Fermentation processes implementation for improving bioethanol production from agricultural food waste

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Abstract

Statement of the Problem: There is increasing interest in the valorization of the wastes generated by the food industry, also as a consequence of the new developments in process engineering and the resulting byproducts. Agricultural food wastes are mainly composed of sugars, fibers, proteins, and minerals, all compounds of potential industrial interest. Due to the large availability and richness in components of these raw materials, a great interest was focused on their reuse, both from an economical and environmental points of view (1-4). The aim of this study was to bioconvert these waste into biethanol.

Methodology & Theoretical Orientation: Three different fermentation processes were used to obtain bioethanol from agricultural food waste by *Saccharomyces cerevisiae*: direct fermentation (DF) followed by enzyme addition; separate hydrolysis and fermentation (SHF); simultaneous saccharification and fermentation (SSF). Moreover, since ethanol production is dependent on glucose concentration but also on specific nutrients, such as trace elements, vitamins and nitrogen often poor in agricultural waste, the fermentation media were supplemented according with Tropea et al. 2016 (5).

Findings: The main sugars, calculated on initial dry biomass revealed that the fermentation medium was primarily composed of celluloses, pectic substances and hemicelluloses. DF gave rise to an EY of 0.07%, due to soluble glucose utilization by yeast. After enzyme addition to the medium, the fiber started to be digested and the ethanol yield rose to 3.4%, corresponding to a 86% of TY. Tests carried out in SHF and SSF gave rise to 3.7% and 3.9% of EY, corresponding to 89% and 96% of TY respectively, calculated on a dry matter basis.

Conclusion & Significance: The significant amount of carbohydrate-rich materials disposed of in agricultural foodwaste makes this substrate an interesting source for ethanol production by *S. cerevisiae* with particular focus on fermentation carried out in SSF mode.

Image

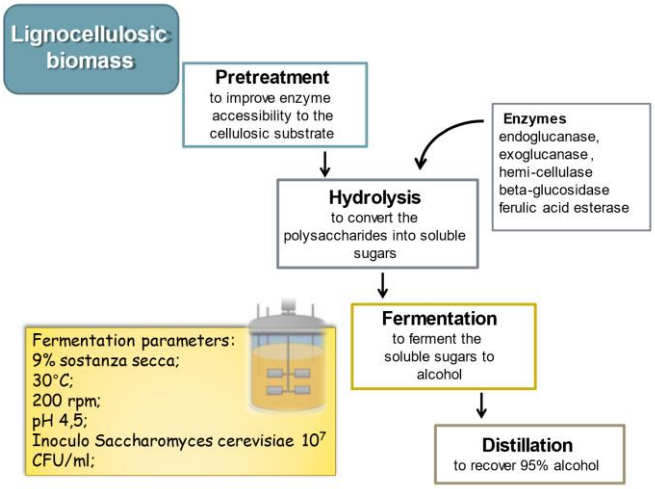


Figure 1. Bioethanol production flowchart and fermentation parameters.

Recent Publications

1 Ferracane A, Tropea A, Salafia F (2021) Production and Maturation of Soaps with Non-Edible Fermented Olive Oil and Comparison with Classic Olive Oil Soaps. Fermentation *7* (4):245; https://doi.org/10.3390/fermentation7040245

2 Goula AM, Lazarides HN (2015) Integrated processes can turn industrial food waste into valuable food by-products and/or ingredients: the cases of olive mill and pomegranate wastes. J. Food Eng. 167:45-50

3 Tropea A, Potortì AG, Lo Turco V, Russo E, Vadalà R, Rando R, Di Bella G (2021) Aquafeed Production from Fermented Fish Waste and Lemon Peel. Fermentation *7*(4):272; https://doi.org/10.3390/fermentation7040272

4 Tropea A, Wilson D, Lo Curto RB, Dugo G, Saugman P, Troy-Davies P, Waldron KW (2015) Simultaneous saccharification and fermentation of lignocellulosic waste material for second generation ethanol production. Journal of Biological Research (Italy) 88 (1):142 - 143

5 Tropea A, Wilson D, Cicero N, Potortì AG, L. La Torre G, Dugo G, Richardson D, Waldron KW (2016) Development of minimal fermentation media supplementation for ethanol production using two Saccharomyces cerevisiae strains. Natural Product Research, 30(9):1009-1016, DOI: 10.1080/14786419.2015.1095748).



Biography

Alessia Tropea has her expertise in fermentation processes for food waste valorization, for obtaining value added products, and in food microbiology. She has got her PhD in Chemistry Sciences: Doctor Europaeus thesis "SECOND ENERATION BIOETHANOL FROM AGRO-FOOD WASTES - Cell wall sugar fermentation by Saccharomyces cerevisiae". She has years of experience in research, evaluation and teaching in education institutions. She is Special Guest Editor, Topic Collection Editor and Topical Advisory Panel Member of Fermentation Journal. Moreover, she has been reviewer for several international journals.

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