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Deliverable D2.1

Report on developed HE products

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Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including Commission services and projects reviewers)	
CO	Confidential, only for members of the consortium (including EACEA and Commission services and projects reviewers)	

Summary:

Following from *D1.4 – Specifications for all modules, courses and educational products*, this deliverable *D2.1 – Report on developed HE products* describes in detail the HE modules in the Graduate Diploma in Beverage Technology & Management.

Since the specification of all modules in D1.4, the responsible teachers have designed and developed all HE modules including the production of teaching materials which have undergone thorough evaluation (see D2.4). During this development process, for some of the HE modules the titles of the courses have been adapted, while also the specifications of the content, learning outcomes, teaching and assessment methods has been changed and adapted to ensure that the Graduate Diploma becomes a holistic, innovative and modern curriculum appropriate to the needs of the target group.

In this deliverable D2.1, all the developed HE modules – which have been evaluated by the EU partners (to be found in D2.4) - are specified with regard to learning outcomes, content, teaching and learning methods, language, available teaching materials, assessment method and evaluation, qualification and skill requirements for teacher, previous knowledge expected and workload for students.

All this data will be made available in a web database maintained by the Academy and can be found under <https://www.sea-abt.eu/graduate-diploma-beverage-technology-management>

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Introduction

Following from *D1.4 – Specifications for all modules, courses and educational products*, this deliverable *D2.1 – Report on developed HE products* describes in detail the HE modules in the Graduate Diploma in Beverage Technology & Management with regard to learning outcomes, content, teaching and learning methods, language, available teaching materials, assessment method and evaluation, qualification and skill requirements for teacher, previous knowledge expected and workload for students.

Since the specification of all modules in D1.4, the responsible teachers have designed and developed all HE modules including the production of teaching materials which have undergone thorough evaluation (see D2.4). During this development process – taking into the account the test runs and the suggestions for improvement of the teaching materials - for some of the HE modules the titles of the courses have been adapted, while also the specifications of the content, learning outcomes, teaching and assessment methods has been changed and adapted to ensure that the Graduate Diploma becomes a holistic, innovative and modern curriculum appropriate to the needs of the target group.

Below an overview of the changed titles of the single HE modules noting that the numbering has remained identical:

Table 1: overview of HE module titles in D1.4 and D2.1

	Titles of HE modules as specified in D1.4	Titles of HE modules as specified in D2.1
1	Food Law and Regulations	Food Law and Regulations
2	Non Alcoholic Beverage Technology	Non-Alcoholic Beverage Technology
3	Alcoholic Beverage Technology	Alcoholic Beverage Technology
4	Product and Process Development	Beverage Product Development
5	Hygienic Engineering for Beverage Processing	Hygienic Engineering and Design
6	QA&QC	Quality Assurance and Quality Control
7	Beverage Chemistry & Microbiology	Beverage Chemistry & Microbiology
8	Target Marketing and Strategic Pricing for Beverage Industry	Target Marketing and Strategic Pricing for Beverage Industry
9	Supply Chain Management for Beverage Industry	Supply Chain Management for Beverage Industry
10	Planning and Project Management for Beverage Industry	Planning and Project Management for Beverage Industry
11	Practical Laboratory in Beverage Industry	Practical Laboratory in Beverage Industry
12	Seminar	Seminar
13	Special Problem	Special Problem

The HE modules and the corresponding teaching materials have been partly modified from existing courses (which focused on general food) and adapted/complemented to beverage products and partly newly developed for the Graduate Diploma in Beverage Technology and Management. The table below gives an overview of each of the modules:

Table 2: Overview of HE modules modified or newly developed during the SEA-ABT project

1. HE Modules				
	Subject	modified from existing courses (which focus on general food) and adapted / complemented to beverage products	new developed for the SEA-ABT project	Comment
1.1	Laws and Regulations for beverages		x	Focused more specialized in national and international laws, standards and regulations related to beverages.
1.2	Non Alcoholic Beverage Technology			Modified to cover topics related to non-alcoholic beverage industry. For topics in existing curriculum, the materials need to be translated to English for reviewing purpose.
1.3	Alcoholic Beverage Technology			Modified to specific with applicants from beverage industry. Basic fermentation and distillation concepts will be delivered. Technical knowledge and case studies from wine, fruit wine, cider, beer and spirits educated during training in EU will be transferred to course attendees. Production of local alcoholic beverages will be discussed. Health concerns, state regulation regarding consumption and taxation will be addressed.
1.4	Product and Process Development			Fully produced in the frame that suitable for industrial practice by integration of new product development concept with suitable process and packaging. In addition, waste utilization management will be taught to make awareness during new product development.
1.5	Hygienic Engineering and Design			Modified to fulfil the knowledge of hygienic engineering and design specified in the area of beverage production. The basic engineering such as fluid mechanics, measurement and instrumentation, and automation system will be included in this subject to achieve the understanding on cleaning and disinfection especially for cleaning in place.
1.6	QA & QC			Modified from existing subject to suit the industrial practice in terms of quality evaluation and control, statistic, sensory analysis and food safety management for beverage industry.

1.7	Beverage chemistry & microbiology			Developed the contents to cover chemical and microbiological aspects regarding beverage quality. Case studies from beverage industries and regulation agencies will be demonstrated.
1.8	Target marketing and strategic pricing for beverage industry			Developed to specific with beverage industry. Case study on beverage industry will be used in the module.
1.9	Supply chain management for beverage industry			Developed to specific with beverage industry. Case study on beverage industry will be used in the module.
1.10	Planning and project management for beverage industry			Designed to specific with beverage industry. Case study on beverage industry will be used in the module.
1.11	Practical Laboratory in Beverage Industry			Developed to fulfill professional skills on unit operation and emerging automation systems relevant to beverage production. Novel equipments granted by the projects will be employed. In addition, technical practices on physical, chemical and microbiological analysis in the quality control of beverages will be taken into account.
1.12	Seminar (scientific communication skills)			Modified the seminar topics to be related to beverage industry. Topics on new trends and development of beverage products and process will be discussed.
1.13	Special Problem			Modified to encourage students' initiative to perform independent research and development of new beverage products. Implementation of GARAGE concept will be included. Industrial partners from various Thai beverage industries will be invited as project mentors. Idea generation, presentation and communication skill of students will be coached.

The equipment purchased during the project duration has been installed and used accordingly in the different HE modules:

Table 3: overview of equipment used in HE modules

Equipment	HE Module
CIP testing	Hygienic Engineering and Design
Spray dryer	Practical Laboratory in Beverage Industry
Evaporator	Practical Laboratory in Beverage Industry
Pasteurizer	Practical Laboratory in Beverage Industry
Automatic Filling Machine System	Non Alcoholic Beverage Technology
Liquor Distiller	Alcoholic Beverage Technology
Micro brewery system	Alcoholic Beverage Technology

1. Food Law and Regulation

Module	Food Law and Regulation
Person responsible	Kriskamol Na Jom, Kasetsart University, Thailand
Learning outcomes	<ul style="list-style-type: none"> • Understanding both domestic and international laws and regulations related beverages • Achieve the way to search related websites and documents to locate information correlated to laws, standards and regulations related to beverages • Apply knowledge of relation while developing new beverage products or seeking the approval of new beverage products
Content	Domestic & International Food Law and Regulations related to food additives, beverage manufacturing and packaging
Teaching and learning methods	<ul style="list-style-type: none"> - Lecture - Case study - Role playing and discussion - Sharing of ideas and brainstorming aspects by a project
Language	Thai/English
Teaching materials	<p>Clip video, Youtube, Newspaper, Magazine, Kahoot or Game, Power point on:</p> <ul style="list-style-type: none"> • Additives – how to use and regulations • Codex Alimentarius Commission • Beverage Regulation – drinking water in sealed containers, Natural mineral water and Electrolyte drinks • Fruit and vegetable juice • International standards and regulations related to beverages • Packaging and contact materials • Protein drinks • Tea – notification of the Ministry of Public Health
Assessment method and evaluation	Written examination and oral presentation of assignment
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> - Ph.D. qualification with teaching experience in food law, food standard, food regulation etc. - Senior experts from some related organization i.e. FDA, FAO - Language competence in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/food-law-and-regulations

1.2 Non-Alcoholic Beverage Technology

Module	Non-Alcoholic Beverage Technology
Person responsible	Sasitorn Tongchitpakdee, Kasetsart University, Thailand
Learning outcomes	Students understand principle processing, characteristics, quality standards and safety criteria for non-alcoholic beverages, including juices, dairy-based beverages, soft drinks, energy drinks, coffee, tea, etc.
Content	Juices, dairy-based beverages, soft drinks, energy drinks, coffee, tea, etc. n the aspects of chemical composition, classification, raw materials and ingredients, processing step, current and new technology related to production, quality standards and safety criteria, factors affecting shelf life of products.
Teaching and learning methods	Lecture
Language	Thai/English
Teaching materials	Clip video, Power point
Assessment method and evaluation	Written or oral examination
Qualification and skill requirements for teacher	- Ph.D. qualification with teaching experience in non-alcoholic beverage - Language competence in both Thai and English
Previous knowledge expected and workload for students	None
Further information	-
Available	https://www.sea-abt.eu/gd-btm/non-alcoholic-beverage-technology

1.3 Alcoholic Beverage Technology

Module	Alcoholic Beverage Technology
Person responsible	Sumallika Morakul, Kasetsart University, Thailand
Learning outcomes	<ul style="list-style-type: none"> • Understand principle of alcohol beverage processing, including wine, beer, spirits and related drinks • Know how to control the quality of product • Can identify the problem and its solution properly
Content	<ul style="list-style-type: none"> • Principle of wine, beer, spirit and related drink production • Process control • Product quality control and analytical method • Nutrition and health aspects • Trends and developments
Teaching and learning methods	<ol style="list-style-type: none"> 1. Lecture 2. E-learning 3. Lab demonstration
Language	Thai/English
Teaching materials	<p>PPT presentation on:</p> <ul style="list-style-type: none"> • Beverage Technology I+II • Winemaking Technology • Distilled Spirits • Whisky - cereal-based distilled beverage • Brandy - fruit-based distilled beverage • Rum, vodka, gin • ☐ Rice spirits of Asian countries
Assessment method and evaluation	<p>written examination 50% oral presentation 25% course attendance 5%</p> <p>The overall score must higher than 50% to pass the course</p> <p>A: 80% up B:70-79% C:60-69% D:50-59% F<50</p>
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> - Ph.D. qualification with teaching experience in food biotechnology and food science - Senior experts from some related organization - Language competence in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/alcoholic-beverage-technology

1.4 Beverage Product Development

Module	Beverage Product Development
Person responsible	Sudathip Sae-Tan (Kasetsart University, Thailand) Chaleeda Borompichaichartkul (Chulalongkorn University, Thailand)
Learning outcomes	<ul style="list-style-type: none"> • Capability to understand and gain experience in the process of beverage product development • Capability to integrate knowledge in chemistry, microbiology, processing, packaging and engineering concepts in beverage product development • Capability to identify challenges involved in beverage product development • Understanding techniques and knowledge related to basic consumer research and marketing concerns in beverage industry • Capability to prepare a prototype or concept of new beverage product • Understanding knowledge regarding innovative processing for beverage industry • Capability to develop and enhance team cooperation and communication skills
Content	<ul style="list-style-type: none"> • Introduction: types of product development , significance to beverage industry, product policy and goals, product failure and success • Generating and screening of new product ideas • Product concept and concept testing • Development of prototype product: information search, feasibility, detailed process and packaging • Experimentation in prototype development • Beverage packaging development • Innovative processing for beverages
Teaching and learning methods	<ul style="list-style-type: none"> • PowerPoint Presentation • E-learning
Language	Thai/English
Teaching materials	<p>Lecture note, Book and Online materials on:</p> <ul style="list-style-type: none"> • Innovation: Product Development Revolution, Perspective • Global food and drink developments • Brainstorming and Idea Schreening • Glass Packaging • Paper packaging • Plastic Packaging • Metal Packaging • Aseptic Packaging • Overview: Innovative Processing Technology for Beverage Industry • Pulsed electric field processing • Ohmic Heating • Microwave pasteurisation/sterilisation • High Pressure Processing • Microbiological aspects of high pressure processing • High pressure Homogenization for beverage application • UV technology

	<ul style="list-style-type: none"> • Cold plasma technology
Assessment method and evaluation	<ul style="list-style-type: none"> • Course assignment • Oral presentation • Written examination • Participation during contact hours
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> • Ph.D in Food Technology, Food Science and Technology, Biotechnology or related field <i>or</i> • Having experience in the product development of food factory for at least 5 years
Previous knowledge expected and workload for students	<ul style="list-style-type: none"> • Unit operation and automation • Beverage chemistry and microbiology
Further information	
Available	https://www.sea-abt.eu/gd-btm/product-and-process-development

1.5 Hygienic Engineering and Design

Module	Hygienic Engineering and Design
Person responsible	Navaphattra Nunak & Taweepol Suesut, King Monkut Institute of Technology Ladkrabang, Thailand
Learning outcomes	<ul style="list-style-type: none"> • Understand principle measurement, instrumentation and automation used in beverage industry • Understand law & regulations for food machinery design, Material of construction for equipment in contact with food • Design and specify the specifications of factory building, piping system and other equipment related to beverage factory. • Understand cleaning and disinfection for beverage factory.
Content	Basic engineering; Fluid mechanics, measurement and instrumentation and automation system for beverage technology, Law & Regulations for food machinery design, Material of construction for equipment in contact with food, Hygienic equipment design and installation.
Teaching and learning methods	Lecture, E-learning, Workshop
Language	Thai/English
Teaching materials	Presentation, E-learning, Equipment (cleanability test rig) on: <ul style="list-style-type: none"> • Overview hygienic engineering • Fluid properties and fundamental concepts of fluid flow • Principles of measurement and process instruments • Principles of automation systems including PLC, DCS and SCADA • Legal requirements for food processing equipment • Food safety hazards and sources of contamination • Hygienic process layout for the beverage industry • Food contact surface (type of materials and surface treatment) • Mixing and storage tanks, pipe connection instrumentation • Hygienic pump and valve • Cleaning and disinfection in beverage production lines
Assessment method and evaluation	Oral assessment of the learning outcomes
Qualification and skill requirements for teacher	- Knowledge on Mechanical engineering, Electrical engineering and Hygienic Engineering
Previous knowledge expected and workload for students	Fluid mechanics, Instrumentation and control, Unit operations, microbiology
Further information	
Available	https://www.sea-abt.eu/node/308/edit

1.6 Quality Assurance and Quality Control

Module	Quality Assurance and Quality Control
Person responsible	Chaleeda Borompichaichartkul (Chulalongkorn University, Thailand)
Learning outcomes	<ul style="list-style-type: none"> • Understanding the principles of quality control and quality assurance in the beverage industry • Capability to diagnose and analyze problems causing variation in beverage manufacturing process • Understanding the standard quality analysis tools and techniques • Understanding the complexities of statistical analysis and control-chart interpretation and application
Content	<ul style="list-style-type: none"> • Food quality: importance and functions of quality control and quality assurance • Types of risks associated with food and beverage • Overview of food quality and safety assurance systems • Principles of aspects of sampling plan, sample collection techniques, sampling tools and documentation • Methods of quality assessment of raw materials, in-process and finished products : physical, chemical and microbiological properties assessment • Principles of sensory analysis in quality control • Statistical methods for food and beverage quality control • Current challenges in quality, safety, fraud and adulteration in beverage industry
Teaching and learning methods	<ul style="list-style-type: none"> • PowerPoint Presentation • E-learning
Language	Thai/English
Teaching materials	<ul style="list-style-type: none"> • Lecture note • Book • Online materials • Clip VDO of case study
Assessment method and evaluation	<ul style="list-style-type: none"> • Course assignment • Oral presentation • Written examination • Participation during contact hours
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> • Ph.D in Food Technology, Food Science and Technology, Biotechnology or related field <i>or</i> • Having experience in the QA/QC of food factory for at least 5 years
Previous knowledge expected and workload for students	<ul style="list-style-type: none"> • Beverage chemistry and microbiology • Practical LAB in beverage industry
Further information	
Available	https://www.sea-abt.eu/gd-btm/quality-assurance-and-quality-control

1.7 Beverage Chemistry and Microbiology

Module	Beverage Chemistry and Microbiology
Person responsible	Kriskamol Na Jom (Kasetsart University, Thailand)
Learning outcomes	<ul style="list-style-type: none"> - Understand the chemistry of different beverages - Understand the microbiology of different beverages - Understand the basics of shelf life prediction
Content	Principle of chemistry for beverage e.g. colloid, additives, preservatives, principle of microbiology for beverage, shelf-life
Teaching and learning methods	<ul style="list-style-type: none"> - Lecture - Workshop - Field trip - Case studies - Projects
Language	Thai/English
Teaching materials	<p>Clip video, Youtube, Newspaper, Magazine, Kahoot or Game, Power point on:</p> <ul style="list-style-type: none"> • Beer fermentation • Chemical composition of beverages • Wine fermentation • Microbiology of Beverages
Assessment method and evaluation	Written examination and oral presentation of term project
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> - Ph.D. qualification in Food Science and Technology or related field with teaching experience in food chemistry, food analysis and food microbiology - Senior experts from some related organization i.e. National Food Institute - Language competence in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/beverage-chemistry-and-microbiology

1.8 Target Marketing and Strategic Pricing for Beverage Industry

Module	Target Marketing and Strategic Pricing for Beverage Industry
Person responsible	Dr. Ajchara Kessuvan (Kasetsart University, Thailand)
Learning outcomes	-Students understand concept of A target marketing or STP strategy as well as pricing strategy for beverage business.
Content	A target marketing or STP strategy for beverage business. The profit function, willingness to pay and pricing strategy are provided to comply with the target consumers and become a positioning strategy.
Teaching and learning methods	Lecture/ Case study on: <ul style="list-style-type: none"> • <i>Strategic marketing</i> • <i>Profit function</i> • <i>Measuring WTP direct</i> • <i>Measuring WTP indirect</i> • <i>Pricing strategy</i>
Language	Thai/English
Teaching materials	Power Point Presentation
Assessment method and evaluation	Written or oral examination and project work
Qualification and skill requirements for teacher	- Ph.D. qualification in marketing and related field in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/target-marketing-and-strategic-pricing-for-beverage-industry

1.9 Supply Chain Management for Beverage Industry

Module	Supply Chain Management for Beverage Industry
Person responsible	Assoc. Prof. Pornthipa Ongkunaruk (Kasetsart University, Thailand)
Learning outcomes	-Students understand supply chain and logistics management for beverage industry
Content	Integration of procurement, logistics network distribution, operations, inventory management, transportation and distribution of beverages from raw materials to consumers. Supply chain operations reference model and supply chain performance measurement. Strategies and tactics in supply chain and logistics management for sustainable development.
Teaching and learning methods	Lecture with case study on: <ul style="list-style-type: none"> • Introduction to SCM • Food and Beverage Management • Forecasting • Inventory Management • Logistic Network Configuration • Procurement
Language	Thai/English
Teaching materials	Power Point Presentation
Assessment method and evaluation	Written or oral examination and project work
Qualification and skill requirements for teacher	- Ph.D. qualification in supply chain management and related field in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/supply-chain-management-for-beverage-industry

1.10 Planning and Project Management for Beverage Industry

Module	Planning and project management for beverage industry
Person responsible	Assoc. Prof. Parthana Parthanadee (Kasetsart University, Thailand)
Learning outcomes	-Students understand management concepts for beverage operations as well as planning and operational strategy for beverage industry.
Content	Management concepts for beverage operations. Operational strategy, planning and decisions. Process and work-force management. Techniques in site selecting and plant layout, capacity planning, production planning, inventory control and project management for beverage-industry.
Teaching and learning methods	Lecture/ Case study
Language	Thai/English
Teaching materials	Power Point Presentations on: <ul style="list-style-type: none"> • 01 Introduction • 02 Forecasting – 1 • 03 Forecasting – 2 • 04 Aggregate planning • 05 Inventory -1 • 06 Inventory – 2 • 07 Inventory – 3 • 08 Master Production Schedule (MPS) • 09 Rough Cut Capacity (RCCP) • 10 Material Requirements Planning (MRP) • 11 Capacity Requirements Planning (CRP) • 12 Scheduling -1 • 13 Scheduling – 2 • 14 Production Activity Control (PAC)
Assessment method and evaluation	Written or oral examination and project work
Qualification and skill requirements for teacher	- Ph.D. qualification in planning and project management and related field in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/planning-and-project-management-for-beverage-industry

1.11 Practical Laboratory in Beverage Industry

Module	Practical Laboratory in beverage industry
Person responsible	Chaleeda Borompichaichartkul (Chulalongkorn University, Thailand)
Learning outcomes	<ul style="list-style-type: none"> • Understanding concepts and practices of process involved in the manufacturing of beverages • Understanding the implementation of physical, chemical, microbiological and sensory measurements in beverage industry • Capability to evaluate the impact of manufacturing process on the quality and safety of beverage products • Improving skills in planning and conducting experiments, collecting data, analyzing and interpreting results, and writing technical reports
Content	<ul style="list-style-type: none"> • Introduction to laboratory practice and safety concern • Preparation of raw materials: sorting, peeling, extraction etc. • Thermal process: retort, canning and heat penetration • Pasteurization unit: plate-heat exchanger • UHT pilot plant demonstration • Spray and drum drying system • Concentration by evaporation • Clarification and filtration • Beverage packaging assessment • Analysis of physical, chemical, microbiological and sensory characteristics of beverage products
Teaching and learning methods	<ul style="list-style-type: none"> • PowerPoint Presentation • E-learning
Language	Thai/English
Teaching materials	<ul style="list-style-type: none"> • Laboratory direction • Equipment or instrument demonstration • Clip VDO for demonstrate the process
Assessment method and evaluation	<ul style="list-style-type: none"> • Attendance, technical skill and performance • Laboratory report • Written examination
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> • Ph.D in Food Technology, Food Science and Technology, Biotechnology or related field <i>or</i> • Having experience in the processing unit of beverage industry for at least 5 years
Previous knowledge expected and workload for students	<ul style="list-style-type: none"> • Unit operation and automation • Beverage chemistry and microbiology
Further information	
Available	https://www.sea-abt.eu/gd-btm/practical-laboratory-in-beverage-industry

1.12 Seminar

Module	Seminar
Person responsible	Sumallika Morakul (Kasetsart University, Thailand)
Learning outcomes	<ul style="list-style-type: none"> • Be able to analyze and comprehend the scientific research papers. • Use scientific database to update or follow the research • Be able to give oral scientific presentation effectively • Write a seminar report as the scientific review paper
Content	Literature reviewing for information related to special problem topics and presenting the literature review
Teaching and learning methods	Lecture
Language	Thai/English
Teaching materials	PPT presentation
Assessment method and evaluation	<ul style="list-style-type: none"> • Active discussion and oral presentation 70% • Abstract and final written report 25% • Participation during contact hours 5% <p>The overall score must higher than 50% to pass the course</p> <p>A: $\geq 80\%$ B: 70-79% C: 60-69% D: 50-59% F: < 50</p>
Qualification and skill requirements for teacher	<ul style="list-style-type: none"> - Ph.D. qualification with teaching experience in food biotechnology and food science - Senior experts from some related organization - Language competence in both Thai and English
Previous knowledge expected and workload for students	None
Further information	
Available	https://www.sea-abt.eu/gd-btm/seminar

1.13 Special Problem

Module	Special Problem
Person responsible	Sarn Settachaimongkon (Chulalongkorn University, Thailand)
Learning outcomes	<ul style="list-style-type: none"> • Capability to identify a research problem in beverage industry • Capability to search and collect relevant information • Understanding how to write a project proposal • Understanding research methodology in beverage technology • Capability to perform critical discussion and interpretation of results • Capability to communicate the outcomes by oral presentation and report
Content	<ul style="list-style-type: none"> • Information literacy including relevant article searching, data collection and reference handling • How to write a project proposal • Research methodology and data interpretation • Scientific documentation and presentation
Teaching and learning methods	<ul style="list-style-type: none"> • Formulate a research problem / hypothesis related to beverage products based on personal / career interest • Submit a research proposal after consultation with supervisor(s) • Conduct a research project (equivalent to B.Sc. thesis level) in the field of interest • Regular consultation with supervisor (s) • Presentation in a final colloquium and submit a final report
Language	Thai/English
Teaching materials	<ul style="list-style-type: none"> • Technical supports / facilities in a hosted university / laboratory • On-line scientific literatures relevant to each project
Assessment method and evaluation	<ul style="list-style-type: none"> • Independent study competence • Progressive works • Active discussion and oral presentation • Final written report • Participation during contact hours
Qualification and skill requirements for teacher	<p>For project supervisors:</p> <ul style="list-style-type: none"> • Ph.D. qualification in Food Sciences, Biotechnology, Agriculture, Engineering or related fields • Language competence in both Thai and English • More than 3 year experience in supervising B.Sc. or higher level thesis projects • Appropriate scientific publication record in ISI/SCOPUS/PUBMED etc. database
Previous knowledge expected and workload for students	<ul style="list-style-type: none"> • Product and process development OR • Other related courses according to the consent of faculty
Further information	https://www.sea-abt.eu/gd-btm/special-problem

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