

Ensiling of wheat straw decreases the required temperature in hydrothermal pretreatment - DTU Orbit (09/11/2017)

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BACKGROUND: Ensiling is a well-known method for preserving green biomasses through anaerobic production of organic acids by lactic acid bacteria. In this study, wheat straw is subjected to ensiling in combination with hydrothermal treatment as a combined pretreatment method, taking advantage of the produced organic acids. **RESULTS:** Ensiling for 4 weeks was accomplished in a vacuum bag system after addition of an inoculum of *Lactobacillus buchneri* and 7% w/w xylose to wheat straw biomass at 35% final dry matter. Both glucan and xylan were preserved, and the DM loss after ensiling was less than 0.5%. When comparing hydrothermally treated wheat straw (170, 180 and 190°C) with hydrothermally treated ensiled wheat straw (same temperatures), several positive effects of ensiling were revealed. Glucan was up-concentrated in the solid fraction and the solubilisation of hemicellulose was significantly increased. Subsequent enzymatic hydrolysis of the solid fractions showed that ensiling significantly improved the effect of pretreatment, especially at the lower temperatures of 170 and 180°C. The overall glucose yields after pretreatments of ensiled wheat straw were higher than for non-ensiled wheat straw hydrothermally treated at 190°C, namely 74-81% of the theoretical maximum glucose in the raw material, which was ~1.8 times better than the corresponding yields for the non-ensiled straw pretreated at 170 or 180°C. The highest overall conversion of combined glucose and xylose was achieved for ensiled wheat straw hydrothermally treated at 180°C, with overall glucose yield of 78% and overall conversion yield of xylose of 87%. **CONCLUSIONS:** Ensiling of wheat straw is shown to be an effective pre-step to hydrothermal treatment, and can give rise to a welcomed decrease of process temperature in hydrothermal treatments, thereby potentially having a positive effect on large scale pretreatment costs.

General information

State: Published

Organisations: Department of Chemical and Biochemical Engineering, Center for BioProcess Engineering

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Pages: 116

Publication date: 2013

Main Research Area: Technical/natural sciences

Publication information

Journal: Biotechnology for Biofuels

Volume: 6

Issue number: 1

ISSN (Print): 1754-6834

Ratings:

BFI (2017): BFI-level 2

Web of Science (2017): Indexed yes

BFI (2016): BFI-level 2

Scopus rating (2016): CiteScore 5.89 SJR 1.969 SNIP 1.65

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 2

Scopus rating (2015): SJR 2.409 SNIP 1.89 CiteScore 6.79

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 2

Scopus rating (2014): SJR 2.414 SNIP 1.722 CiteScore 5.86

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 2

Scopus rating (2013): SJR 2.17 SNIP 1.815 CiteScore 6.21

ISI indexed (2013): ISI indexed yes

Web of Science (2013): Indexed yes

BFI (2012): BFI-level 2

Scopus rating (2012): SJR 2.15 SNIP 1.849 CiteScore 5.7

ISI indexed (2012): ISI indexed yes

Web of Science (2012): Indexed yes

BFI (2011): BFI-level 1

Scopus rating (2011): SJR 2.249 SNIP 2.168 CiteScore 6.1

ISI indexed (2011): ISI indexed no

BFI (2010): BFI-level 1

Scopus rating (2010): SJR 1.774 SNIP 1.745

BFI (2009): BFI-level 1

Scopus rating (2009): SJR 1.317 SNIP 1.74

BFI (2008): BFI-level 2

Original language: English

Silage, Ensiling, Combined pretreatment, Hydrothermal treatment, Wheat straw, Enzymatic hydrolysis

Electronic versions:

1754_6834_6_116.pdf

DOIs:

10.1186/1754-6834-6-116

Source: dtu

Source-ID: n::oai:DTIC-ART:bmc/390930494::31402

Publication: Research - peer-review › Journal article – Annual report year: 2013