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Fungal cellulases production by solid-state fermentation: Scale-up of packed-bed bioreactors

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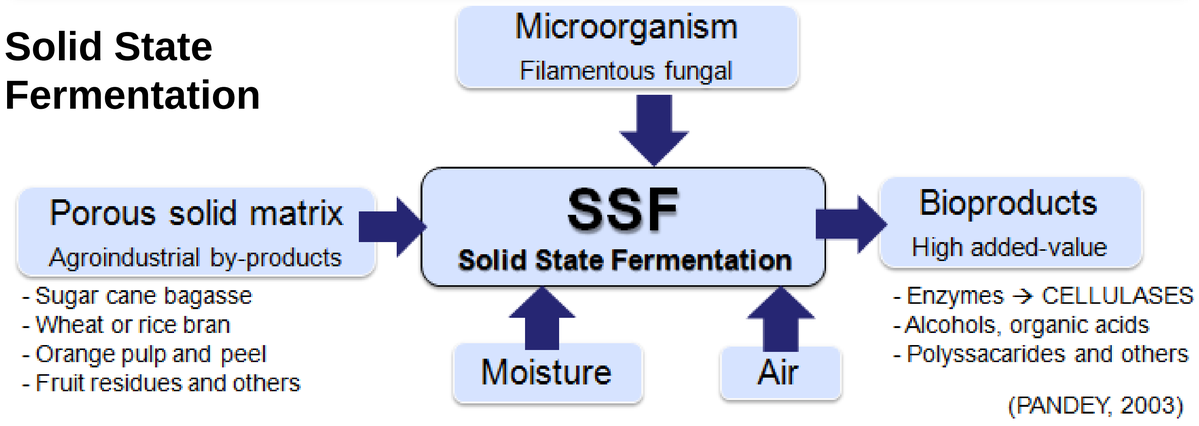
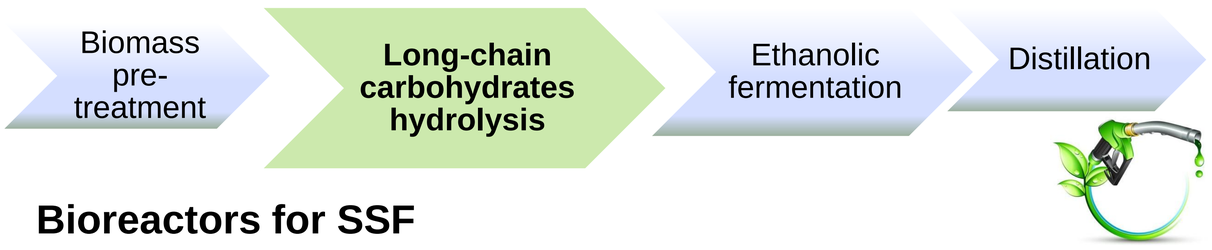
INTRODUCTION

Solid State Fermentation



Bioethanol production



Bioreactors for SSF

	No mixing	Continuous mixing / High shear stress
No forced aeration	Tray chamber; Spores and koji production	Rotating drum; Stirred drum
Forced aeration (air blown forcefully through the bed)	Packed-bed; Enzymes production by filamentous fungi	Fluidized bed; Stirred bed; Rocking drum

(extracted and adapted from Mitchell; Krieger; Berovic, 2006)

MATERIALS AND METHODS

Substrates

Sugar cane bagasse (SCB)
Wheat bran (WB)
SCB:WB 7:3 (w/w)

Fungi

Myceliophthora thermophila I-1D3b

Packed-bed bioreactor (PBB)

L = 1 m; D = 76.2 mm

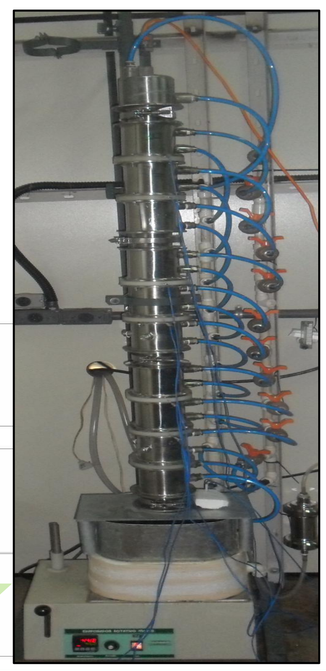
Substrate preparation and inoculation
Substrate is weighted, autoclaved and inoculated with fungal spores and moisturized with salt solution

Packing
Inoculated substrate is packed in the bioreactor

Fermentation
Airflow through the bed and waterflow through the jacket are open
M. thermophila → 4 days 45 ºC

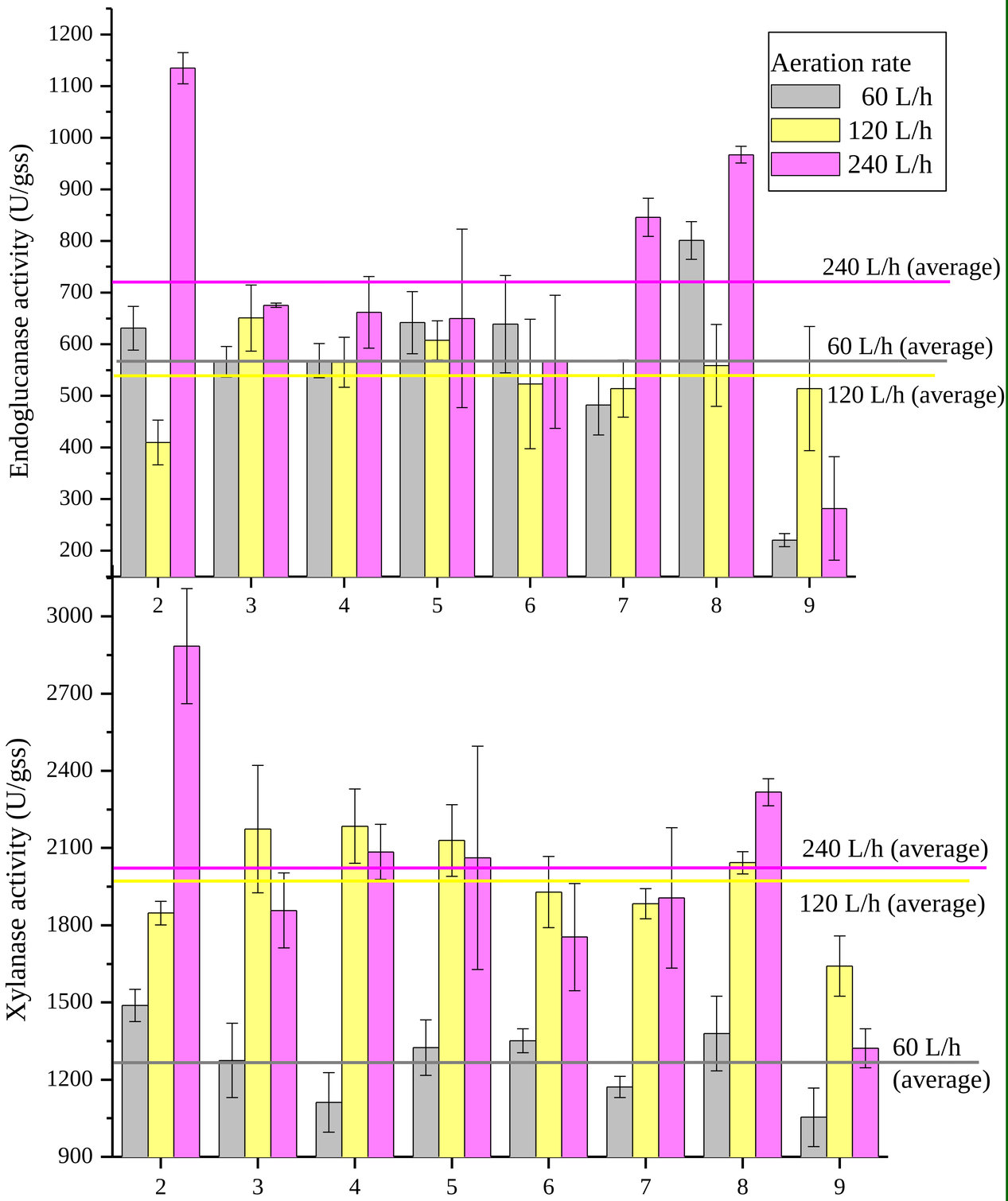
Extraction
Enzymes are extracted from the ermented material iwith distilled water (20 mL / g)

Enzyme activities
Enzyme activities are determined according to Ghose (1987)



RESULTS

Cellullolytic enzymes activities (U/gss = Unit per gram of solid substrate)



FINAL CONSIDERATIONS

➢ In the SSF fermentations with *M. thermophila* performed in the narrow and 1 m long PBB developed in the current work, the increase of temperature with both time of fermentation and axial position has been always less than 3 ºC above the process temperature.

➢ The thermal control within the PBB is assumed to be the result of a good combination between microrganism (thermophilic fungus), substrate (high porosity), operational conditions (enough airflow rate) and equipment dimensions (narrow diameter with a jacket).

➢ The aeration rate showed to influence significantly the endoglucanases and xylanases yields; anyway, enzyme activities have been high for all the experiments, suggesting a promising application of this SSF system for supplying cellullases for the bioethanol production chain.

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