SUNLIBB

Sustainable Liquid Biofuels from Biomass Biorefining

Grant Agreement no. 251132

Collaborative Project
EU 7th Framework Programme
ENERGY

Project duration: 1st October 2010 – 30th September 2014

Deliverable 7.6
"Pilot scale trials repeated using improved feedstock from WP4"

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Workpackage: **7**
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Due date: **March 2014 (Month 42)**
Actual date submitted: **September 2014**
Re-formatted version submitted: **December 2014**

Dissemination Level: **PU**

This project has received funding from the European Union's Seventh Programme for research, technological development and demonstration under grant agreement number 251132

Work progress and achievements during the period

SP Processum

Deliverable 7.6 and 7.7

Material with high and low digestibility and pre-treated with water was received from P1 and enzymatically hydrolysed and further fermented. The sugar yield from the enzymatic hydrolysation was low and the subsequent fermentation can only be seen as an indication of the fermentability of the material.

The study was performed at 50 liter pilot scale instead of the 4X10m^3 SEKABs due to requests from the other partners.

Due to the low sugar yield, further pre-treatment studies will be performed at SP Processum.

Enzymatic hydrolysis and fermentation of Maize and Miscanthus

Introduction

Enzymatic hydrolysis is used in combination with a pre-treatment method as a technique for sugar release from lignocellulosics. The pre-treated material used in this study was received from P1 University of York. The aim of this experiment was to investigate the potential to enzymatically hydrolyse maize stover and Miscanthus with high and low digestibility, and pre-treated with water.

Material and Method

Pre-treated samples

12 samples of pre-treated neutralized material were obtained from University of York. Analysis of dry weight and polysaccharide content were done prior to enzymatic hydrolysis. The samples were stored at -20°C in order to prevent microbial degradation.

Hydrolysis with enzymes

8 of the 12 samples were selected for enzymatic hydrolysis. 10% dry matter content was used in a total volume of approximately 30 litres. Agitation was set to 90 rpm, temperature to 55°C, pH was set to 5.2 with a solution of 65% H_2SO_4. The enzyme dosage was 10% based on dry weight of raw material. Time for enzymatic hydrolysis was approximately 24 h. Analyses of monosaccharides, polysaccharides and common inhibitory substances were carried out after enzymatic hydrolysis.

The material was thawed at 4°C and 3 kg (dw) was added to autoclaved water to a weight of 30 kg. pH, temperature and agitation were set prior to enzyme dosage. Prior to hydrolysation at pilot scale, shake flasks experiments were done in order to determine the enzyme dosage and hydrolysation time.

Fermentation

The slurry received after hydrolysis was subjected to fermentation without filtration. The fermentation organism was *Saccharomyces cerevisiae* Thermosacc. Temperature, pH and agitation were set to 30°C, 5.0 and 150 rpm. Fermentations were performed in shake flasks.

Discussion

Deliverable 7.6 and 7.7

The material used in deliverable 7.6 and 7.7 was produced to achieve low and high digestibility and pre-treated with autolysis (water). The sugar yield was somewhat higher than for the material in D 7.4 and 7.5 but still quite low (fig. 2). As in D 7.4 and 7.5, the xylan content prior to the enzymatic hydrolysis was rather high (fig. 1) which indicates a mild pre-treatment. The sugar yield makes it difficult to distinguish the different lines with respect to digestibility. The common fermentation inhibitors HMF or furfural were not detected after enzymatic hydrolysis.

As the sugar yield was very low, the subsequent fermentation can only be seen as an indication of the fermentability.

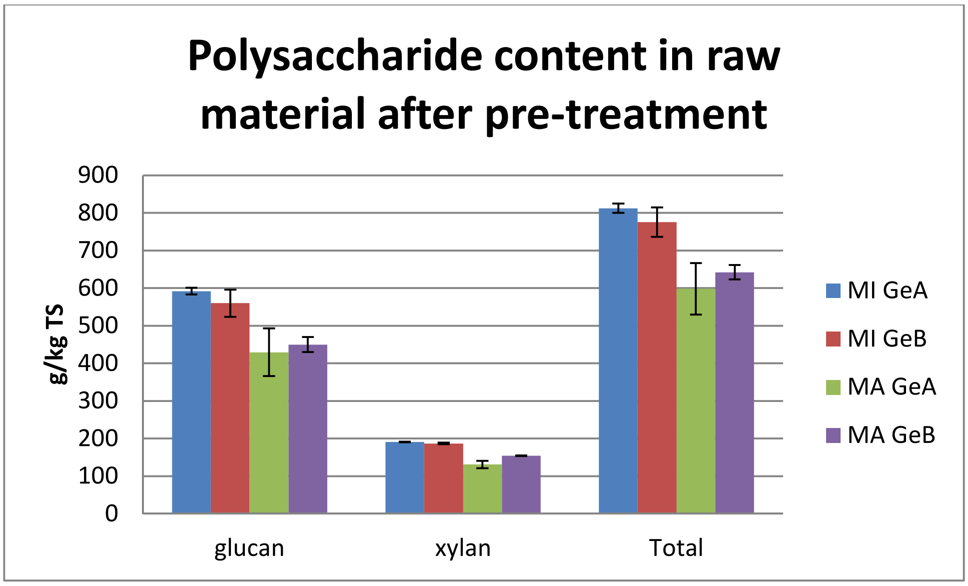

Fig. 1. Polysaccharide content in raw material after pre-treatment of material with high and low digestibility. Error bars indicate max/min values from two separate batches.

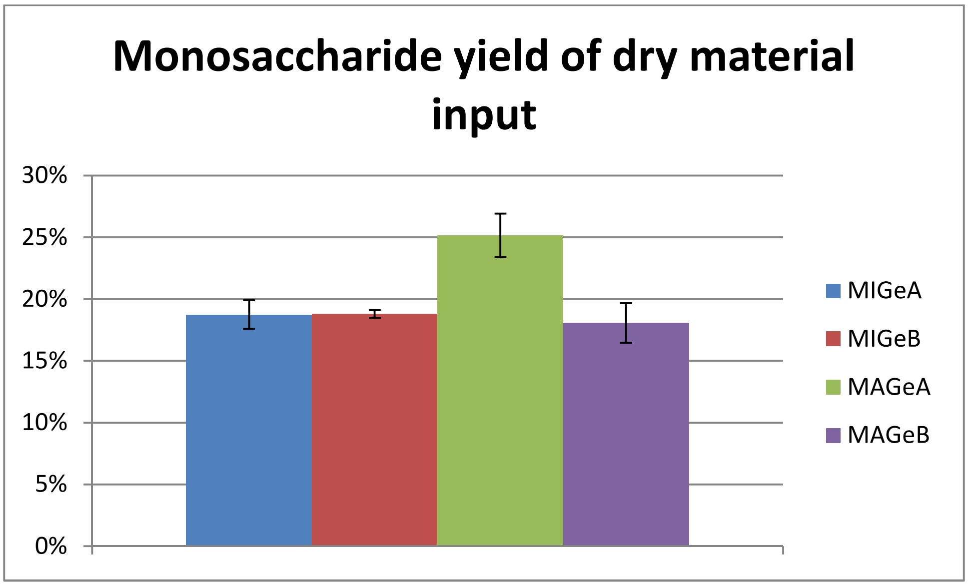

Fig. 2 Monosaccharide yield after enzymatic hydrolysation based on total dry weight prior to the enzymatic hydrolysis. Error bars indicate max/min values from two separate batches.

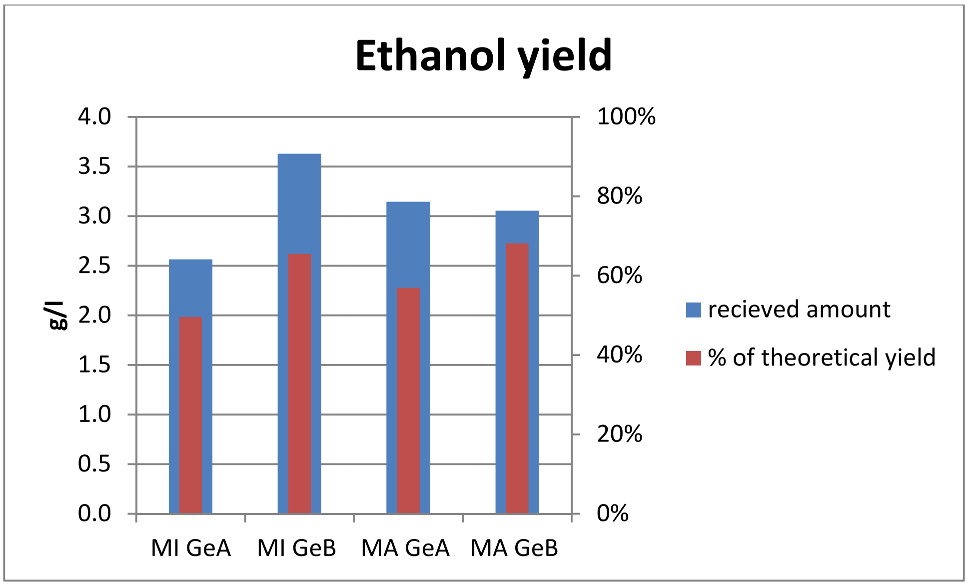

Fig. 3 Ethanol yield in concentration of ethanol (g/l) and % of theoretical yield.