

Inventory Analysis of Bio-Ethanol Production from Energy Crops

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Abstract

Bio-ethanol can be produced from various kinds of energy crops. However, energy consumption and GHG emissions to produce unit bio-ethanol would be different by the feedstock energy crops, for the preconditions for feedstock and bio-ethanol production such as the required amount of fertilizers to cultivate feedstock crops, the energy inputs for applicable energy conversion process, utilization of the byproducts from bio-ethanol production as energy, etc. vary by the feedstock, the assumed conversion process or the places where feedstocks are cultivated and bio-ethanol is produced. In this study, inventory analyses of bio-ethanol production are conducted and energy consumption and GHG emissions by unit product of bio-ethanol have been estimated from the viewpoint of life cycle assessment. 6 energy crops have been chosen as objective starchy and carbohydrate feedstocks: corn, wheat, cassava, sweet sorghum, sugarcane and sugar beet.

Keywords: Bio-Ethanol, Inventory Analysis, Energy Crop Feedstock, Energy Consumption, GHG Emissions

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Backgrounds

Biomass energy utilization

- **GHG reduction**
Carbon neutral
- **Energy diversity from oil**
Improve self-sufficiency rate of energy
- **Promotion of resource circulation**
Make efficient use of waste material
- **Local energy production and consumption**
Promote the use of local resources
- etc.

Bio-ethanol is regarded as one of the options to promote energy diversity from oil and reduce GHG emissions in transport sector.

Since bio-ethanol can be produced from various kinds of energy crops, energy consumption and GHG emissions to produce unit amount would be different.

Major energy crops for bio-ethanol production

Type	Energy crop	Countries introduced
Starchy	Corn	US, UK, China
	Wheat	Germany, Spain, France, UK, China
	Cassava	China, Thailand
Carbohydrate	Sweet sorghum	China
	Sugarcane	Brazil, India, Thailand, The Philippines
	Sugar beet	France

Objectives

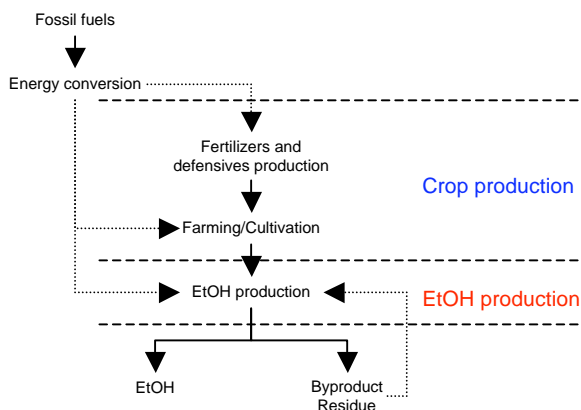
Inventory analyses of bio-ethanol production are conducted to estimate **energy consumption** and **GHG emissions** by unit product of bio-ethanol from 6 energy crop from the viewpoint of life cycle assessment.

Starchy feedstocks: Corn, wheat and cassava

Carbohydrate feedstocks: Sugar beet, sugarcane and sweet sorghum

Preconditions

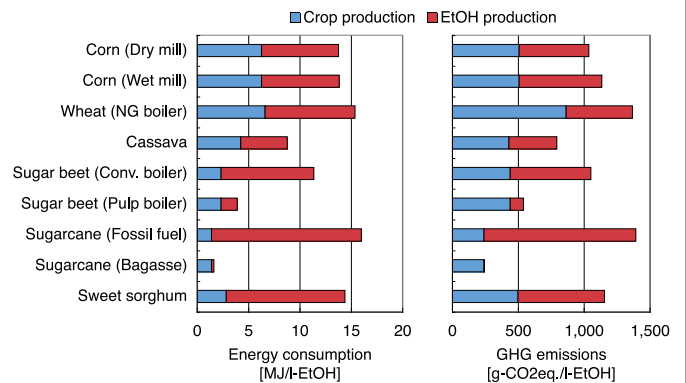
- Inventory data have been collected by literature survey.
- Only the energy flows for bio-ethanol production are regarded.
- System boundary of the analyses is shown below.
- If the byproducts are treated as valuables, energy consumption and GHG emissions through the main process are allocated to all the products according to the heat value of each product.



Summary

- It is confirmed that bio-ethanol from sugarcane shows the least energy consumption and GHG emissions.
- Whether byproducts or residues can be utilized or not would be one of the key factors to produce bio-ethanol in an environmentally friendly way.
- Uncertainty analyses are being carried out to evaluate the effect of difference in inputs towards the total results.

Results of inventory analyses



Why these differences occur?

