Fermentation of lignocellulosic hydrolysate by the alternative industrial ethanol yeast Dekkera bruxellensis - DTU Orbit (11/01/2019)

Fermentation of lignocellulosic hydrolysate by the alternative industrial ethanol yeast Dekkera bruxellensis

Aim: Testing the ability of the alternative ethanol production yeast Dekkera bruxellensis to produce ethanol from lignocellulose hydrolysate and comparing it to Saccharomyces cerevisiae. Methods and Results: Industrial isolates of D. bruxellensis and S. cerevisiae were cultivated in small-scale batch fermentations of enzymatically hydrolysed steam exploded aspen sawdust. Different dilutions of hydrolysate were tested. None of the yeasts grew in undiluted or 1 : 2 diluted hydrolysate [final glucose concentration always adjusted to 40 g l⁻¹ (0.22 mol l⁻¹)]. This was most likely due to the presence of inhibitors such as acetate or furfural. In 1 : 5 hydrolysate, S. cerevisiae grew, but not D. bruxellensis, and in 1 : 10 hydrolysate, both yeasts grew. An external vitamin source (e.g. yeast extract) was essential for growth of D. bruxellensis in this lignocellulosic hydrolysate and strongly stimulated S. cerevisiae growth and ethanol production. Ethanol yields of 0.42 ± 0.01 g ethanol (g glucose)⁻¹ were observed for both yeasts in 1 : 10 hydrolysate. In small-scale continuous cultures with cell recirculation, with a gradual increase in the hydrolysate concentration, D. bruxellensis was able to grow in 1 : 5 hydrolysate. In bioreactor experiments with cell recirculation, hydrolysate contents were increased up to 1 : 2 hydrolysate, without significant losses in ethanol yields for both yeasts and only slight differences in viable cell counts, indicating an ability of both yeasts to adapt to toxic compounds in the hydrolysate. Conclusions: Dekkera bruxellensis and S. cerevisiae have a similar potential to ferment lignocellulose hydrolysate to ethanol and to adapt to fermentation inhibitors in the hydrolysate. Significance and Impact of the study: This is the first study investigating the potential of D. bruxellensis to ferment lignocellulosic hydrolysate. Its high competitiveness in industrial fermentations makes D. bruxellensis an interesting alternative for ethanol production from those substrates.

General information

State: Published
Organisations: Swedish University of Agricultural Sciences, Norwegian University of Life Sciences
Number of pages: 6
Pages: 73-78
Publication date: 2011
Peer-reviewed: Yes

Publication information

Journal: Letters in Applied Microbiology
Volume: 53
Issue number: 1
ISSN (Print): 0266-8254
Ratings:
- Web of Science (2019): Indexed yes
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 1.81
- Web of Science (2017): Impact factor 1.471
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 1.82
- Web of Science (2016): Impact factor 1.575
- BFI (2015): BFI-level 1
- Scopus rating (2015): CiteScore 1.66
- Web of Science (2015): Impact factor 1.579
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): CiteScore 1.8
- Web of Science (2014): Impact factor 1.659
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): CiteScore 2.09
- Web of Science (2013): Impact factor 1.749
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes