Workshop-1: Review of model repositories, application to reference cases

A-Z Bio-Refineries Workshop

Place: *Chulalongkorn University, Bangkok, Thailand*

Date: *19-20 July 2018*

Deliverable D7.1

Responsible for delivery: Professor John M Woodley (DTU)

Work package concerned: WP7

Prepared by: Dr. Franjo Cecelja (UoS), Professor Antonis Kokossis (NTUA)

Delivered on: 31/01/2019

DTU **NTUA** **UoS**

Contents

Introduction

On the 19-20 July 2018 the first workshop was organized within the RENESENG II project framework aiming at review of model repositories, application to reference cases in biorefining and publicized under the title A-Z Biorefineries. The workshop was organised by the project consortium member DTU, it was co-sponsored by PSE for SPEED, Chulalongkorn University, Thailand Research Fund (CAT-REAC industrial project), and the Crown Property Bureau incorporated with National Science and Technology Development Agency and it was held at the Chulalongkorn University, Bangkok, Thailand. This workshop is part of a series of training activities to form system engineers expected to have a high impact in the design of the new, complex biorefinery industry.

The attendees from within the RENESENG project were from DTU represented by Prof. Rafiqul Gani, from NTUA represented by Prof. Antonis Kokossis, from the UoS represented by Dr Franjo Cecelja and from Imperial represented by Dr Gonzalo Guillen Gosalbez in addition to over 150 paricipants attending the workshop and 50 delegates from industries and with great interest in biorefining (Appendix 1).

Workshop Topics

The workshop was organised in two parts:

1. A-Z biorefineries workshop, and
2. Design of Integrated Biorefinery intensive course.

A-Z biorefineries workshop

In total 14 scientific papers were presented in the course of two days of the workshop as demonstrated in the workshop schedule in Appendix 2. The A-Z Biorefineries workshop focused on five thematic areas:

1. Synthesis and process integration;
2. Biorefineries, bio-economy and circular economy;
3. Downstream separation;
4. Modelling, flow-sheeting and optimisation, and
5. Sustainability and supply chain analysis.

Each of the topical sessions was represented by 2-4 presentations as demonstrated in Appendix 2. The RENESENG II contribution was in the form of three presentations:

1. Rafiqul Gani, DTU: **Conversion paths, downstream processing & Computer aided methods and tools needed for development of biorefineries**
2. Antonis Kokossis, NTUA: **Value chains, process and energy efficiency**
3. Franjo Cecelja, UoS: **Social drivers, industrial symbiosis, waste as feedstock**

The workshop was a great success as demonstrated by the feedback from workshop participants (Appendix 3), which also demonstrate interest across various segments, from academy to industrial.

Design of Integrated Biorefinery intensive course

This two-day intensive course was delivered by Prof. Antonis Kokossis and covered two main topics in biorefining (Appendix 4):

1. Basic concepts and technologies to introduce basic principles of process systems engineering as they are applied in the development of real-life biorefineries, and
2. Advanced topics, industrial applications and societal flows to present a range of different industrial applications that relate to different biomass feedstocks (including organic waste), and means to assess sustainability, and the potential of biorefineries to integrate industrial and societal flows.

The course was attended by 32 participants and was a great success as demonstrated by the participant feedback (Appendix 5).

The Workshop Outcome

The outcome of the workshop is measured in two ways:

1. The workshop proceedings: the workshop proceedings will be published in the form of a book titled A-Z Biorefineries aimed to be publicly available in early 2020 as demonstrated by the agreement with Elsevier publishing house (Appendix 6). The working structure of the book is:
    a. Section 1 – Overview of A-Z of Biorefinery
    b. Section 2 – Biomass and Biobased Products
    This section will classify the renewable resources (type, description, location, availability) & the potential biomaterial and biobased products by the number of carbon backbone (C1-C5, C6-C10, and C10 or higher).
    c. Section 3 – Conversion of biomass to high-value products
    This section will cover the classification of conversion processes in terms of conversion ratio, selectivity, specificit, productivity, process, efficacy, environmental impact (green/white processes)).
    d. Section 4 – Downstream recovery and separation
    This section will present recent synthesis and separation techniques and designs in biorefinery along with the case studies)
    e. Section 5 – Process generation, design and analysis
    This section will highlight the construction of the biorefinery network, the conventional protocol for process design, and advanced tools in development of biorefinery platform.
    f. Section 6 – Tools and complete case studies
    This section will cover the complete design cases in biorefinery industries using recent advanced tools.
2. Networking: a separate 2 hrs slot was organised for networking which was attended by academic representatives on one side and most of 50 industries on the other side.

Observation

The engagement of workshop attendees in the programme of the workshop was remarkable

Appendix 1: A-Z Biorefineries workshop promotion poster

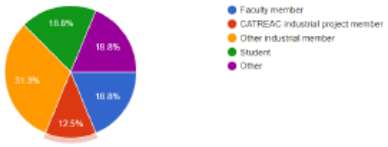
Appendix 2: A-Z Biorefineries workshop schedule

"A to Z of Bio-Refineries Workshop"

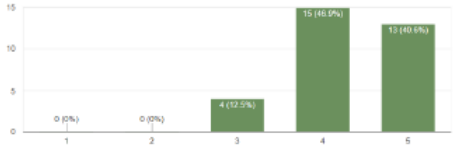
Time	Session	Topics
Day I: 19th July 2018		
08:00 – 09.00	Registration	
09:00 – 09:15	**Opening ceremony** Professor Piyasan Praserthdam Chulalongkorn University	**Welcome speech from conference chair** Professor Suttichai Assabumrungrat Chulalongkorn University Professor Rafiqul Gani PSE for SPEED, Denmark-Thailand
09:15 – 09:30	**Introduction to CAT-REAC Industrial Project** Professor Piyasan Praserthdam CAT-REAC Chairman	
09:30 – 10:30	**Session I – Synthesis and process integration** Invited Lecturer: Professor Antonis Kokossis National Technical University of Athens, Greece	Value chains, process and energy efficiency
10:30 – 10:45	Coffee Break	
10:45 – 11.15	Professor Bunjerd Jongsomjit Chulalongkorn University	Ethanol conversion over heterogeneous catalysts
11.15 – 11.45	Professor Joongjai Panpranot Chulalongkorn University	Selective hydrogenation of agricultural waste-derived compounds into high value-added fine chemicals
11.45 – 12.15	Assistant Professor Dr. Jonggol Tantirungrotechai Mahidol University	Microwave-assisted one-pot functionalization of metal-organic framework and its application in catalytic oxidations
12:15 – 13:30	Lunch Break	
13:30 – 14:30	**Session II – Biorefineries, bioeconomy and circular economy** Invited Lecturer: Dr Franjo Cecelja University of Surrey, UK	Social drivers, industrial symbiosis, waste as feedstock
14:30 – 15:00	Professor Navadol Laosiripojana King Mongkut's University of Technology Thonburi	Conversion of lignocellulosic biomass to industrial-needed products
15:00 – 15:15	Coffee Break	
15:15 – 15:45	Dr. Daungamol N. Tungasmita Chulalongkorn University	Micro- and meso-porous catalysts for biorefinery applications
15:45 – 16:15	Assistant Professor Dr. Worapon Kaitkittipong Silpakorn University	Hydrocarbon biofuel production via hydrotreating by using alternative feedstocks
17:00 – 19:00	**Dinner Reception at Faculty of Arts Chulalongkorn University (for all attendant)**	
Day II: 20th July 2018		
08:00 – 09:00	Registration	
09:00 – 09:30	**Session III – Downstream separation** Invited Lecturer: Professor Tetsuya Kida Kumamoto University, Japan	Catalysis of graphene oxide under microwave irradiation: Biodiesel production, glycerol conversion, and cellulose depolymerization
09:30 – 10:00	Associate Professor Dr. Nuttha Thongchul Chulalongkorn University	Alternated membrane based process for lactic acid recovery from a fermentation broth
10:00 – 10:30	Assistant Professor Dr. Apinan Soottitantawat Chulalongkorn University	Hydrogenolysis of glycerol in fixed bed reactor using commercial NiMo Catalyst
10:30 – 10:45	Coffee Break	
10:45 – 11:45	**Session IV – Modeling, flow sheeting and optimization** Invited Lecturer: Professor Rafiqul Gani PSE for SPEED, Denmark-Thailand	Conversion paths, downstream processing
11:45 – 13:00	Lunch Break	
13:00 – 13:30	**Computer aided tools for biorefinery** Professor Rafiqul Gani PSE for SPEED, Denmark-Thailand	Computer aided methods and tools needed for development of biorefineries
13:30 – 14:00	**Summary of conference** Professor Antonis Kokossis Professor Rafiqul Gani Professor Suttichai Assabumrungrat	**Closing ceremony** Professor Suttichai Assabumrungrat Chulalongkorn University Professor Rafiqul Gani PSE for SPEED, Denmark-Thailand
14:00 – 15:00	**Discussion Session - EU Experts & CAT-REAC Industrial members**	
19:00 – 21.30	**Excursion – Chaophraya river dinner cruise (by invitation)**	

Appendix 3: A-Z Biorefineries Workshop Feedback

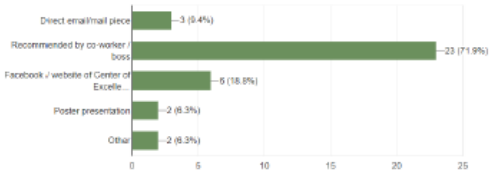
1. Please select your category



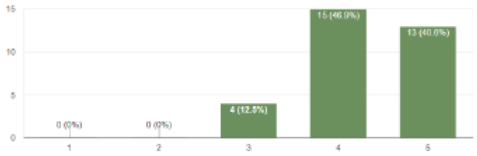
3. How helpful was the content presented at the event?



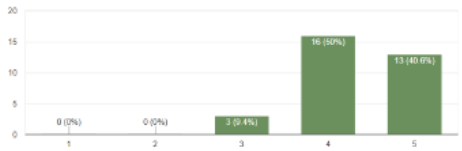
2. Where did you initially hear about this event? (you can select more than one)



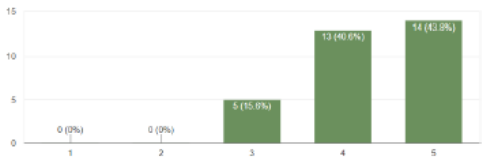
4. How would you rate the speakers in session I: synthesis and process integration?



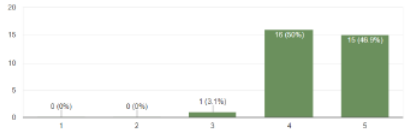
5. How would you rate the speakers in session II: biorefineries, bioeconomy and circular economy?



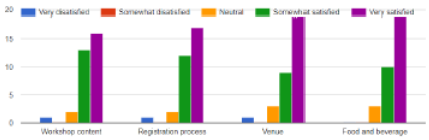
6. How would you rate the speakers in session III: down stream separation?



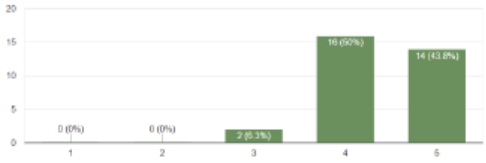
7. How would you rate the speakers in session IV: modelling flow sheeting and optimization?



8. Please indicate your overall satisfactory with this event



9. What was the overall impression of the event?



10. What could we have done to improve?

Answers 16

- (4)
The venue should be added in the invitation and schedule heading.
Time keeping
Better classify the talks to be fitted well with session
None
No
Add more topics
The font on slide is too small. It had better if the speaker share his/her ptt.
Prepare slide content to everyone
For each topic, should more address on how your work will potentially impact the industry.
Some topics should be more related to the biorefinery
Venue

Appendix 4: Intensive course schedule

Evaluation Survey

Intensive Course

Design of Integrated Biorefinery

Design of Integrated Bio-Refineries Workshop

Professor Antonis Kokossis

National Technical University of Athens, Greece

Date:	23rd-24th July 2018
Time:	9.00 – 16.00
Venue:	Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University (Building 4, 10th floor)

Day 1 – Basic concepts and technologies

Purpose: *Introduce basic principles of process systems engineering as they are applied in the development of real-life biorefineries.*

Learning outcome: *Familiarize with concepts of process synthesis, modelling, process integration and optimization. Understand the use and the scope of their application to build efficient and integrated biorefineries that make holistic use of available biomass.*

- Introduction: synthesis and screening of biorefinery value chains
- Flowsheeting for biorefinery plants
- Energy savings with process integration
- Water savings with re-use, recycle and regeneration
- Advanced topics in process integration

Day 2 – Advanced topics, industrial applications and societal flows

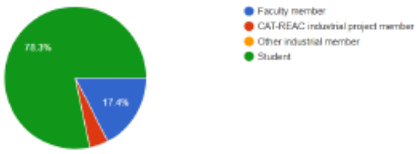
Purpose: *Present a range of different industrial applications that relate to different biomass feedstocks (including organic waste), and means to assess sustainability, and the potential of biorefineries to integrate industrial and societal flows.*

Learning outcome: *Familiarize with several industrial applications and understand the opportunities to use the biorefineries to promote circular economy and industrial symbiosis.*

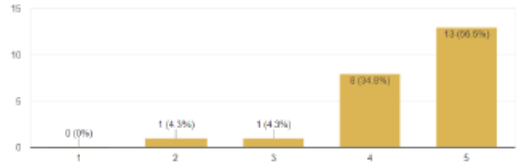
- Integration across the value chain
- Design of algo-biorefineries
- Biorefineries and LCA
- Biorefineries and Industrial Symbiosis
- Waste biorefineries – textile industries

Appendix 5: The course feedback

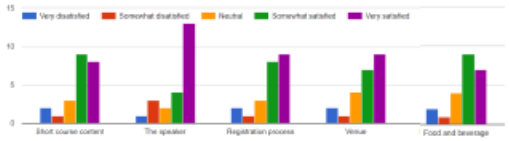
1. Please select your category



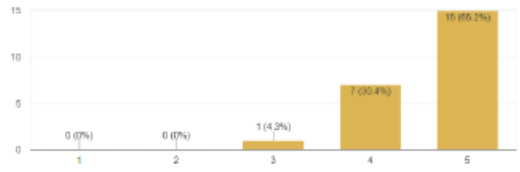
2. How helpful was the content presented at the short course



3. Please indicate your overall satisfactory with this short course



4. What was the overall impression of the short course



5. What could we have done to improve

- (6)
More knowledge when compare with time period
There are many content to study in 2 days. Should have the time to study more.
No
None
dont could
NA
the schedule should be more flexible. maybe break time 20 min
Extent time for clearly presentation
.
Muffin
Food
Some contents is to hard too understand within the class. So, if you have someone that can conclude the content at the end of presentation that will be great.
การประชาสัมพันธ์
n/a
Nothing
เนื้อหามาก อยากให้จัดพฤหัสวันเดียว

Appendix 6: PUBLISHING AGREEMENT for the A-Z Biorefineries book

PUBLISHING AGREEMENT

AGREEMENT made this 28th day of November, 2018, by and between **Elsevier Inc.** with offices at 50 Hampshire St., 5th Floor, Cambridge, MA 02139, USA (the "Publisher"), and

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Institute Building 3, Floor 5, Chulalongkorn University
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(collectively, the "Editor").

WHEREAS, the Work (defined below) will be composed of a number of chapters or articles (the "Contributions") written by a number or a group of contributors (the "Contributors"); and

NOW, THEREFORE, the parties agree to the publication by the Publisher of that certain work tentatively entitled **A-Z OF BIOREFINERY: A COMPREHENSIVE VIEW**, as more fully described below upon the terms and conditions set forth below: