
GO BIG
with
iBIG
No.1
Integrative Biorefinery R&D &
Commercialization Hub
in Southeast Asia
IBIG
Industrial Bioprocess Innovation Group
HANDBOOK

What is **Biorefinery?**

Biorefinery is a sustainable means of valorizing and converting **biomass** and **industrial by-products** into high-value products.

Thus, biorefining is one of the key enabling strategies of a circular bioeconomy.

Why **Biorefinery?**

Biorefinery offers numerous benefits to society and nations:

1. It fosters **new industries**, which generate new investment, business opportunities, and career development pathways.

2. It contributes to a **cleaner environment** by replacing conventional, less environmentally friendly technologies with new products and processes.

3. It creates **job opportunities** and accelerates **economic growth** by increasing the value of export products and enhancing the **quality of life.**

Thailand is the leading exporter of agricultural products globally.

Thailand As World's Top Agricultural Manufacturer

Thailand possesses numerous **untapped agricultural resources and by-products**, which we believe can be more effectively utilized to generate new value.

Do you know?

Over 130 million tons of sugarcane in Thailand were processed to produce raw sugars, bioethanol and bioenergy.

IBIG

Industrial Bioprocess Innovation Group

Who is IBIG?

Industrial Bioprocess Innovation Group (IBIG) was established under the EECi umbrella to take the lead in translational biorefinery research & development and commercialization.

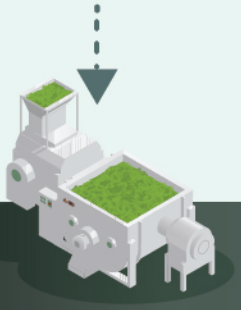
Our team pioneers this innovation with **a food GMP-compliant pilot plant,** enabling the commercialization of products in the **biochemical, biomaterial, nutraceutical, functional ingredients and cosmeceutical sectors.**

Our mission is to drive sustainable innovation through integrative biorefinery scale-up, accelerating real-world applications and making meaningful contributions to society.


GO BIG
with iBIG

A Modular Capability

Agricultural crops
and industrial by-products



01

Biomass Pretreatment

02

Upstream Fermentation

03

Downstream Process

04

Green Chemistry

Products

01

Biomass Preparation & Pretreatment

Example equipment

Equipment	Max Capacity
Drying Unit	Flow rate: up to 300 kg/h Particle size: 0.1 - 5 mm. Dry matter Concentration : 75 - 95% W/W (depend on product)
Batch reactor	Working volume: 2,400 L
Other tanks (blenders, bleaching, precipitation, buffer and holder)	Working volume from 1,600 L to 8,000 L
Decanter centrifuge	Flow rate: 500 - 1,000 L/h
Plate and Frame Filter Press 400 x 400	Flow rate: 1,000 - 5,000 L/h (Depend on product)
ETC.	

Optimize the efficiency of product while balancing capital, operational, and biomass costs

Biomass or industrial by-products have complex structures that hinder the extraction of essential compounds without first undergoing "pre-treatment".

This module converts by-products from their original form into a form that can be hydrolyzed by enzymes in order to extract the target compounds in the upstream and downstream process.

The module offers **multifaceted flexibility**, as the pre-treatment procedures are designed to accommodate **multi-compound extractions and a wide range of raw materials,** such as bagasse, fibers, pulps and molasses.

An effective pre-treatment should result in high yield recovery with low energy demand. We focus on achieving optimal pre-treatment efficiency to reduce both capital and operational costs.

Grow the cells from smaller to larger batches through seed trains

The heart of the upstream process is the 'bioreactor' - a vessel used to cultivate microorganisms, tissues, or biological cells with the aid of culture media and enzymes.

IBIG offers fermenters with varying ranges of **capacities from 150 L to 15,000 L, operation modes (batch, fed-batch, and continuous modes) and scale-up and scale-down services** to minimize risks, utilizing our best-in-class machines.

Additionally, **you can bring your own equipment to install in our mobile area**. Our experts assist in optimizing culture conditions, simplifying operations and ensuring that your bioprocesses remain contamination-free.

02

Upstream Fermentation

Scope of fermenters

- Operating temperature: 6-130 °C
- Pressure: 0 to 4 bar abs

Operating mode:

- ☑ Batch ☑ Fed-batch
- ☑ Fully CIPs and SIPs
- ☑ Aerobic ☑ Anaerobic
- ☑ Bacteria ☑ Yeast ☑ Fungi ☑ Vegetable cells
- ☑ GMP designed

Volume of fermenters	#	Working Volume
50 L	1	10 - 40 L
150 L	5	20 - 100 L
500 L	1	50 - 400 L
1,500 L	2	150 - 1,000 L
5,000 L	1	500 - 4,000 L
15,000 L	2	1,000 - 10,000 L

03

Downstream Processing

Example equipment

Equipment	Types	Max Capacity
Filtration unit	Ceramic	Volume range: 500 - 10,000 L
	Spiral wound	Volume range: 5,000 - 10,000 L
Centrifuges	Disc stack centrifuge	Flow rate: 100 - 1,500 L/h
	Decanter Centrifuge High G Force	Flow rate: 1,000 L/h
Evaporators	Rising film	Flow rate: 500 - 2,500 kg/h (depend on product)
	Forced circulation	Flow rate: 100 - 1,600 kg/h (depend on product)
	Wiped film	Flow rate: 800 kg/h (wet), 200 kg/h (dry)
Dryers	Freeze dryer	Quantity to dried: 100 kg
	Spray dryer	Quantity to dried: >= 10 kg (depend on product)
	Hot air dryer	Shelve area: 20 m^2
Cell disruptor	Homogenizer	Flow rate: 500 - 1,000 L/h Pressure: up to 1,500 bar abs
	Microfluidizer	Flow rate: 100 - 200 L/h Pressure: up to 1,500 bar abs
Chromatography	Ion Exchange	Volume range: 10 - 1,000 L
ETC.		

Troubleshoot and optimize your bioprocess in a cost-efficient way

High productivity in the upstream fermentation process does not always guarantee success if the target compounds are not efficiently extracted.

Our downstream module comprises a variety of processes including **clarification, concentration, purification, sterilization, formulation, drying, filling and packaging.**

With seamless integration between upstream and downstream processes, **you can flexibly customize your bioprocess to formulate different products**. Our experts are here to simplify the procedures, ensuring you harvest and purify the highest quality compounds.

Design biorefineries towards carbon neutrality

We emphasize minimizing the environmental impact from biorefinery activities, while exploring alternative strategies to reduce Cost of Goods Sold (COGs).

Our green chemistry module features **large reactors, processing tanks (ATEX crystallization), downstream processes with clarification/ purification/ drying/ catalyst processing and a packaging unit.** In addition, to ensure worker safety, **all equipment and instruments comply with ATEX standards.**

We are committed to continuously exploring new catalytic strategies, clean technologies and eco-friendly solvents to minimize waste and achieve high production efficiency.

04 Green Chemistry

ATEX vessels

- ☑ ATEX designed
- ☑ Fully CIPS

Example equipment

Equipment	Max Capacity
Bio-chemical reactor	Working volume: up to 800 L Operating Pressure: 16 bar abs
Fine chemical reactor	Working volume: 30 - 140 L Operating Pressure: 40 bar abs
Processing tanks	Working volume: 80 - 4,000 L
Crystal centrifuge	Bowl volume: 50 L G-Force: 1,255 g Filtration area: 0.4 m^2
Solid/liquid/ liquid centrifuge	Flow rate: 200 – 1,000 L/h Bowl speed: 7,800 rpm Bowl volume: 8 L
Filter dryer	Drying chamber: 1.5 m^2 Filtration area: 1.1 m^2
Distillation unit	Flow rate: up to 500 L/h
Centrifugal partition chromatography	Flow rate: 100 – 300 g/h Rotor volume: 5 L
Drum coating	Quantity to treated: 30 – 100 kg (depend on product)
Vacuum tray dryer	Quantity to dried: 20 – 300 kg
ETC.	

We drive sustainable innovation through integrative biorefinery scale-up.

Accelerating real-world applications and making contributions to society.

Quick Facts about IBIG's biorefinery facility

- **The National Science and Technology Development Agency (NSTDA)** *(www.nstda.or.th)* has been entrusted by the Eastern Economic Corridor (EEC) to establish EECi, a new research and development campus in Rayong, Thailand.

- EECi is situated in **Wangchan Valley**, an innovation city model under the concept of **a Smart Innovation Ecosystem** *(www.wangchanvalley.com)*.

- IBIG's biorefinery facility, a USD 90 millions investment in EECi, is divided into two buildings: **Building R**, dedicated to the upstream fermentation process and green chemistry, and **Building Q**, focusing on the downstream process. Each building provides approximately 6,780 square meters of space ready for utilization.

- IBIG offers a comprehensive range of services, from **contract research, development and manufacturing to training.** We follow the first-on-the-shelf policy as mandated by the EEC committee, enabling us to provide both scale-up research activities and first commercial product launches under one roof.

- Our neighbors include the advanced research institute, **VISTEC**, who is our close partner, and Thailand's top STEM high school, **KVIS,** creating Thailand's largest innovation cluster in the EEC.

- Investors can apply for **incentives from the EEC** *(www.eeco.or.th)* to establish a plant within the EECi area.


Building
Q
Building
R
Q
Downstream Process
Product recovery and purification processes
R
Upstream Process & Green Chemistry
Pretreatment and fermentation processes

Our **One-stop Service**

Process Development & Optimization

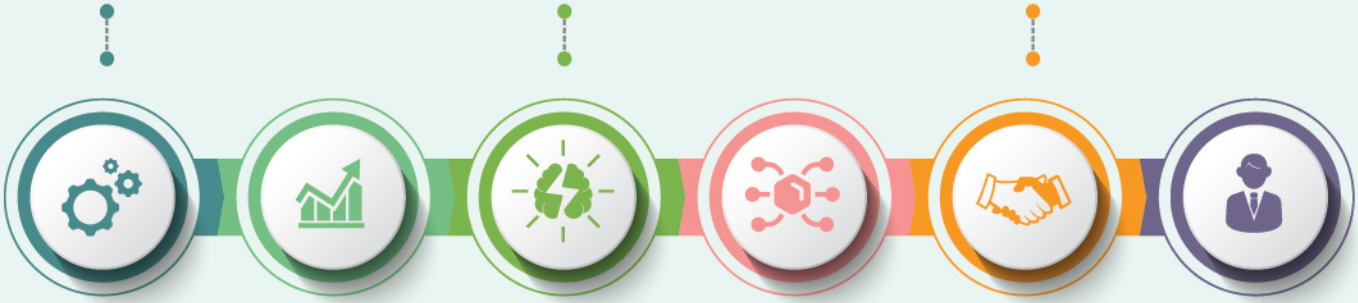
Keeping the confidentiality of your proprietary knowhow is our top priority, and we are committed to achieving **high productivity at low costs.**

Ideation

Our 'ideation' specialties will thoroughly evaluate every aspect of your business, including **technical feasibility, scalability and market viability.**

Commercialization

Commercialization requires more than just scientific knowledge. Overcome your business bottlenecks with the support of our **regulatory and technical teams' services** starting today.



Scale-Up

We consistently perform **robustness and efficiency checks** and assist you in navigating your product's market potential and transferring your process from the laboratory to a larger pilot scale.

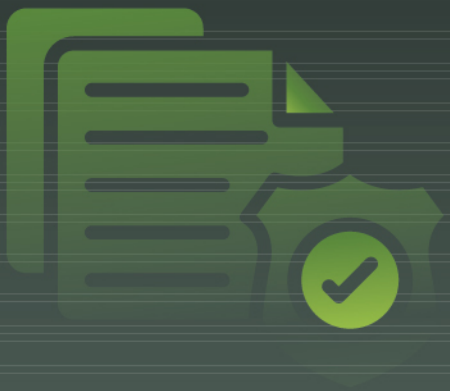
Technology Transfer

EECi provides a unique environment that supports **business expansion, offshore production and foreign-direct investment,** promoted by EEC, a public agency facilitating innovative projects.

Training

We offer both **technical and business training tailored to your need.**

Regulatory Compliance



Our facilities meet a range of legal requirements to ensure the highest standards and are open to applying for additional certifications or compliance upon your request:

- **GMP:** The equipment is GMP-compliant across the board.
- **CIP/SIP:** All instruments feature Clean-In-Place (CIP) and Sterilization-In-Place (SIP) technologies.
- **ATEX:** Compliance with ATEX regulations, as mandated by the European Union.
- **QMS:** We have a Quality Management System.

This makes our facility ideal for businesses planning to expand their operations in Thailand or other countries.

Regulatory Services

Many businesses seek to eliminate regulatory hassles while fulfilling required obligations. EECi offers a one-stop service, ensuring a smooth transition from moving in to operating your own biorefinery plant:

- **Guidance:** We guide you through related local and international regulations.
- **Support:** We provide document preparation and registration services.

EEC Incentive

Enjoy up to **15 years** of corporate tax exemption,

smart visa,

a **17% flat** personal income tax exemption,

and many other benefits, exclusively in the **EEC Special Economic Zone.**

Learn more about the incentives:
www.eeco.or.th/en

Our Team

IBIG's success is driven by a team of **experienced professionals from multiple fields** to enable a broader range of biorefinery applications. Our IBIG team is **affiliated with the National Science and Technology Development Agency (NSTDA)'s BIOTEC and NANOTEC centers,** which are Thailand's **largest R&D centers**, housing over 700 scientists. This represents **the highest concentration of research scientists** in the fields of biotechnology and nanotechnology in Thailand.

This close collaboration brings extensive knowledge and decades of experience to the table, pushing the boundaries of translational biorefinery R&D and commercialization. Together, we are not only advancing S&T innovation; we are shaping a greener and more sustainable future for generations to come.

Our **Partners**

EEC
EASTERN ECONOMIC CORRIDOR
THE PRIME GATEWAY TO ASIA

VISTEC
VIDYASIRIMEDHI
INSTITUTE OF SCIENCE AND TECHNOLOGY

SynBio Consortium

BIOTEC
a member of NSTDA

NANOTEC
a member of NSTDA

foodSERP

BBF
BIOTEC Bioprocessing Facility

IAIG
Innovative Agriculture Innovation Group

about EECi

The unique innovation hub for translational research and localization technology to commercialization

The Eastern Economic Corridor of innovation or EECi is an innovation hub located at the heart of the Eastern Economic Corridor (EEC) in Wangchan District, Rayong Province. Its focus industries, under the **Thailand 4.0 scheme,**

EECi is positioned to accelerate and bridge the gap in Thailand's Technology Readiness Level (TRL) between laboratory development (TRL 1-4) and industrial applications (TRL 8-9).

TRL 1 2 3 4 5 6 7 8 9

Laboratory Development

Pilot Plant, Testbed, Sandbox, Tech Demonstration & Localization, Techno-economics

Industrial Application

Rental Space

for research and development to support technology business

EECi headquarters provides translational research infrastructures to support scaling-up of research activities, validation and demonstration of actual innovation prior to mass commercialization i.e., Pilot Plants, Plant Factories, Smart Greenhouses, Demonstration Plants, Testbeds. Amidst the balanced innovation ecosystem for researchers and innovators to live, relax and work collaboratively together.

Private and public organizations as well as universities gain benefit from the well-equipped and highly connected EECi innovation ecosystem by setting up their research and innovation related operations on-site.

Basic Utilities in EECi Headquarters

Utility	Specifications
Electricity Capacity	Total capacity = 12 MVA
Watersupply	Capacity at 1,500 cu.m/day
Wastewater Treatment	Capacity at 300 cu.m/day (Max BOD = 600 mg/L and max COD = 1,600 mg/L)
Waste and Hazardous Waste	Sorting and storage waste center for proper disposal
Cold Water Supply	3,600 tons (refrigeration) (CHS/CSR : 6/15 deg.C at 5,712 RT.hr)
ICT Infrastructure	Boardband 3G, 4G and 5G and Wi-Fi coverage in all area with fiber optic network for high speed connection

Safety & Security

- Fire alarm / Firm pump / Generator
- Access control
- CCTV camera with facial recognition
- Emergency call center
- Security guards on-site 24 hours a day - 7 days a week

Internet/ Communication Providers

- Voice over Internet Protocol (VoIP)
- Leased line ihnternet
- Internet share bandwidth / FTTx
- IP VPN
- Cloud service
- Fax to e-mail
- VDO conference

Pilot Plant

High Bay Area

Plant Factory

Greenhouse

Wet Laboratory

Office Space

สวทช
NSTDA

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