

Lawrence Berkeley National Laboratory

Recent Work

Title

High Performance Polymers from Biomass:

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SUMMARY REPORT

Objective

The objective of this study was to demonstrate feasibility and scale-up of cellulosic feedstocks for the production of a commercial C₆ lactone. Visolis, Inc. has developed a fermentation platform for production of the lactone at high titers and yields. The lactone is used in high-end cosmetics industry and also serves as a valuable intermediate for production of biopolymers and biofuels. Strains employed by Visolis are capable of metabolizing both glucose and xylose, enabling full utilization of cellulosic hydrolysates as feedstock. Visolis and ABPDU conducted a 2L proof-of-concept fermentation campaign followed by a 50L scale-up campaign.

ABPDU Project Team: Eric Sundstrom, Stephen Hubbard, Qian He, Ning Sun, Fre Tachea, Deepti Tanjore, and Todd Pray

Pareto Project Team: Jianping Sun, Phil Barr

Deliverables

1. Cellulosic sugars for completion of 4x2L and 50L fermentation campaigns

Visolis staff members produced two batches of lignocellulosic sugars. The first one was obtained from Renmatix and was used for 2L fermentation campaign. For 50L fermentation, sugars were generated through dilute alkali pretreatment and saccharification of corn stover.

2. Completion of 4x2L campaign for proof of concept of MVL production using cellulosic sugars

Product titers reached 39g/L on glucose hydrolysate and 43g/L on xylose hydrolysate in 2L fermentations, with near-theoretical yields achieved during lactone production. The Renmatix process splits cellulosic hydrolysate into a glucose stream and xylose stream separately. This

data demonstrates clearly that high yields and titers can be achieved with both 5 and 6-carbon sugars.

3. Completion of 50L scale-up campaign for lactone production using cellulosic sugars

A 50L fermentation campaign was conducted with the corn stover hydrolysate. Product titers during this campaign reached similar but lower level than the 2L demonstrating feasibility of this process at pilot scale.. Productivity will increase with process optimization.

4. Delivery of fermentation broth from 50L campaign to Visolis, Inc for downstream processing

Fermentation broth from the 50L campaign was provided to Visolis.

Summary

Researchers at Visolis, Inc and the Advanced Biofuels Process Demonstration Unit (ABPDU) at Lawrence Berkeley National Lab have successfully demonstrated a system for biological production of a C₆ lactone from cellulosic sugars. Both glucose and xylose were readily converted to product at near-theoretical yield in 2L fed-batch fermentation. This process was then successfully demonstrated to 50L scale using alkali-pretreated corn stover hydrolysate as feed. These results demonstrate the feasibility of using cellulosic sugars at large scale under industrially relevant conditions.