in the UK (1978). She has been working nearly 40 years in the development and evaluation of bioprocesses for the sustainable use of water, with emphasis in the fields of phycoremediation and phytoremediation. In the last 10 years, she has combined these two fields with the production of biofuels within a Biorefinery of third generation. She is a member of the Mexican Academy of Sciences and has been distinguished as member of the National Research System since 1989 (Level III). Prof. Olguín received the National Award '*María Lavalle Urbina*' in the area of Environment and Sustainable Development in 1999. She was awarded with *the "State Prize in Science and Technology"* in the field of Technology Development and Innovation in 2019. She is currently the President of the International Society of Environmental Biotechnology (ISEB). She is the founding President of the Latin American Society of Environmental Alga! Biotechnology (SOLABIAA) (2008-2011).



Dr. Giuseppe Torzillo, 37- years of research activity; h-index (Scholar) 41, Citations: 4340; 2016 -2018, Acting Director of Institute of Ecosystem Study of the National Research Council of Italy.

At the present he is associated researcher at the Institute of Bioeconomy (Florence) of the National Research Council of Italy. He is also associated at the *Centro de Investigación y Ciencias del mar y Limnología* (CIMAR), University of Costa Rica. His field of study is the physiology and biotechnology of microalgae and cyanobacteria.

He has published more than 120 papers, 76 in international peer review journals, 17 chapters dealing with photosynthetic microorganisms, and edited 1 book on the photobiological hydrogen production with microalgae. He has patented two photobioreactor designs for outdoor culture of microalgae, one process to tread olive mill wastewater, and a process to attain phycocyanin analytical grade.



TRAINING COURSE: "CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY" Short Biography of Lecturers



Prof. Hugo Moreira Soares. Graduated in Chemical Engineering from UFRJ (1980), Master in Chemical Engineering from USP (1990), Doctor in Environmental Engineering - UMASS (1995). Currently, he is a professor at the Department of Chemical Engineering and Food Engineering at UFSC, Brazil. He has held several administrative positions at UFSC, such as: Department Head, Undergraduate Course Coordinator, Graduate Assistant Director and Graduate Director. He currently coordinates the Nucleus for Environmental Rescue (REMA) and is President of the Latin American Society for Environmental Biotechnology, mainly in the following areas: treatment of industrial effluents, anaerobic digestion, nutrient removal (C, N and S), advanced oil recovery by microbial methods (MEOR) and fuel bio-cells. He has supervised 58 graduate students at the master's and doctoral levels and has 45 articles published in Journals.



Roberto De Philippis is Professor of Microbial Biotechnology at the University of Florence, Italy. He was Visiting Professor at the Wuhan University, China. He is Past President of the International Society for Applied Phycology (ISAP); Associate Editor of the Journal of Applied Phycology; member of the Board of Directors of the International Society for Environmental Biotechnology (ISEB); member of the Experts group of the Section on Environmental Biotechnology of the European Federation of Biotechnology. He is President of the Master Course on Biotechnology for environmental management and sustainable agriculture (BIO-EMSA) at the University of Florence.

His research activity is mainly concerned with the physiology and the possible biotechnological exploitation of phototrophic microorganisms, in particular for the production of biopolymers and bioenergy.



TRAINING COURSE: "CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY" Short Biography of Lecturers



Dr. Germán Buitrón Méndez is a Chemical Engineer graduated from the Faculty of Chemistry of the UNAM, and has a Master's and a PhD in Water Treatment Engineering from the National Institute of Applied Sciences in Toulouse, France. He is currently Deputy Director of Foreign Academic Units and Head of the Juriquilla Academic Unit at the UNAM Institute of Engineering. At the Institute of Engineering, he is a Researcher C and professor of the Master and Doctorate Program in Environmental Engineering at UNAM. He is a National Researcher Level III of the National System of Researchers. He has more than 112 publications in indexed international journals (ISI-JCR) and around 450 publications in congress reports, refereed and dissemination journals, as well as project reports to sponsors. His works have been cited more than 1700 times. He is a reviewer for most of the journals in his area. He is a member of the Mexican Academy of Sciences, the Mexican Society of Biotechnology and Bioengineering and the International Water Association.



Prof. Guillermo Quijano is an Industrial Biochemical Engineer from the Universidad Autónoma Metropolitana (UAM), where he also studied a Master's Degree in Biotechnology. He obtained his PhD in Biotechnology at the Centre for Research and Advanced Studies of the Mexican National Polytechnic Institute (Cinvestav-IPN). From 2010 to 2014, Guillermo Quijano was a senior researcher at the École Nationale Supérieure de Chimie in Rennes (France) and a Juan de la Cierva Researcher at the University of Valladolid (Spain). From 2014 to 2016 he was Professor of the Department of Chemical Engineering and Environmental Technology at the University of Valladolid and has been a guest lecturer at the Ecole des Mines d'Alès (France). He is a member of the National System of Researchers Level II. He has published 55 articles in indexed journals with 1,429 citations, resulting in an h index of 23 (SCOPUS-Elsevier, September 2019). Guillermo is editor of the book "Advances and Applications of Partitioning Bioreactors" from the prestigious Elsevier Advances in Chemical Engineering Series.

Participants of the training course "CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY"

NAME	INSTITUTION	COUNTRY
1 Muhamad Maulana Azimatun Nur	University of Groningen	Netherlands
2 Rodrigo Uriel García Robles	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
3 Lilia Tapia Pérez	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
4 Margarira Rocío Vega Gómez	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
5 Olga Berenice Benítez López	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
6 Luis Fernando Calixto Canseco	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
7 Eduardo Campos Ramirez	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
8 Luis Ángel Alcalá Arellano	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
9 Rohit Saxena None	Universidad Autónoma de Coahuila	México
10 Marco Yael Nuñez Castillo	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
11 Margarita Acosta Mijangos	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
12 Hugo Perales Vela	UNAM FES Iztacala	México
13 Eduardo Olvera Ramos	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
14 Leonardo Zamora Zecua	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
15 Francisco Javier Choix Ley	Universidad de Guadalajara	México
16 Mario Bryan Porras Hernández	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
17 Dayana Rabassa Rabassa	Centro de Estudios Ambientales de Cienfuegos	Cuba
18 Ilein Ahtziri Sanchez Velazquez	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
19 Melania Osornio Cornejo	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
20 Aimee Valle Pombrol	Centro de Estudios Ambientales de Cienfuegos	Cuba
21 Daniel Alejandro García López	Instituto de Ecología	México
22 Fátima de la Luz Félix Díaz	Unidad Profesional Interdisciplinaria de Biotecnología IPN	México
23 Leanis Mireya Pitre Ruiz	Universidad de la Guajira	Colombia
24 Wilberth Chan Cupul	Universidad de Colima	México
25 Monserrat Hernández Maldonado	UNAM	México
26 Federico Augusto Trampe Torija	Universidad Autónoma Metropolitana U. Azcapotzalco	México
27 Javier Zagal Rojo	Industry	México
28 Anilú Mendoza Guerrero	Instituto de Ecología	México
29 Ashley García Arroyo	Instituto de Ecología	México



TRAINING COURSE: "CHALLENGES AND APPLICATIONS IN MICROALGAL BIOTECHNOLOGY"

Experimental Work



Identification of Microalgae, practical sessions at the Laboratory



Experimental work at Pilot-plant scale, demonstration of equipment for the cultivation of Spirulina, and extraction/purification of phyco-pigments

