Comparison of process alternatives for bioethanol production from milling industry by-product

Jovana Gucunski, Bojana Bajić, Vesna Vučurović, Damjan Vučurović, Đurđina Belić, Siniša Dodić
University of Novi Sad, Faculty of Technology Novi Sad, Department of Biotechnology and Pharmaceutical Engineering, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia

INTRODUCTION

By-products of the milling industry (shrunken and damaged wheat grains) with a significant amount of starch can be considered as a substrate for bioethanol production. There are several process alternatives for this, and each has specific advantages and disadvantages. Separated hydrolysis and fermentation (SHF) can ensure that enzymatic hydrolysis of starch (liquefaction and saccharification) and bioethanol fermentation are performed separately, under optimal conditions for each step. However, the overall process time is longer and the substrate inhibition of the production microorganism may occur. Simultaneous saccharification and fermentation (SSF) takes less time and utilizes less energy compared to SHF. Still, it is challenging to optimize SSF, considering that optimal conditions need to be achieved for the saccharification enzyme and fermenting yeast. In simultaneous liquefaction and saccharification and separated fermentation (SLSaF) the main goal is to decompose starch molecules in a one-step hydrolysis process. The disadvantage of this process can be the substrate inhibition due to the high concentration of glucose.

OBJECTIVES

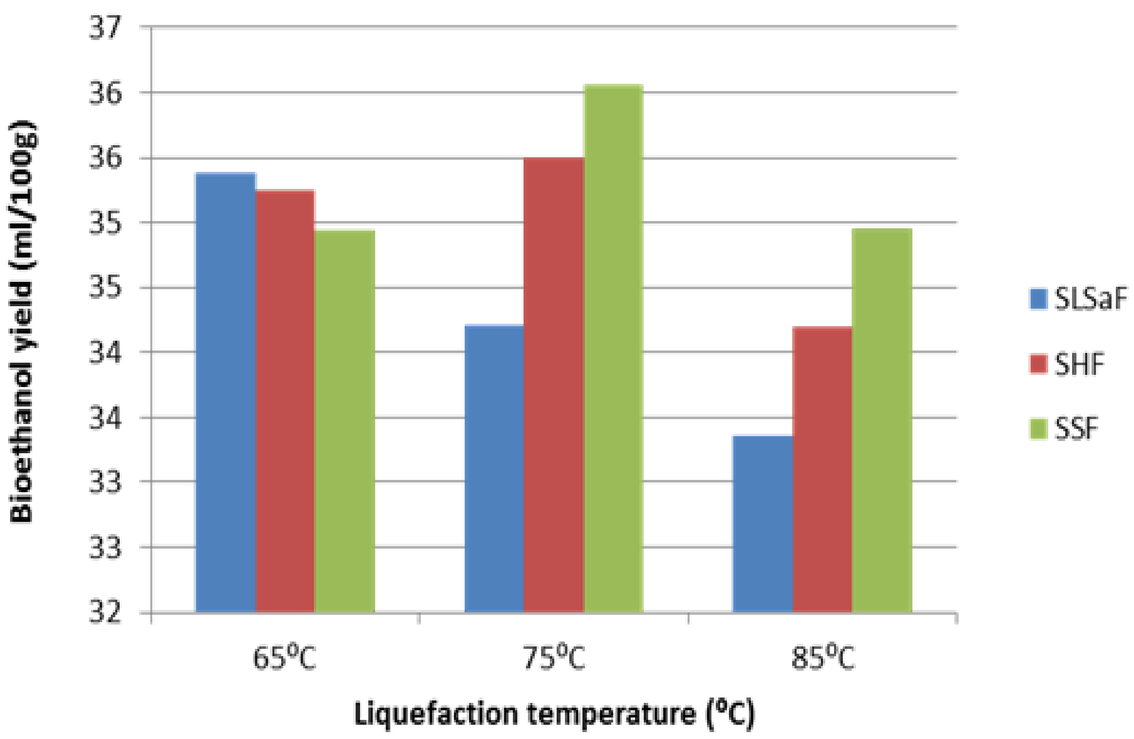
This study aimed to compare three different process alternatives, SHF, SSF and, SLSaF for bioethanol production from milling industry by-product, using commercial enzymes and yeast *Saccharomyces cerevisiae*.

Additionally, the influence of different liquefaction temperatures (65°C, 75°C, 85°C) on bioethanol production were investigated.

METHOD / DESIGN

RESULTS

Comparison of bioethanol yield from SHF, SSF and SLSaF process alternatives at different liquefaction temperatures (65°C, 75°C, 85°C)



Raw material utilization:

- SLSaF - 50.97 g/100g (65°C),
- SHF - 51.15 g/100g (75°C,),
- SSF - 51.95 g/100g (75°C).

Starch utilization:

- SLSaF - 93.94%,
- SHF - 94.26%,
- SSF - 95.73%.

CONCLUSIONS

The SSF process alternative was considered superior compared to SLSaF and SHF, due to the higher bioethanol yield and raw material utilization. Further research will focus on the optimization of simultaneous saccharification and fermentation bioethanol production process from the milling industry by-product.

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Jovana Gucunski
jgucunski@uns.ac.rs