AIST NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)
Biomass Technology Research Center
BTRC

Study of utilization of ASEAN Biomass in a large-scale plant ~ Optimization of ethanol production from woody biomass ~

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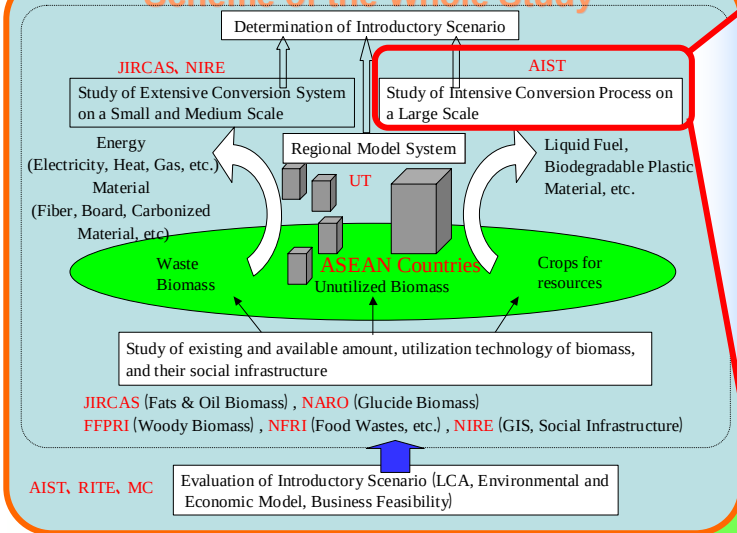
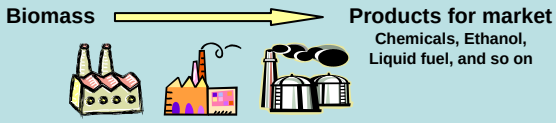
Scheme of the Whole Study



This study



Method

1. survey of technologies
   - Thermochemical conversion
     - combustion, pyrolysis, gasification, hydrothermal, etc.
   - Biochemical conversion
     - enzyme, fermentation (ethanol, lactic acid, etc)
2. Process design
   - Main process and utilities
   - Mass and energy balance analysis
3. Optimization
   - Heat and power Pinch analysis
   - Material Pinch analysis

Case study: Process for ethanol production from woody biomass

Technologies

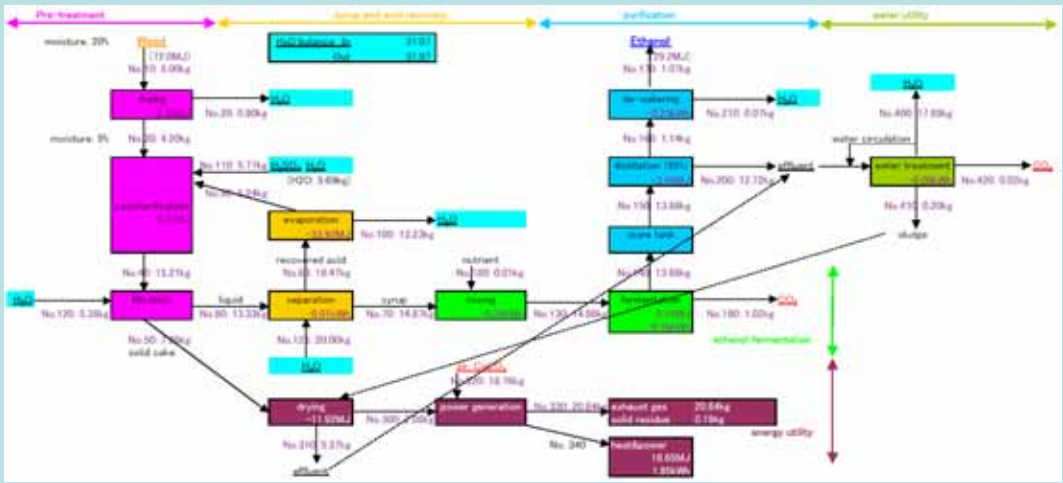
saccharification; acid (H_2SO_4) separation; chromatography fermentation; conventional distillation; conventional de-watering; membrane

Process design

It consisted mainly of saccharification, acid recovering, fermentation, distillation, and de-watering.

Utilities for energy and water treatment were also included.

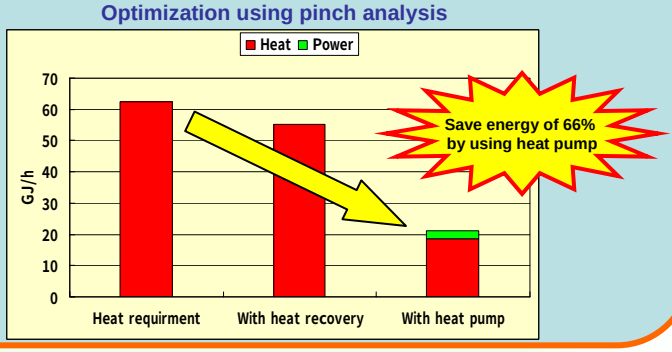
Mass and energy balances were calculated.



Energy data on the stream

Stream Data	Type	Ts C	Tt	dH
Dry heating	Cold	105	105.2	2.986
Dryer condenser	Hot	100	99.8	2.008
Acid decomposition	Hot	70	69.8	0.222
Evaporator heating	Cold	25	105	4.376
	Cold	105	105.2	29.539
Evaporator condenser	Hot	100	99.8	33.204
Fermentator cooling	Hot	35	34.8	0.182
Distl feed	Cold	25	90	3.608
Distl Reboiler	Cold	100	100.2	6.979
Distl Condenser	Hot	78	77.8	6.485
WW cooler	Hot	100	25	3.956
Cake drying	Cold	105	105.2	14.899
Recovered Heat	Hot	200	199.8	16.646

Optimization using pinch analysis



Conclusions

- As a case study, the process for ethanol production from woody biomass was designed.
  1 kg-ethanol could be produced from 5 kg-wood. Energy recovery (Higher heating value basis) was 41%.
- The process was optimized by pinch analysis.
  Heat recovery could not save energy so much, but 66% of heating energy can be saved by introducing heat-pump system.
- This method is effective to construct and estimate the process.

ACKNOWLEDGMENTS

This work was carried out under the project of "ASEAN Biomass R&D Strategy" funded by Ministry of Education, Culture, Sports, Science and Technology, and handled by Japan Science and Technology Agency.