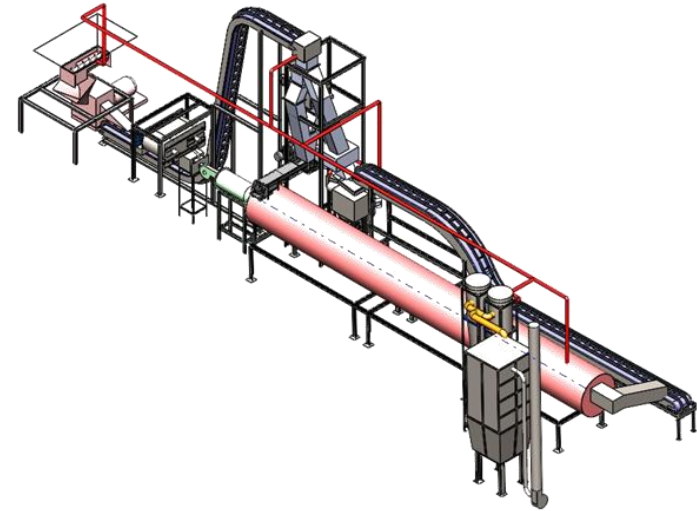


# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 1

### Biomass Pretreatment Process

- Biomass Grinder and Dryer
- Biomass Preparation
- Batch Reactor & Holder Tank
- Bleaching / Washing Tank
- Precipitation & Buffer Tank
- Distillation
- Filter Press & Decanter



### Equipment & Specs

	Capacity	Temperature	Pressure
1. Biomass Drying Unit	300 kg/h	200 to 300 °C	
2. Biomass Discharging with Transport Rail and Bypass (Big bag of 1 m <sup>3</sup> )	1,000 kg/h		
3. Batch Reactor 3,000L	Agitator: 1,180L - 2,400L	6 to 230°C	-0.9 to 35 Bar-G
4. Holder Tank 5,000L	Agitator: 1,167L - 4,000L	6 to 110°C	
5. Bleaching / Washing Tank 3,000L	Agitator: 899L - 2,400L	6 to 95 °C	
6. Blender Tank 2,000L	Agitator: 479L - 1,600L	6 to 95 °C	
7. Precipitation Tank 10,000L	Agitator: 1,252L - 8,000L	6 to 95 °C	
8. Buffer Tank 10,000L	Agitator: 4,600L - 8,000L	6 to 95 °C	
9. Lump breaker with Hopper	300 kg/h	45 °C (Max)	
10. Plate and Frame Filter Press 400x400	1,000 to 5,000 L/h	6 to 95 °C	1 to 8 Bar-Abs



# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 1

### Biomass Pretreatment Process (cont.)

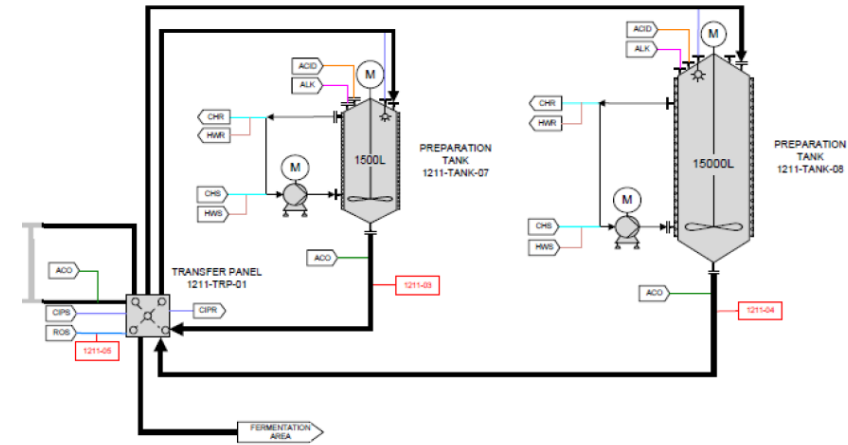
	Capacity	Temperature	Pressure
11. Decanter Centrifuge	500 - 1,000 L/h	6 to 95 °C	1 to 8 Bar-Abs
12. Distillation unit	<i>Specs will be determined</i>		
13. Vacuum Try Dryer	250 kg (Max)	25 to 90 °C	
14. Freeze Dryer	30 kg (Max)		



# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 2 Upstream Process

- Big Bag Empty Station and S-L Mixer
- Preparation Tank
- Fermenter 150L x 5
- Fermenter 1,500L & 15,000L with Feed Tank
- Sterile 300L & 3,000L
- Fermenter 50L & 500L & 5,000L



## Equipment & Specs

	Capacity	Temperature	Pressure
1. Big Bag Empty Station and Solid-Liquid Mixer	40 - 60 kg/min	25 to 70 °C	
<b>Preparation Tank</b>			
2. Preparation Tank 1,500L	Agitator: 205L - 1,200L	6 to 95 °C	
3. Preparation Tank 15,000L	Agitator: 1,200L - 12,000L	6 to 95 °C	
<b>Fermenter 150L - 1500L - 15000L</b>			
4. Fermenter 150L	Agitator: 20L-100L	6 to 130 °C	-1 to 5 Bar-G
5. Feed Tank 1,200L	Agitator: 150L - 1,000L	6 to 130 °C	-1 to 3 Bar-G
6. Fermenter 1,500L	Agitator: 150L - 1,000L	6 to 130 °C	-1 to 3 Bar-G
7. Feed Tank 12,000L	Agitator: 1,000L - 10,000L	6 to 130 °C	-1 to 3 Bar-G
8. Fermenter 15,000L	Agitator: 550L - 10,000L	6 to 130 °C	-1 to 3 Bar-G



# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 2 Upstream Process (cont.)

		Capacity	Temperature	Pressure
<b>Fermenter 50L – 500L - 5000L</b>				
9. Fermenter	50L			<i>Specs will be determined</i>
10. Fermenter	500L			<i>Specs will be determined</i>
11. Fermenter	5,000L			<i>Specs will be determined</i>
<b>Sterile Unit</b>				
12. Sterile tank	300L			<i>Specs will be determined</i>
13. Sterile tank	3,000L			<i>Specs will be determined</i>

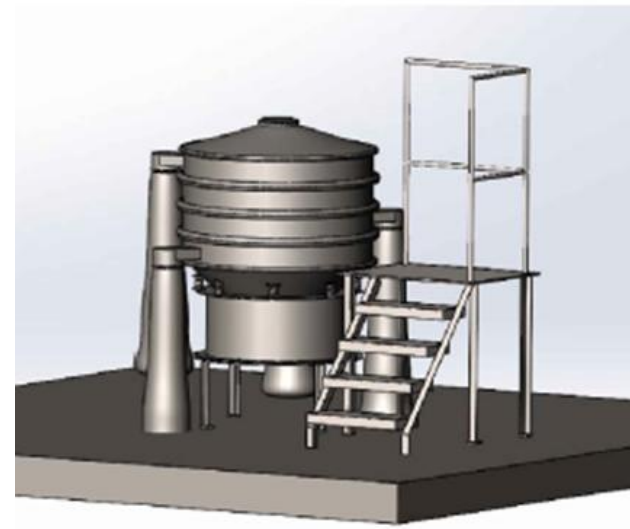


# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 3

### Downstream Process

- Processing Tank
- Downstream Process for Clarification & Concentration
- Evaporation
- Formulation
- Purification (Chromatography)
- Drying
- Filling



### Equipment & Specs

#### Processing Tank

1. Stirred Pressurized Tank 2,500L
2. Stirred Pressurized Tank 5,000L
3. Atmospheric Processing Tank 2,500L
4. Atmospheric Processing Tank 5,000L
5. Atmospheric Processing Tank 10,000L
6. Atmospheric Processing Tank 15,000L
7. Atmospheric Processing Tank 25,000L

#### Capacity

#### Temperature Pressure

- Agitator: 250L - 2,000L 6 to 140 °C -1 to 3 Bar-G
- Agitator: 500L - 4,000L 6 to 140 °C -1 to 3 Bar-G
- Agitator: 270L - 2,000L 6 to 95 °C
- Agitator: 440L - 4,000L 6 to 95 °C
- Agitator: 1,245L - 8,000L 6 to 95 °C
- Agitator: 1,200L - 12,000L 6 to 95 °C
- Agitator: 2,000L - 20,000L 6 to 95 °C

#### Clarification & Concentration

8. Solid-Liquid-Liquid Centrifuge

100 - 500 L/h

6 to 90 °C 1 to 6 Bar-Abs



info@eeci.or.th



www.eeci.or.th



EECiThailand

**Open for Services: Mid of 2026**

# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 3

### Downstream Process (cont.)

	Capacity	Temperature	Pressure
9. Solid-Liquid Centrifuge	<i>Specs will be determined</i>		
10. Decanter Centrifuge High G Force	1,000 L/h	6 to 95 °C	
<b>Purification</b>			
11. Small Filtration Test Unit	10 L (Min)	6 to 80 °C	
12. Ceramic Filtration (MF/UF) Unit (Large)	10,000 L (Max)	6 to 80 °C	
13. Ceramic Filtration (MF/UF) Unit (Medium)	5,000 L (Max)	6 to 80 °C	
14. Ceramic Filtration (MF/UF) Unit (Small)	500 L (Max)	6 to 80 °C	
15. Spiral-wound filtration (MF/UF/NF/RO) (Large)	10,000 L (Max)	6 to 95 °C	41 Bar-Abs (for RO)
16. Spiral-wound filtration (MF/UF/NF/RO) (Small)	5,000 L (Max)	6 to 95 °C	41 Bar-Abs (for RO)
17. Chamber Filter Press 800x800	500 - 2,000 L/h	6 to 95 °C	1 to 15 Bar-Abs
18. Chamber Filter Press 400x400	150 - 200 L/h	6 to 95 °C	1 to 15 Bar-Abs
19. Plate and Frame Filter Press 600x600	1,000 – 5,000 L/h	6 to 95 °C	1 to 8
<b>Chromatography</b>			
20. Ion Exchange Column 1,000L	500 - 6,000 L/h	15 to 80 °C	4 Bar-Abs (Max)
21. Ion Exchange Column 100L	100 - 1,000 L/h	15 to 80 °C	4 Bar-Abs (Max)
22. Ion Exchange Column 10L	5 - 60 L/h	15 to 80 °C	4 Bar-Abs (Max)



# Biorefinery Pilot Plant @EECi: List of Equipment

**Module 3**  
**Downstream Process (cont.)**

	Capacity	Temperature	Pressure
<b>Evaporation</b>			
23. Force Circulation Evaporator	600 - 1,600 kg/h	6 to 90 °C	0.1 to 3Bar-Abs
24. Falling Film Evaporator	2,500 kg/h	10 to 110 °C	0.1 to 3Bar-Abs
25. Wiped Film Evaporator	1,000 kg/h	15 to 95 °C	0.1 to 1Bar-Abs
<b>Formulation Unit</b>			
26. Horizontal Mixing Vessel	500 L per batch	7 to 95 °C	
27. Mixing tank Package 2,500L	<i>Specs will be determined</i>		
28. Vacuum Mixing tank 250L	<i>Specs will be determined</i>		
29. Homogenizer	500 - 1,000 L/h		1,500 bars
30. Microfluidizer (cell disruptor)			
<b>Drying Unit</b>			
31. Freeze Dryer	100 kg (Max)		
32. Hot Air Dryer	100 kg (Max)	25 to 100 °C	
33. Drum Dryer	1-3 m <sup>2</sup>	6 to 130 °C	
34. Spray Dryer	30 - 850 kg	170 to 200°C	
<b>Material Handling Package</b>			
35. Vibrating Sieve Package Unit	30 kg		
36. Sieving Tower	30 kg		
37. Packaging Unit 25 kg with Belt Conveyor	1500 kg/h (Max)		

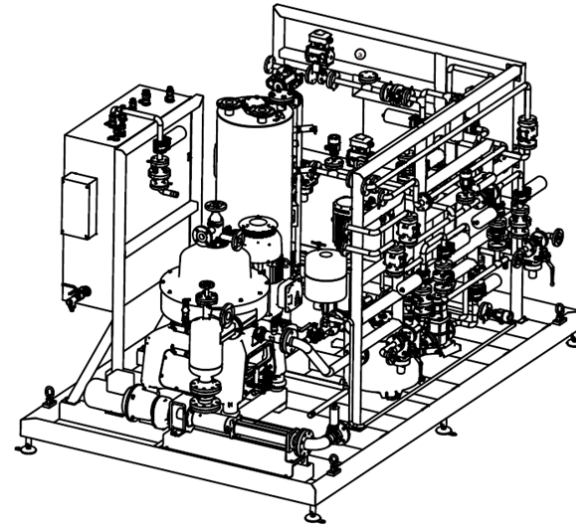


# Biorefinery Pilot Plant @EECi: List of Equipment

## Module 4

### Green Chemistry Process

- Fine Chemical
- Processing Tank
- Vacuum unit
- Extraction / Separation / Purification
- Preparative chromatography
- Top/bottom Spray
- Catalyst Processing



### Equipment & Specs

	Capacity	Temperature	Pressure
<b>Multi-Purpose Reactor</b>			
1. Fine Chemical Reactor 200L	Total 200 L & Working 140 L	20 to 250 °C	-1 to 40 Bar-G
<b>Vessel Module Equipment (ATEX)</b>			
2. ATEX Reactor Package 1,000L	Agitator: 201L - 800L	20 to 250 °C	0 to 15 Bar-G
3. Processing Tank 1,000L	Agitator: 201L - 800L	6 to 140 °C	-0.95 to 3 Bar-G
4. Processing Tank 2,500L	Agitator: 417L - 2,000L	6 to 140 °C	-0.95 to 3 Bar-G
5. Processing Tank 5,000L	Agitator: 616L - 4,000L	6 to 140 °C	-0.95 to 3 Bar-G
<b>Vacuum Station</b>			
6. Vacuum Station:	300 m <sup>3</sup> /h	20 to 65 °C	50 mBar-Abs





	Capacity	Temperature	Pressure
<b>Separation / Extraction / Purification</b>			
7. Preparative Chromatography	<i>Specs will be determined</i>		
8. Bottom/Top Spray	<i>Specs will be determined</i>		
9. Filter Dryer	Working 1,280 L	10 to 152 °C	0 to 5 Bar-Abs
10. Chamber Filter Press 600x600 (ATEX):	500 L/h	6 to 95 °C	1 to 15 Bar-Abs
11. Solid-Liquid-Liquid Centrifuge:	550 L/h	6 to 95 °C	
12. Crystal Centrifuge:	52 L	5 to 60 °C	-100 to 300 mBar-Abs
13. Simulated Moving Bed Chromatography:	300 L/h	20 to 90 °C	
14. Centrifugal Partition Chromatography	<i>Specs will be determined</i>		
15. L/L Extractor	<i>Specs will be determined</i>		
16. CO <sub>2</sub> Extractor:	2x24 liters vessels	20 to 60 °C	max 300 bar
<b>Solid Packaging</b>			
17. Solid Packaging	<i>Specs will be determined</i>		
<b>Catalyst Processing</b>			
18. Impregnation Process:	10 L (Binder) > 32 L (Coated Product)	25 to 105 °C	
<b>Calcination</b>			
19. Furnace :	> 37 L	70 to 1,000 °C	
<b>Material Handling Package</b>			
20. Mobile Mill Unit:	100 kg	35 °C (Max)	
21. Vibrating Sieve Laboratory:	20 – 25 kg		



# Biorefinery Pilot Plant @EECi: List of Equipment

## Mobile Equipment, CIP Station & Other Equipment

### Equipment & Specs

		Capacity	Temperature	Pressure
<b>Mobile Tanks</b>				
1.	Mobile Stirred Tank with and without Jacket	200L	Agitator: 20L – 160L	6 to 95 °C
2.	Mobile Stirred	250L	Agitator: 25L - 200L	6 to 95 °C
3.	Mobile Stirred Tank	400L	Agitator: 50L - 300L	6 to 95 °C
4.	Mobile Stirred Tank	500L	Agitator: 50L - 400L	6 to 95 °C
5.	Mobile Stirred Tank	1,000L	Agitator: - 800L	6 to 95 °C
<b>Mobile Dosing Station</b>				
6.	Dosing Station			
	• ATEX Dosing Station	100L	100 L/h	
	• ATEX Dosing Station	200L	200 L/h	
	• Non-ATEX Dosing Station	100L	100 L/h	
	• Non-ATEX Dosing Station	200L	200 L/h	
<b>Stainless Steel IBC Tanks</b>				
7.	Stainless Steel IBCs	1,000L		6 to 95 °C
<b>Chromatography Package</b>				
8.	Chromatography Ion Exchange Column	100L	50 - 600 L/h	15 to 80 °C 8.5 Bar-abs (Max)



# Biorefinery Pilot Plant @EECi: List of Equipment

## Mobile Equipment, CIP Station & Other Equipment (cont.)

	Capacity	Temperature	Pressure
<b>Mobile Filtration</b>			
9. Pre-Filter	3,000 L/h	20 to 130 °C	5 Bar-Abs
10. Sterile Filter	3,000 L/h	20 to 130 °C	5 Bar-Abs
11. Bag Filter	30 m <sup>3</sup> /h (Max)	-10 to 160 °C	0 to 11 Bar-Abs
<b>Mobile Heat Exchanger</b>			
12. Mobile Plate Heat Exchanger	10,000 kg/h Max.		
13. Mobile Shell & Tubes Heat Exchanger	10,000 kg/h Max		
<b>Mobile Pumps</b>			
14. Centrifugal Pumps			
• Centrifugal Pump	5 m <sup>3</sup> /h		
• Centrifugal Pump	10 m <sup>3</sup> /h		
• Centrifugal Pump	20 m <sup>3</sup> /h		
• Centrifugal Pump	30 m <sup>3</sup> /h		
• Centrifugal Pump	50 m <sup>3</sup> /h		
15. Peristaltic Mobile Pumps			
• Peristaltic Mobile Pump	0 - 2.5 m <sup>3</sup> /h		
• Peristaltic Mobile Pump	0 - 5.0 m <sup>3</sup> /h		
• Peristaltic Mobile Pump	0 - 10.0 m <sup>3</sup> /h		
16. Screw Mobile Pumps			
• Screw Progressive Cavity	2 and 10 m <sup>3</sup> /h		
• Screw Progressive Cavity with Hopper	2, 5 and 10 m <sup>3</sup> /h		
17. Diaphragm Mobile Pump			
• Diaphragm Mobile Pump	0.5 m <sup>3</sup> /h		



# Biorefinery Pilot Plant @EECi: List of Equipment

## Mobile Equipment, CIP Station & Other Equipment (cont.)

	Capacity	Temperature	Pressure
• Diaphragm Mobile Pump	2 m <sup>3</sup> /h		
• Diaphragm Mobile Pump	5 m <sup>3</sup> /h		
• Diaphragm Mobile Pump	10 m <sup>3</sup> /h		
• Diaphragm Mobile Pump	20 m <sup>3</sup> /h		
<b>CIP Package</b>			
18. CIP Station:	25 m <sup>3</sup> /h	20 to 90 °C	6.5 Bar-Abs
19. Mobile CIP Station	25 m <sup>3</sup> /h	20 to 90 °C	4 Bar-Abs

## Transfer Panel and Accessories

- Transfer Panel
- Process Flexibles Hose (3A Ferrule with Tri-Clamp & FDA Gasket)
- Extra Process Connection Pieces (3A Ferrule)
- Utilities Flexibles Hose
- Extra Utility Connection Pieces
- Operation / Commissioning Extra Adaptor
- Portable Type Ultrasonic Flow Meter (Clamp - on Detector and Transmitter)
- Infrared Thermometer (Temperature Gun)
- Portable Pressure Gauge
- Mobile Stainless-Steel Rack
- Stainless Steel Cupboard with Shelves
- Stainless Steel Storage Box for Extra Connection
- Flexible Hose for Solvent



# Biorefinery Pilot Plant @EECi: List of Equipment

## Lab-scale Equipment

### Equipment & Specs

1. Fermenter	5 L and 10 L	
2. Incubator shaker		
3. Cooling incubator	384 L	0 to 70 °C
4. Cooling incubator	115 L	-5 to 100 °C
5. Cooling incubator	150 L	0 to 65 °C
6. Refrigerated floor-type centrifuge		-10 to 40°C
7. Refrigerated bench-type centrifuge		-11 to 40°C
8. Microcentrifuge		
9. Refrigerated microcentrifuge		-9 to 40°C
10. Ultra high performance liquid chromatography		
11. High performance liquid chromatography		
12. Gas chromatography		
13. Multimode microplate reader		
14. Spectrophotometer		
15. Biochemistry analyzer (Biosensor)		
16. Light microscope		
17. Ultra-low temperature freezer	845 L	-50 to -90 °C
18. Deep freezer	265 L	-10 to -40 °C
19. Ultra-low temperature freezer	700 L	-50 to -86 °C
20. Freezer	482 L	-20 to -40 °C
21. Refrigerator	600 L	
22. Refrigerator	1,000 L	
23. Microfluidizer		
24. Ultrasonic cleaner		
25. Sonicator bath		



# Biorefinery Pilot Plant @EECi: List of Equipment

## Lab-scale Equipment (cont.)

26. Probe-type ultrasonic		
27. Freeze dryer and ultra-low temperature freezer		
28. Large autoclave	248 L	
29. Small autoclave	110 L	
30. Hot air oven	250 L	10 to 300 °C
31. Hot air oven	400 L	5 to 300 °C
32. Hot air oven	105 L	10 to 300 °C
33. Hot air oven	440 L	10 to 300 °C
34. Vacuum pump		
35. Thermocycler		
36. Electrophoresis system		
37. Circulating water bath		
38. Spray dryer		
39. Refrigerated/heated bath circulator		
40. Rotary evaporator		
41. Precision balance 2 digits		
42. Precision balance 5 digits		
43. Precision balance 4 digits		
44. Vacuum drying oven		
45. Vacuum concentrator		
46. Vacuum pump		
47. Incubated shaker		
48. Sieve shaker		
49. Viscometer		
50. Hot plate and stirrer		
51. Ice maker machine		
52. pH Meter		
53. Pipette set		



# Biorefinery Pilot Plant @EECi: List of Equipment

## Lab-scale Equipment (cont.)

- 54. Vortex
- 55. Water purification system
- 56. Peristaltic pump                    2.4 L/min
- 57. Peristaltic pump                    18 L/min
- 58. Homogenizer probe
- 59. Laboratory dishwasher
- 60. Small glass chemical reactor
- 61. Density meter
- 62. Conductivity meter
- 63. Portable turbidimeter
- 64. Laboratory scale filter press
- 65. Laboratory glassware set
- 66. Thermomixer
- 67. Buchner filter set
- 68. Thermogravimetric analysis
- 69. Glass columns for lab scale chromatography
- 70. Moisture analyzer
- 71. Refractometer (Brix) set
- 72. High performance anion-exchange chromatography
- 73. Microwave oven
- 74. Overhead stirrer
- 75. Mass spectrometer
- 76. Continuous homogenizer for cell disruption

