Direct bioconversion of brewers' spent grain to ethanol

Authors: Charilaos Xiros and Paul Christakopoulos

Address: Biotechnology Laboratory

Department of Product and Process Development

School of Chemical Engineering
National Technical University of Athens

Iroon Polytechniou 5, 15780 ATHENS, GREECE

chaxiros@ntua.central.ntua.gr

Ethanol production from brewers' spent grain by F. oxysporum

Brewers' spent grain (BG) is a low-value co-product of the brewing process.

BG is rich in cellulose (17%) and non-cellulolosic polysaccharides (mainly arabinoxylans) (39%)

Fusarium oxysporum **have been reported to acquire the ability of fermenting cellulose and hemicellulose directly to ethanol**

F. oxysporum **is used as the fermentation organism, it is not necessary to perform a separate enzymic hydrolysis of the lignocellulosic raw material, as this microorganism can produce the necessary enzymes**

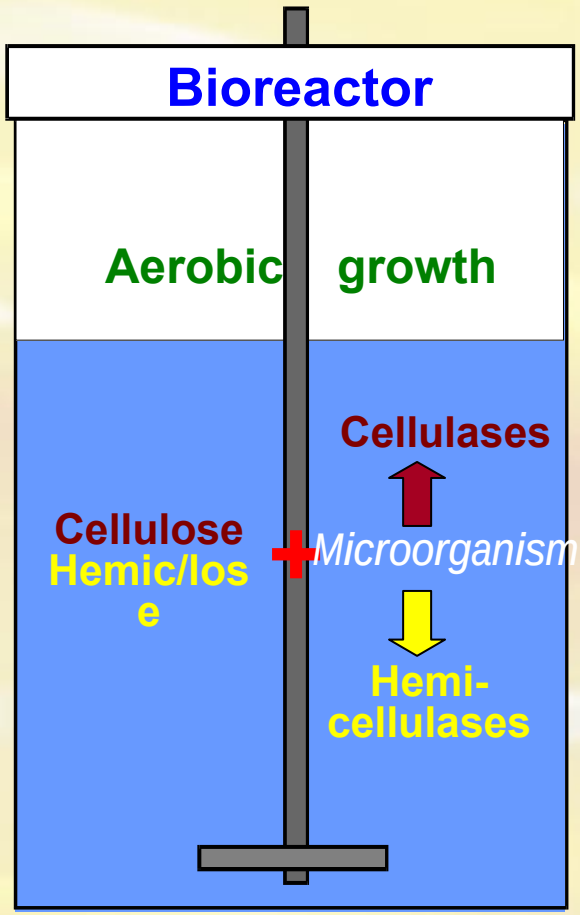
The production of cellulose and hemicellulose degrading enzymes was studied in several conditions

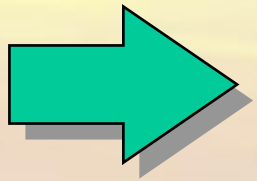
Enzyme Microbial Technology, 11, 236-239, 1989

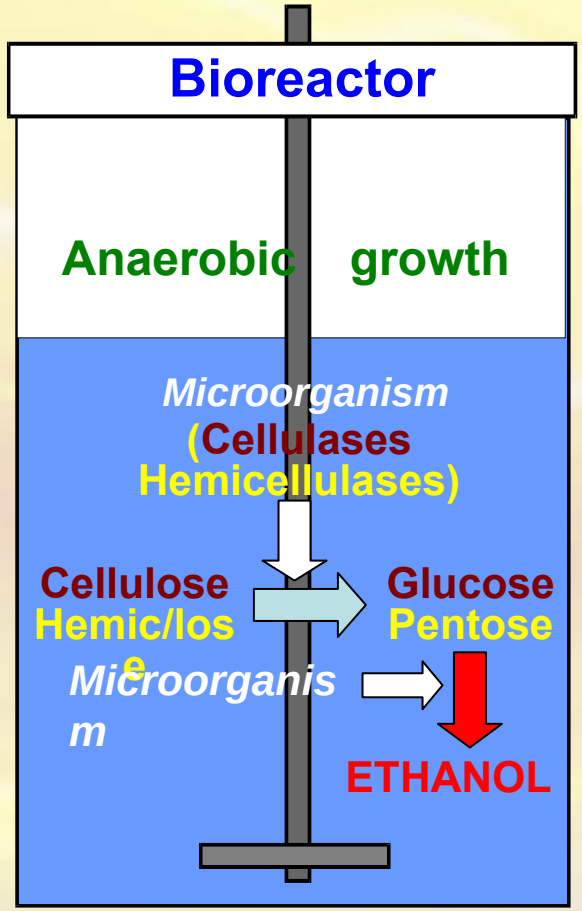
Enzyme Microbial Technology, 36, 693-699, 2005

F. oxysporum Consolidated System

Lignocellulosic materials → Pretreatment → Ethanol fermentation







Studied factors affecting bioethanol production

- **Production of cellulolytic and hemicellulolytic enzymes**
- **pH**
- **Aeration level**
- **A mixed substrate (corn cob - spent grain) and four days of aerobic growth found to be the optimum for the enzyme production**
- **Achieved activities for the degrading enzymes:**

  The mixed substrate in the ratio 1:1 was found to give the optimum activities: 133.3 U/mL for xylanase, 22.47 U/mL for endoglucanase, 0.47 U/mL for β-glucosidase, 0.064 U/mL for xylosidase, 0.159 U/mL for arabinofuranosidase, 1.03 U/mL for exoglucanase and 0.014 U/mL for feruloyl esterase
- **Ethanol production was carried out in 6% of spent grain**