



## IProPBio WORKSHOPS

**Valuable products from residual biomasses  
Towards a greener society (ProGreS)**



**ProGreS FIRST WORKSHOP**  
***Biomass selection, characterization and  
valorization***

**Sofia, Bulgaria**  
**23.09.2019 – 24.09.2019**



**IProPBio**

Integrated Process and Product design for sustainable Biorefineries

**ORGANIZER:**

**INSTITUTE OF CHEMICAL ENGINEERING  
BULGARIAN ACADEMY OF SCIENCES**

**National Organizing Committee**

**Roumiana Stateva**

**Dragomir Yankov**

**Greta Naydenova**

**Stanislava Boyadjieva**

**Stefan Stefanov**

**Galina Kalotova**

**Scientific Committee**

**Massimiliano Errico – University of Southern Denmark**

**Dragomir Yankov – Institute of Chemical Engineering, Bulgarian Academy of Sciences**

**Jose Coelho- Instituto Superior De Engenharia De Lisboa**

**INDROPB**

## Day 1

September 23, Monday

9.00 Coffee.

**Opening – The Coordinator Prof. M. Errico, Charing.**

9.15-9.30 Welcoming address by G. Tchouprenska - The Marie Sklodowska-Curie Actions National Contact Point for Bulgaria, Horizon 2020 Framework Programme.

9.30-9.40 R.P. Stateva: Presentation of the Key Note Speaker Sir William A. Wakeham, FREng

9.45-10.30 **Key Note Lecture: Professor Sir William A. Wakeham:** “The Dangerous Nexus of Process Simulation, Molecular Modelling and Physical Reality”.

### ORAL PRESENTATIONS

**Session: Bio-component separation by supercritical extraction and compressed fluids**

Chair: M. Martin

10.30-10.50 **J.A.P. Coelho**, S. Boyadjieva, R.M. Filipe, M.P. Robalo, G.St. Cholakov, and R.P. Stateva: "Supercritical CO<sub>2</sub> extraction of feed stocks to generate high added value bio-products".

10.50-11.10 **R.M. Filipe**, J.A.P. Coelho, M.P. Robalo, G.St. Cholakov, and R.P. Stateva: "Modelling the kinetics of supercritical CO<sub>2</sub> extraction of biomass ".

11.10-11.30 **S.M. Stefanov**, D.L. Fetzer, A.C. Rieder, M.L. Corazza and R.P. Stateva: “Extraction and characterization of Burdock extracts (leaves, seeds and roots) with compressed solvents technologies”.

## **Session: Waste cooking oil and alternative feedstocks**

Chair: G.J. Lye

11.30-11.50 **M. Errico** and C. Pastore: “An economically viable two-step process for biodiesel production from waste cooking oils”.

11.50-12.10 **L. di Bitonto**, H.E. Reynel-Ávila, D.I. Mendoza-Castillo, C.J. Durán-Valle, A. Bonilla-Petriciolet, and C. Pastore: “Synthesis, characterization and applications of carbon-based calcium catalysts deriving from avocado seeds for biodiesel production from waste cooking oil”.

12.10-12.30 **D. Tsaoulidis**, F. Farooqui, E. Garciadiego Ortega, and P. Angeli: “Scale-up studies for intensified production of biodiesel from used cooking oil”.

12.30-12.50 **M. Papadaki**, V. Casson Moreno, A. Tugnoli, V. Cozzani, M. El Halwagi, D. Sengupta: “Valorization of tree waste biomass in inaccessible areas”.

**13.00–14.00 Lunch**

## **Session: Thermodynamic modeling**

Chair: J.A.P. Coelho

14.00-14.20 **S. Leveneur**, H. Ariba, and Y. Wang (Institut National des Sciences Appliquées de Rouen Normandie, France): “Structure-Reactivity applied to the valorization of biomass”.

14.20–14.40 **M.L. Corazza**, L.P. Ramos, D.T. Melfi, and E.L.N. Escobar: “Extraction of lipids from waste biomass using compressed solvents: Kinetic and thermodynamic aspects”.

**15.00-17.00: POSTER SESSION and DISCUSSION**

**19.30 Dinner**

**PROP B**

## Day Two

September 24, Tuesday

### ORAL PRESENTATIONS

#### Session: Biorefinery design

Chair: M. Errico

9.00-9.20 A. Criado, **M. Martin**: “Integrated facility for the use of oranges as a source for power, chemicals and juice”.

9.20-9.40 **P. Páramos**, M.L. Corazza, and H.A. Matos: “Studies on extraction from Avocado's waste biomass to generate process design alternatives of valuable products”.

9.40-10.00 **L. Pereira Ramos**, M.J. Suota, G. Pavaneli, and M.L. Corazza: “The role of biomass pretreatment for sustainable biorefineries”.

10.00-10.20 M. Cardenas-Fernandes, and **G.J. Lye**: “An integrated biorefinery concept for conversion of sugar beet pulp into fuels and value-added chemicals ”.

#### Session: Adsorption and catalysis

Chair: C. Pastore

10.20-10.40 L.L. Diaz-Muñoz, **H.E. Reynel-Avila**, L. di Bitonto, D.I. Mendoza-Castillo, C. Pastore, and A. Bonilla-Petriciolet: “The potential use of calcium-doped flamboyant char as a heterogeneous catalyst in triglycerides transesterification”.

10.40-11.00 D.I. Mendoza-Castillo, **H.E. Reynel-Ávila**, A. Bonilla-Petriciolet, C. Pastore, and L. di Bitonto: “Avocado seeds valorization as adsorbents of priority pollutants from water”.

11.00-13.00 **Coffee. Round Table.**

**The Coordinator Prof. M. Errico, Chairing**

13.00-14.00 Lunch

**Closing Address by the Coordinator Prof. M. Errico**

PROP B

**September 23, Monday**

**15.00-17.00: POSTER SESSION and DISCUSSION**

1. A. Bonilla-Petriciolet, H.E. Reynel-Ávila, and J.C. Tapia-Picazo: “Development of hybrid thermodynamic models for the prediction of phase equilibria and physical properties of multicomponent systems associated to biorefineries”.
2. O.E. Gómez-Hernández, A. Bonilla-Petriciolet, and R.P. Stateva: “Modeling of vapor-liquid equilibrium data of multicomponent systems based on a multi-objective optimization approach”.
3. P. Hernández-Pérez, A. Bonilla-Petriciolet, and R.P. Stateva: “Phase stability analysis of multicomponent systems using alternative stochastic optimization methods”.
4. O.E. Gómez-Hernández, A. Bonilla-Petriciolet, and J.C. Tapia-Picazo: “Design and characterization of separation processes for ternary mixtures using a multi-objective optimization approach”.
5. S. González de la Cruz, A. Bonilla-Petriciolet, J.P.A. Coelho, R.M. Filipe, J.C. Tapia-Picazo, and R.P. Stateva: “Artificial neural network-based modeling for the prediction of solubilities of value-added compounds using supercritical fluids”.
6. O. Becerra-Pérez, S. Georgopoulos, H.E. Reynel-Ávila, D.I. Mendoza-Castillo, M. Papadaki, and A. Bonilla-Petriciolet: “Recovery of bioalcohols with potential as biofuels using an energetically sustainable separation strategy”.
7. L. di Bitonto, H.E. Reynel-Avila, D.I. Mendoza-Castillo, C. Pastore, and A. Bonilla-Petriciolet: “Mexican biomass wastes: valorization for potential application in bioenergy”.
8. F.J. Villalobos-Delgado, C. Pastore, L. di Bitonto, H.E. Reynel-Ávila, D.I. Mendoza-Castillo, and A. Bonilla-Petriciolet: “Green solvent extraction of lipids from sewage sludge of wastewater treatment plants”.
9. D. Hernández-Chaos, H.E. Reynel-Avila, D.I. Mendoza-Castillo, and A. Bonilla-Petriciolet: “Evaluation of the synthesis routes for the preparation of heterogeneous catalysts obtained from coconut shell and its application in the biodiesel production”.
10. A. Angelini, L. di Bitonto, E. Zikou, S. Santzouk, G. Santzouk, M.C. Roda-Serrat, M. Errico and C. Pastore: “Assessing of potential of Aronia Berries residue after juice extraction as a feedstock for platform molecules production”.
11. M.C. Roda-Serrat, T.A. Andrade, and M. Errico: “Optimization of the Anthocyanins extraction process from Aronia berries pomace”.

12. G. Santzouk, S. Santzouk, I. Gerodimou, P. Angeli, and M. Dormousoglou: “Red grape skin and seeds: Extraction, characterization and wine production waste biomass valorization”.
13. S. Santzouk, G. Santzouk, I. Gerodimou, D. Tsaoulidis, and M. Dormousoglou: “*Opuntia ficus indica* (Prickly pear): Extraction and characterization of products with anti-age and antioxidant activity”.
14. D. Tsaoulidis, E. Garciadego Ortega and P. Angeli "Scale-out of liquid-liquid processes in small channels using double manifolds".
15. M. Papadaki, V. Casson Moreno, A. Tugnoli, V. Cozzani, M. El-Halwagi, and D. Sengupta “Smaller, mobile, efficient fit-for-the-purpose waste valorisation methods”.
16. M. Papadaki and M. Lanara: “Algae growth in photoreactors and open ponds for biofuel production”.
17. G. Naydenova and D. Yankov: “Butyric acid production by fermentation of waste hydrolysates”.
18. D. Sengupta, M. El-Halwagi, R.P. Stateva, S. Santzouk, and M. Papadaki: “On the way to circular economy: A systems approach towards sustainable *Arctium Lappa* valorization via valuable medicinal products extraction”.
19. I. Efthimiou, M. Dormousoglou, D. Vlastos, M. Papadaki: “Towards improved valorization of *Betula pendula*: preliminary study of the genotoxic, antigenotoxic and cytotoxic potential of a commercial aqueous silver birch leaf extract”.
20. D.E.L. Fetzer, and M.L. Corazza: “Comparative study on the seeds oil extraction of two species of *Dipteryx* (*Alata Vogel* and *Odorata*) using supercritical CO<sub>2</sub> and ethanol as co-solvent”



IPROPB



The Institute of Chemical Engineering (IChE) is an academic specialized scientific organization for chemical engineering at the Bulgarian Academy of Sciences and a principal national research centre for chemical and biochemical engineering science.

In 1961, within the framework of the Institute of General and Inorganic Chemistry at the Bulgarian Academy of Science, a Department for Mass Transfer Processes was created. It represented the first Bulgarian specialized academic entity for chemical engineering research. In 1972, the Department was reorganized and the Central Laboratory of Theoretical Foundations of Chemical Technology was created. By 1986 the latter, with an act of the Council of Ministers of Bulgaria, was transformed to Institute of Chemical Engineering. Nowadays, the scientific staff of the Institute includes 5 full professors, 7 associate professors, and 20 researchers with PhD degrees.

The mission of IChE is to contribute to the environmental sustainable development of Bulgaria with methodologies, potential and expertise in the scientific and applied research fields of chemical technology and industrial biotechnology.

The main directions in research and development activities of IChE are consonant with the societal challenges and priorities of the National and European strategies 2020 and can be summarized as follows:

- *Energy and energy efficiency*
- *Development of green and eco-technologies*
- *Advanced materials and technologies*
- *Information and communication technologies*
- *Biotechnology*

Over the years, more than 40 new processes, equipment and technological systems with environmentally friendly or energy-saving effects have been developed, designed and prepared for industrial use and application in the Institute of Chemical Engineering.



Equipment for aniline distillation in Neochim, Dimitrivgrad



Contact economizers, TPP "Sofia"



Production of bioethanol, Almagest AD, v. Verinsko



Production of anhydrous ethanol, Synthesia AD, Gorna Oryahovitsa





The Bulgarian Academy of Sciences is the successor of the Bulgarian Learned Society, founded on 12 October 1869 in the Romanian city of Braila. This is one of the peak events during the Bulgarian Revival along with the creation of the first Bulgarian *chitalishte*

(community center) in Svishtov and the establishment of the Bulgarian Exarchate. Its purpose, enshrined in its first statute of 1869, was to disseminate enlightenment among Bulgarians, to improve the Bulgarian language and to study Bulgarian history and life, to be a scientific center and to establish contacts with similar scientific centers abroad.

The first Chairman of the Society was the university scientist historian Marin Drinov. After the Liberation of Bulgaria (1878), the Bulgarian Learned Society moved its activities to Sofia and established itself as an authoritative scientific center with a rich social, cultural and political activity. The list of the founders and donors includes traders, writers, educators, scholars, public figures, revolutionaries, who will remain forever in our memory as builders of the largest scientific institution in Bulgaria.

With the help of its longtime chairman, politician and public figure Ivan Evstratiev Geshov, the Bulgarian Learned Society became a separate, independent institution. **In 1911, it was renamed Bulgarian Academy of Sciences** and the first law was adopted for it. In 1928, the central building of the Bulgarian Academy of Sciences, built on the land donated by Sofia Municipality, was completed. Twenty-two academicians mortgaged their personal property and invested 3 million levas for its construction.

The Academy developed its activities in 3 scientific branches: historical-philological, philosophical-public and natural-mathematical. In 1947, the Grand National Assembly adopted a new law according to which the Academy became a central state institution. After 1991, the academic units of the Bulgarian Academy of Sciences became autonomous.

The mission of the Bulgarian Academy of Sciences is to conduct scientific research in accordance with universal values, national traditions and interests, to participate in the development of world science, to study and to multiply the material and intangible cultural and historical heritage of the nation.

The Bulgarian Academy of Sciences is the leading scientific, spiritual and expert center of Bulgaria. The Academy has a consistent policy for the development of science and innovation as a condition for the economic progress of the country. It is an active participant in the European Research Area.

Today, Bulgarian Academy of Sciences comprises 42 autonomous scientific entities and is an organization governed in accordance with democratic principles. The Academy employs about 3,000 scientists, accounting for about 15% of those engaged with science in Bulgaria, produces about half of the scientific output in the country, and its H index is 190 (28.02.2019).

**In 2019, we are celebrating 150 years from the establishment of the Bulgarian Academy of Sciences!**