

# Energy Production from Lignocellulosic Biomass by Combination of Hydrothermal Pretreatment and Anaerobic Digestion

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## ■ Background

Lignocellulosic biomass is regarded as a promising renewable resource that can be potentially used to provide second-generation biofuels. Pretreatment can improve hydrolysis of lignocellulosic biomass, thus enhance methane production in the subsequent anaerobic digestion. Hydrothermal treatment (HTT) of lignocellulosic biomass has received considerable attention because of its feasibility and efficient generation of valuable products (as shown in Fig.1).

In this study, rice straw was used as a representative lignocellulosic biomass and pretreated under different hydrothermal conditions. The effects of HTT peak temperature, holding time, etc. on solubilization of rice straw and subsequent H<sub>2</sub> production were explored. The relationship between H<sub>2</sub> yield and soluble products from rice straw during HTT pretreatment was also discussed.

## ■ Results and Discussion

### 1. Performance of HTT pretreatment on rice straw

#### 1.1 TS and VS reduction

The total solid (TS) and volatile solid (VS) contents of rice straw decreased under all tested conditions. More reductions in TS and VS of rice straw were achieved at higher HTT temperature like 210°C (HTT210), about 10–21% and 3–7%, respectively. Results from TS and VS reductions indicated that peak temperature at 210 °C seemed to be more favorable for the hydrolysis of rice straw.

#### 1.2 Soluble products from rice straw during HTT treatment

HTT has an effective solubilization effect on lignocellulosic materials like rice straw in this study. Different HTT pretreatment conditions achieved

different amount of carbohydrates and other by-products from rice straw. Compared with the results from HTT150, more effective solubilization of rice straw was achieved after HTT at 210°C because of much higher production of SCOD and VFAs. HTT210 pretreatment with holding 0 min achieved the highest SCOD and soluble carbohydrates from rice straw, about 420 and 80 mg/g-VS, respectively.

### 2. Batch H<sub>2</sub> fermentation tests by using the resultant substrate from rice straw after HTT pretreatment

The amount of soluble carbohydrates produced from rice straw during HTT treatment was found to have strongly positive correlation with the H<sub>2</sub> yield from the subsequent H<sub>2</sub> fermentation. Among these conditions, HTT pretreatment at peak temperature of 210 °C with holding time of 0 min achieved the highest H<sub>2</sub> yield, about 28 ml H<sub>2</sub>/g-VS.

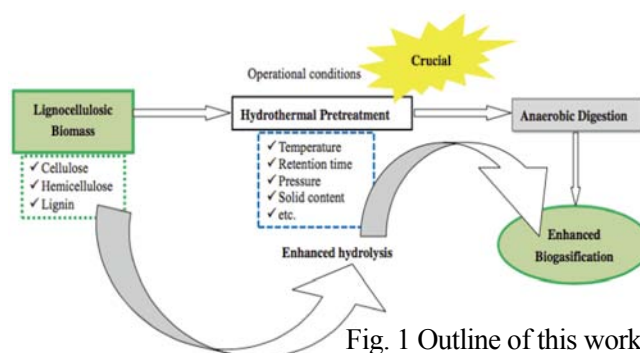


Fig. 1 Outline of this work

## ■ References

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 (3) Anaerobic digestion