



RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas



Workshop report: Drying optimization for the sustainable development of cassava industry

SEA-EU-NET project and RTB Post-harvest project

“Driving livelihood improvements through demand-oriented interventions for competitive production and processing of RTBs”

Bangkok, 2-4 December 2015

A broad alliance of
research-for-development
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www.rtb.cgiar.org

RTB Project Report

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Table of contents

Table of contents	iii
Acknowledgments	iv
1 Motivation and objectives of the workshop. Workshop overview	1
1.1 Motivation.....	1
1.2 RTB Post-harvest project: Driving livelihood improvements through demand-oriented interventions for competitive production and processing of RTBs.....	1
1.3 Objectives of the workshop	2
1.4 Intended participants.....	2
1.5 Sponsors of the workshop	3
2 Workshop proceedings	4
2.1 Program.....	4
2.2 List of speakers and presentations (Friday 4/12/15 afternoon)	5
2.3 Questions and discussion after each presentation (Friday 4/12/15).....	5
2.4 Summary of the roundtable discussion at end of the workshop (4/12/15)	7
3 Photo essay of the factory visit and workshop presentations.	9
4 Annexes	17

Acknowledgments

The organizers of the workshop gratefully acknowledge the collaborative efforts of several institutions who have contributed to make this workshop a success:

- CSTRU (Cassava and Starch Technology Research Unit), Kasetsart University, Thailand.
- NSTDA-BIOTEC, Bangkok, Thailand.
- SEA-EU-NET project.
- The Embassy of France in Thailand.
- Chorchaiwat Industry Co. Ltd.

We extend our sincere thanks in particular to Kuakoon Piyachomkwan, Sunee Chotineeranat, Rungtiva Wansuksri, Sittichoke Wanlapatit, Kasaporn Sukata, Nisarath Niramitvasu, and several other people for their support before, during and after the workshop.

Last but not least, we express our deep appreciation to Klanarong Sriroth, who inspires and makes the Starch Update conference possible.

1 Motivation and objectives of the workshop. Workshop overview

1.1 Motivation

Cassava farming and post-harvest processing is a major economic activity in South-East Asia, Africa and Latin America. Thailand, Indonesia, and Vietnam are among the leading cassava producers with 30.2, 23.9, and 9.8 million ton roots in 2013, respectively. Thailand is the first world exporter of cassava products (starch and chips). At the same time, Cambodia, Laos and Myanmar have experienced a rapid growth in cassava cultivation and processing since the mid-2000s (8.0, 1.1 and 0.6 million tons roots in 2013, respectively) (FAOSTAT).

In Africa and Latin America, cassava is consumed as staple food by 500 million people. It is increasingly processed into transformed products (e.g. ready-to-cook or ready-to-eat) as a result of changing expectations by growing middle-class consumers and urban populations.

In many countries, cassava processing takes place in small- and medium-scale factories. Process inefficiencies, in particular energy losses, are significant and impact on both production costs and the environment. Considering the high potential for growth of the cassava industry, driven by the expanding global population and economic development, it is critical to optimize cassava processing technologies to ensure the industry develops in a sustainable manner.

1.2 RTB Post-harvest project: Driving livelihood improvements through demand-oriented interventions for competitive production and processing of RTBs.

To optimize cassava processing technologies, the CGIAR RTB program (<http://www.rtb.cgiar.org/>) has conducted a benchmarking study of cassava starch and flour technologies in several countries, as part of the 2013-2015 project “Driving livelihood improvements through demand-oriented interventions for competitive production and processing of RTBs” (RTB Post-harvest project). Key findings were as follows:

- **Artificial drying** is faster than sun drying and **is increasingly used by factories** in order to increase their production capacities.
- **Artificial drying represents 70-75% of the total energy** used by a typical cassava starch factory. Therefore energy efficiency improvements can focus on the drying operation in priority to achieve impacts. Other operations with low energy-efficiency included rasping, pressing, cooking/toasting, and also need to be addressed.
- **Flash drying** (Figure 1), the most suitable type of drying for cassava starch and flours, is efficient at large-scale (200-300 ton of product/day), with 80-90% energy efficiency. At small-scale (< 50 ton of product/day) energy efficiency is only 40-60% due to inadequate

dryer designs. Improvements are therefore essential considering that most cassava processing takes place at small and medium scale.

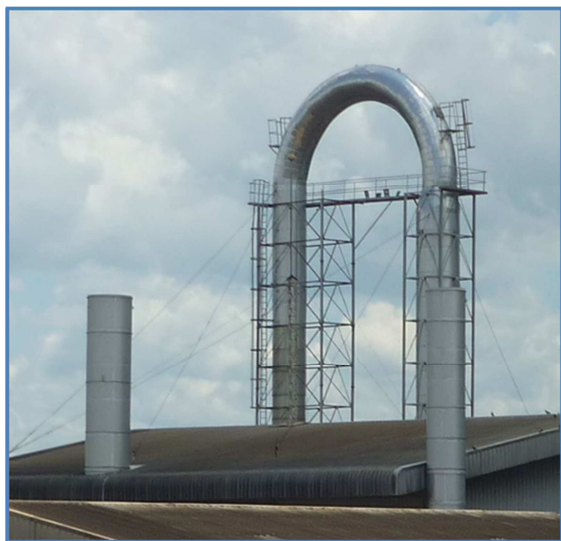


Figure 1: Flash dryer in a cassava starch factory

A subsequent study, also part of the RTB Post-harvest project, used computer-based simulations of the drying operation to establish that such improvements to small-scale dryers are possible. Key innovations from this study include:

- (i) A numerical model of flash drying to simulate drying at both small and large scales.
- (ii) Multi-objective optimization methods to determine the optimum dimensions and operating conditions of flash dryers for different production capacities.
- (iii) Guidelines to design energy-efficient flash dryers.

These innovations are now available to interested stakeholders in the cassava processing industry. In particular, the flash drying model can be useful for cassava factories or equipment manufacturers looking to improve the energy efficiency of their dryers.

1.3 Objectives of the workshop

- To communicate the findings of recent research on cassava processing by the CGIAR RTB program to interested parties from the private and public sectors, in particular cassava processing factories, equipment manufacturers, universities, and government agencies supporting the development of the cassava industry.
- To create networking opportunities and plan future collaborations on the development of the cassava industry.

1.4 Intended participants

- Universities and research institutes: Researchers on cassava processing, mechanical engineering of agro-industrial equipment.

- Private sector: Representatives of cassava processing factories and equipment manufacturers for cassava processing

Participants joined from Thailand, Vietnam, Myanmar, Indonesia, Philippines, Colombia, Nigeria, Tanzania, France and Germany. In addition, the workshop was announced and open to participants from other SEA countries and from Africa and Latin America, as researchers and cassava processors in these regions have expressed interest to develop improved dryers for cassava processing. A list of participants is presented in Annex 1.

1.5 Sponsors of the workshop

The workshop was generously supported by the following organizations:

CGIAR RTB program

<http://www.rtb.cgiar.org/>



SEA-EU-NET project

<https://sea-eu.net/>



The Embassy of France in Thailand: <http://www.ambafrance-th.org/>



The workshop was organized in conjunction with the Starch Update conference by the following organizations:

CIRAD

<http://www.cirad.fr/en>



Kasetsart University

<http://www.ku.ac.th/>



NSTDA / BIOTEC: <http://www.biotec.or.th/en/index.php/home>



2 Workshop proceedings

2.1 Program

In addition to the lectures and presentations of the Starch Update conference, activities specific to the workshop were as follows:

- Wednesday 2/12/15 whole day: Visit to a cassava starch factory, Chorchaiwat Industry Co. Ltd in Chonburi province.



- Thursday 3/12/15 afternoon: Industrial presentations on starch drying and cassava processing
- Friday 4/12/15 afternoon: Scientific presentations and discussions (Figure 2).

The full program is presented in Annex 3.

The afternoon session on Friday 4/12/15 was organized in three parts. In the first part, speakers from CIRAD, IITA, and Universität Hohenheim talked about the technical aspects of drying. In the second part, speakers representing universities, research centers, and government agencies from Myanmar, Indonesia, Philippines and Colombia presented the situation of cassava farming and processing in each country, focusing in the constraints faced by small-scale processors. In the third part, speakers from Hanoi University, Univalle and CIAT/CIRAD discussed about the effects of the different cassava starch processing technologies on the final product, including product quality and users/consumers preferences. The workshop finished with a lively open discussion about challenges that the cassava starch industry faces in South-East Asian countries.

2.2 List of speakers and presentations (Friday 4/12/15 afternoon)

Time	Participant	Affiliation	Topic	Notes
13:00 – 13:10	Thierry Tran	CIRAD / KU	Introduction to the workshop	Part 1: Technical aspects of drying
13:10 – 13:30	Marcelo Precoppe	IITA	Improved energy efficiency of small-scale pneumatic dryer used for cassava processing in Tanzania	
13:30 – 13:50	Arnaud Chapuis	CIRAD	A model of pneumatic drying to optimize the energy efficiency of small-scale cassava starch and flour processing: Design guidelines	
13:50 – 14:10	Sebastian Romuli	Universität Hohenheim, Germany	Physical properties of wet and dry cassava grits as affected by particle size: Implications for pneumatic drying	
14:10 – 14:30	Kyaw Thura	Cassava Growers, Millers and Traders Association – Ayeyarwady, Myanmar	Situation of cassava processing in Myanmar	Part 2: Cassava processing with focus on the constraints of small-scale processors
14:30 – 15:00	Coffee break			
15:00 – 15:20	Bambang Triwiyono	Indonesian Starch Technology Center (BPPT)	Situation of cassava processing in Indonesia	
15:20 – 15:40	Annabelle Briones	Department of Science and Technology, Philippines	Situation of cassava production and processing in the Philippines	
15:50 – 16:00	Martin Moreno	Universidad del Valle, Colombia	Cassava starch production and the issues of starch drying in Colombia and Latin America	Part 3: Effect of processing on product quality, including users/consumers preferences
16:00 – 16:20	Luong Hong Nga	HUST	Effects of drying on starch properties	
16:20 – 16:40	Dominique Dufour	CIAT / CIRAD	Effects of cassava processing on product quality: Rasping, cooking and other unit operations. Perspectives for future research	
16:40 – 17:30	All participants	CIRAD / KU	Roundtable: Building collaborations for the development of cassava processing technologies, in particular at small-scale.	Objectives: Explore potential activities and collaborations between

Figure 2. List of speakers and presentations of the workshop.

2.3 Questions and discussion after each presentation (Friday 4/12/15)

Part 1: Technical aspects of drying

Questions on the presentation of Marcelo Precoppe

Question 1: How to measure air humidity and air flow in the dryer?

Answer: Using captors installed on the dryer. Small modifications in parameters can drive big changes in dryer efficiency.

Questions on the presentation of Arnaud Chapuis

Question 1: Maximum air temperature that can be used in the dryer to not have gelatinization of the starch?

Answer: It was assumed in modeling the dryer that heat convection from the air to the starch controls the heat transfer process in the dryer. This is not true for the entire length of the pipe. Heat conduction within the particle becomes important in some sections. However, to take into account both phenomena (convection and conduction), two partial

differential equations must be solved simultaneously for the entire pipe, which adds complexity to the mathematical model of the dryer.

Question 2: Is the blueprint of the dryer designed in Colombia available (Mr. Thura)?

Answer: The results produced by the RTB Post-harvest project are open-access, so the blueprints and other documents should become available publicly in the course of 2016, after they are finalized. Most likely they will be downloadable from the RTB website <http://www.rtb.cgiar.org/>

Questions on the presentation of Sebastian Romuli

Question 1: Mr. Fidrianto asked about the optimum tapioca starch velocity for drying.

Answer: In his research, S. Romuli used grits, not starch.

Part 2: Cassava processing with focus on the constraints of small-scale processors

Questions on the presentation of Kyaw Thura

Question 1: Marcelo Precoppe asked where the starch processing technology came from.

Answer: It came from Nepal.

Comment on the presentation: Dominique Dufour emphasized the importance of starch companies in Myanmar to be connected to the grid, to have reliable access to electricity and develop production capacity.

Questions on the presentation of Bambang Triwiyono

Question 1: Dominique Dufour asked if small and large-scale cassava starch factories have the same markets.

Answer: Small-scale starch factories are mainly oriented for food production.

Question 2: Arnaud Chapuis enquired about the price for starch from small and large-scale factories.

Answer: Small-scale factories use a traditional method for starch production, therefore, the price of starch is higher than for starch produced in large-scale factories.

Questions on the presentation of Annabelle Briones

Question 1: Thierry Tran enquired about limitations for cassava farming in the Philippines.

Answer: Limitations for cassava farming in Philippines include: Climate constraints, costs (labor, production), and low support from the government.

Part 3: Effect of processing on product quality, including users/consumers preferences

Questions on the presentation of Luong Hong Nga

Question 1: Was the drying time the same for the four different drying method?

Answer: Yes, same time and same batch of starch were used for all the experiments using different drying techniques.

Question 2: Arnaud Chapuis asked if the different methods presented different convective drying.

Answer: Oven drying uses no air flow.

Question 3: Borja Cantero-Tubilla asked about the statistical significance of the results, that is to say, if statistical tests (ANOVA and Duncan Multiple Rank Tests) were run to determine real differences in starch characteristics because of different drying methods.

Answer: Yes, the tests were run and displayed in the presentation.

There was no time left for questions after the presentations of Martin Moreno and Dominique Dufour.

2.4 Summary of the roundtable discussion at end of the workshop (4/12/15)

The round table discussion focused on the topic “What would be the key priority(ies) to improve cassava processing in your country”, or “What improvements would be most useful for cassava processing in your country”. Concerns included equipment performance, technology adaptation for shifting to larger production scales, environmental issues, as well as water savings.

In Indonesia, the use of semi-traditional methods for cassava starch production was identified as a drawback to increase the capacity of factories. Current sun-drying of starch limits production capacity, and more efficient drying solutions would be useful, e.g. flash drying. Also, it is necessary to improve quality standards and consistency of starch produced, as the starch produced from traditional processes differs from the starch resulting from industrial processes.

In Myanmar, the use of flash drying was also perceived as a necessary technological improvement to increase production capacity. Myanmar starch factories do not have any flash dryer at the moment (except possibly a large-scale factory in the North of the country).

In Philippines, there was a strong interest to improve processing facilities, in particular chipping and mobile drying equipment. Introducing good manufacturing practices (GMP) to

increase food quality is also important. Market diversification can be a way to increasing the value of cassava starch, e.g. marketing as gluten-free or Halal products.

Martin Moreno stressed the necessity of working on the carbon footprint of the cassava starch production processes, and to find ways to generate profits and reduce pollution at the same time. A mechanism for the profits from selling cassava starch and cassava products to go back to the farmers to improve infrastructures in small farms would make cassava farming more environmentally sustainable and efficient. A challenge for cassava starch production in Latin American countries was water resources management, water treatment, and reducing wastewater pollution, especially in small-scale factories where wastewater is partially treated in open lagoons. This topic was not covered in the presentations of the workshop. As an example, El Nino causes 5 months-long drought periods that force starch companies to stop activity. The target is to use 15 L of water per kg of starch produced, instead of 30-40 L currently. Thierry Tran advocated for a decrease in cassava starch production costs by decreasing utilities used in cassava production, which at the same time will have a positive environmental effect.

In concluding comments, Marcelo Precoppe emphasized the importance of what he called “put science in reality”. For Marcelo, all the theoretical efforts in dryers optimization could be useless if the users are not involved in these efforts. Participatory development of technology is the only way science improvements in cassava starch production will be adopted and implemented in real factories.

3 Photo essay of the factory visit and workshop presentations.

Visit to Chorchaiwat Industry Co. Ltd in Chonburi province.







ราคาขายปลีก	
%	ราคา
5A	270
5B	265
5C	260
5D	255
5E	250
23	245
99	240
77	235
21	230
85	225
24	220
83	215
82	210
81	205
90	200
19	195
18	190
17	185
16	180
15	175





Starch Update and drying workshop presentations.



From left to right, top to bottom. Speakers of the Starch Update plenary lectures. Thierry Tran introducing the starch drying workshop. General view of the conference room. Marcelo Precoppe presenting “Improved energy efficiency of small-scale pneumatic dryer used for cassava processing in Tanzania”. Arnaud Chapuis presenting “A model of pneumatic drying to optimize the energy efficiency of small-scale cassava starch and flour processing: design guidelines”. Sebastian Romuli presenting “Physical properties of wet and dry starch grits as affected by particle size: Implications for pneumatic drying”.



From left to right, top to bottom. Kyaw Thura presenting “Situation of cassava processing in Myanmar”. Bambang Triwiyono presenting “Situation of cassava processing in Indonesia”. Annabelle Briones presenting “Situation of cassava production and processing in the Philippines”. Luong Hong Nga presenting “Effects of drying on starch properties”. Martin Moreno presenting “Cassava starch production and the issues of starch drying in Colombia and Latin America”. Dominique Dufour presenting “Effects of cassava processing on product quality: Rasping, cooking and other unit operations. Perspectives for future research”.



Professor Klanarong Sriroth presenting certificates to workshop speakers.



Professor Klanarong Siroth presenting a certificate to Dominique Dufour. Group picture for workshop participants and organizer (Thierry Tran). Dinner at the Sukosol gardens.

4 Annexes

Annex 1 List of participants to the workshop

	Affiliation	Country	E-mail
Speakers			
Marcelo Precoppe	IITA	Tanzania / Nigeria	m.precoppe@cgiar.org
Arnaud Chapuis	CIRAD	France	arnaud.chps@gmail.com
Sebastian Romuli	Universität Hohenheim	Germany	Sebastian_Romuli@uni-hohenheim.de
Kyaw Thura	Cassava Growers, Millers and Traders Association – Ayeyarwady	Myanmar	swesonekyaw@gmail.com
Bambang Triwiyono	Indonesian Starch Technology Center (BPPT)	Indonesia	bambang_triwiyono@yahoo.com
Annabelle Briones	DOST, Industrial Technology Dvt Institute	Philippines	avbriones2003@yahoo.com
Luong Hong Nga	Hanoi University of Science and Technology (HUST)	Vietnam	luonghongnga@yahoo.com
Martin Moreno	Universidad del Valle (Univalle)	Colombia	martin.moreno@correounivalle.edu.co
Dominique Dufour	CIAT / CIRAD	Colombia	d.dufour@cgiar.org
Attendees			
Mr. Fidrianto	P.T. Asindo Tech	Indonesia	fidrianto.amt@gmail.com
Mr. Firianto	P.T. Asindo Tech	Indonesia	hauliat.pts@gmail.com
Djun Fo	P.T. Asindo Tech	Indonesia	acung.ast@gmail.com
Alexandre Bouniol	CIRAD	France	alexandre.bouniol@cirad.fr
Olivier Gibert	CIRAD	France	olivier.gibert@cirad.fr
Tu Viet Phu	Hanoi University of Science and Technology (HUST)	Vietnam	tuvietphu@gmail.com
Pham Ngoc Hung	Hanoi University of Science and Technology (HUST)	Vietnam	phamngochung_2001@yahoo.com
Coordinators			
Thierry Tran	CIRAD / Kasetsart University	Thailand	thierry.tran@cirad.fr
Borja Cantero-Tubilla	CIRAD / Kasetsart University / Cornell University	Thailand	bc497@cornell.edu
Nisarat Niramitvasu	Kasetsart University	Thailand	nisarat.nira@gmail.com

Annex 2 Leaflet workshop

Workshop announcement: Drying optimization for the sustainable development of cassava industry

Objectives

- To communicate the findings of recent research on cassava processing by the CGIAR RTB program to interested parties from the private and public sectors, in particular cassava processing factories, equipment manufacturers, universities and government agencies supporting the development of the cassava industry.
- To create networking opportunities and plan future collaborations on the development of the cassava industry.



Date and venue

2/12/2015: Study tour of a cassava starch factory

3-4/12/2015: Workshop on Drying optimization, Sukosol Hotel, Bangkok, Thailand

<http://asie-sud-est.cirad.fr/news/announcement-of-workshop-on-cassava-industry>

The workshop is organized in conjunction with the 8th Starch Update conference:

<http://www.biotec.or.th/starchupdate2015/>

Participants

- Universities and research institutes: Researchers on cassava processing, mechanical engineering of agro-industrial equipment.
- Private sector: Representatives of cassava processing factories and of equipment manufacturers for cassava processing

Participants will join from Thailand, Vietnam, Colombia, Nigeria, Tanzania, France, Germany, UK.

The workshop will be announced and open to participants from other SEA countries: Cambodia, Myanmar, Indonesia, etc.; and from Africa and Latin America, as researchers and cassava processors have expressed interest to develop improved dryers for cassava processing.



Research Program on Roots, Tubers and Bananas



Workshop announcement: Drying optimization for the sustainable development of cassava industry



Research
Program on
Roots, Tubers
and Bananas

Cassava farming and post-harvest processing is a major economic activity in South-East Asia, Africa and Latin America. Thailand, Indonesia and Vietnam are among the leading producers (30.2, 23.9 and 9.8 million tons roots in 2013, respectively), with Thailand the first world exporter of cassava products (starch and chips). At the same time, Cambodia, Laos and Myanmar experience a rapid growth in cassava cultivation and processing since the mid-2000s (8.0, 1.1 and 0.6 million tons roots in 2013, respectively; source FAOStat).

In Africa and Latin America, cassava is consumed as staple food by 500 million people, and is increasingly processed into transformed products (e.g. ready-to-cook or ready-to-eat) as a result of changing expectations by growing middle-class consumers and urban populations.

In many countries, cassava processing takes place in small- and medium-scale factories. Process inefficiencies, in particular energy losses, are significant and impact on both production costs and the environment. Considering the high potential for growth of the cassava industry, driven by the expanding global population and economic development, it is critical to optimize cassava processing technologies to ensure the industry develops in a sustainable manner.

To this end, the CGIAR RTB program has conducted a benchmarking study of cassava starch and flour technologies in several countries:

- **Artificial drying** is faster than sun drying and is **increasingly used by factories** in order to increase their production capacities.



- **Artificial drying represents 70-75% of the total energy** used by a typical cassava starch factory. Therefore energy efficiency improvements should focus on the drying operation.

- Flash drying, the most suitable type of drying for cassava starch and flours, is efficient at large-scale (200-300 t of product/day), with 80-90% energy efficiency. **At small-scale (< 50 t of product/day) energy efficiency is only 40-60%** due to inadequate dryer designs. Improvements are therefore essential considering that most cassava processing takes place at small and medium scale.

A subsequent study has shown that such improvements to small scale dryers are possible, based on computer-based simulations of the drying operation. Key innovations from this study include:

- (i) A numerical model of flash drying to simulate drying at both small and large scales.
- (ii) Multi-objective optimization methods to determine the optimum dimensions and operating conditions of flash dryers for different production capacities.

These innovations are now available to interested stakeholders in the cassava processing industry. In particular, the flash drying model can be useful for cassava factories or equipment manufacturers looking to improve the energy efficiency of their dryers.

Annex 3 Program of the Workshop on Drying optimization for the sustainable development of cassava industry

Sukosol hotel, Bangkok, 2-4 December 2015

The Workshop is organized in conjunction with the Starch Update conference. The program below highlights the activities specific to the workshop, and activities shared between the workshop and Starch Update. For the full program of Starch Update, please refer to:

<http://www.biotec.or.th/starchupdate2015/index.php/program>

1. Wednesday 2/12/2015: Visit to a cassava starch factory (*Workshop participants*)

Time	
9:00	Departure from the Sukosol hotel
9:00 - 11:30	Travel to Banglamung district
11:30 - 12:30	Lunch
13:00 - 16:30	Visit of the factory (Chorchaiwat Industry Co. Ltd)
16:30	Departure to Bangkok
19:00	Arrival at Sukosol hotel

NB: Travel times are indicative and subject to change, depending on traffic conditions



2. Thursday 3/12/2015: Workshop and Starch update, day 1. Location: Sukosol hotel

Time	
8:30	Registration to the Starch Update conference and Workshop
9:00 – 12:00	Opening of Starch Update and Plenary lectures. See detailed program at: http://www.biotec.or.th/starchupdate2015/index.php/program
12:00 – 13:00	Lunch
13:00 – 16:30	Industrial presentations on starch drying and cassava processing (<i>shared session Workshop and Starch Update</i>) 13:00-13:30: Dewatering process 13:30-14:00: Drying process by Spiral Flash Dryer, Juan Hailer, Ingetecsa (Spain) 14:00- 14:30: Drum Drying for modified starch, Arthur Bouwmeester, ANDRITZ Gouda (Netherlands) 15:15-16:00: Paddle Dryer for the dextrination process for tapioca starch, Arthur Bouwmeester, ANDRITZ Gouda (Netherlands) 16:00-16:30: <i>tba</i>
16:30 – 18:30	Poster presentation and Reception cocktail

3. Friday 4/12/2015: Workshop and Starch update, day 2. Location: Sukosol hotel

Time	
9:00 – 12:00	Plenary lectures. See detailed program at: http://www.biotec.or.th/starchupdate2015/index.php/program
12:00 – 13:00	Lunch
13:00 – 17:30	Scientific presentations and discussions. Two concurrent sessions : Session A: See detailed program at http://www.biotec.or.th/starchupdate2015/index.php/program Session B: <i>Workshop Drying optimization for the sustainable development of cassava industry</i>. See program in the table below

4. Session B (4/12/2015, 13:00-17:30): *Program of Workshop Drying optimization for the sustainable development of cassava industry*

Time	Participant	Affiliation	Topic	Notes
13:00 – 13:10	Thierry Tran	CIRAD / KU	Introduction to the workshop	
13:10 – 13:30	Marcelo Precoppe	IITA	Improved energy efficiency of small-scale pneumatic dryer used for cassava processing in Tanzania	Part 1: Technical aspects of drying
13:30 – 13:50	Arnaud Chapuis	CIRAD	A model of pneumatic drying to optimize the energy efficiency of small-scale cassava starch and flour processing: Design guidelines	
13:50 – 14:10	Sebastian Romuli	Universität Hohenheim, Germany	Physical properties of wet and dry cassava grits as affected by particle size: Implications for pneumatic drying	
14:10 – 14:30	Kyaw Thura	Cassava Growers, Millers and Traders Association – Ayeyarwady, Myanmar	Situation of cassava processing in Myanmar	Part 2: Cassava processing with focus on the constraints of small-scale processors
14:30 – 15:00	Coffee break			
15:00 – 15:20	Bambang Triwiyono	Indonesian Starch Technology Center (BPPT)	Situation of cassava processing in Indonesia	
15:20 – 15:40	Annabelle Briones	Department of Science and Technology, Philippines	Situation of cassava production and processing in the Philippines	
15:50 – 16:00	Martin Moreno	Universidad del Valle, Colombia	Cassava starch production and the issues of starch drying in Colombia and Latin America	
16:00 – 16:20	Luong Hong Nga	HUST	Effects of drying on starch properties	Part 3: Effect of processing on product quality, including users/consumers preferences
16:20 – 16:40	Dominique Dufour	CIAT / CIRAD	Effects of cassava processing on product quality: Rasping, cooking and other unit operations. Perspectives for future research	
16:40 – 17:30	All participants	CIRAD / KU	Roundtable: Building collaborations for the development of cassava processing technologies, in particular at small-scale. Wrap-up of the Workshop	Objectives: Explore potential activities and collaborations between workshop participants. Explore possibilities of funding.

A broad alliance of research-for-development stakeholders & partners

