INFLUENCE OF ACETIC ACID AND FURFURAL ON ETHANOL PRODUCTION BY *Saccharomyces cerevisiae* ATCC 4126

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Introduction. The production of ethanol from lignocellulosic materials is a research and development subject that nowadays is being studied intensively. This second generation ethanol, before the fermentation step, requires a pretreatment of the raw material in order to depolymerize the cellulose and hemicelluloses molecules, liberating the fermentable sugars. Most of the pretreatments generate molecules that interfere with the cells activity affecting directly the production of ethanol.
The objective of this work was to quantify the impact of two common inhibitors produced during pretreatment of lignocellusic material, such as acetic acid and furfural, on the production of ethanol by *S. cerevisiae* ATCC 4126.

Methods. The cells were cultivated in 250 mL shake flasks containing 80% volume of defined culture medium having 100 g/L of glucose and enriched with 9 g/L of yeast extract. Culture conditions were 30°C, initial pH of 5.5 and shaking at 100 rpm. Furfural was assayed at levels of 0, 0.8, 1.6 and 2.4 g/L. Acetic acid was evaluated at 0, 4, 6 and 8 g/L. The levels of both inhibitors are in the range of those found in the pretreated of eucalyptus wood.
Biomass was measured in spectrophotometer at 620 nm and converted to dry weight using a calibration curve. Ethanol, glucose and acetic acid were determined using HPLC-IR and furfural using HPLC-UV.

Results. The furfural concentrations tested in this work did not affect the alcoholic fermentation as can be observed in the kinetic parameters shown in Fig. 1 and Table 1, The values are close to those of the control experiment, with the exception of 0.8 g/L of furfural.

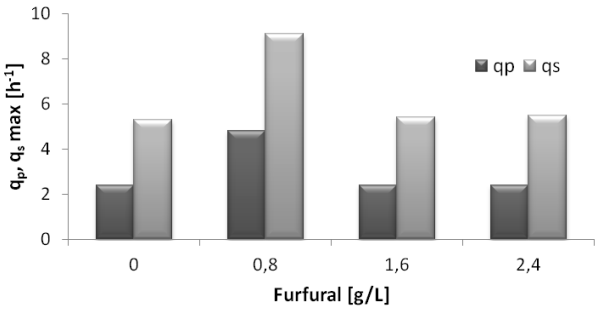

Fig.1 Maximum specific consumption and production rates obtained during ethanol fermentation in the presence of different levels of furfural.

Acetic acid did affect the cell activity. Maximum specific consumption and production rates of glucose and ethanol increased slightly as acetic acid did in the broth (see Fig. 2). However cells could not stand 8 g/L, reducing considerably their fermentation capacity. The effect on volumetric productivity was more notorious as can be seen in Table 2, where is shown that this parameter decreased by 63.9 %, with respect the control experiment, when acetic acid concentration was 6 g/L.

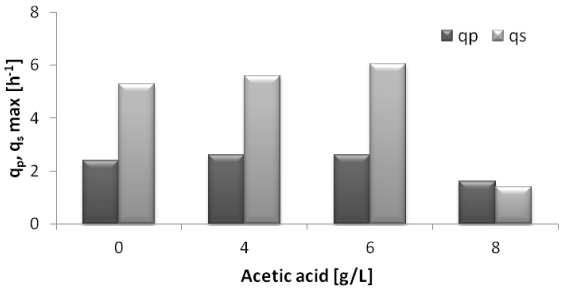

Fig.2 Maximum specific consumption and production rates obtained during ethanol fermentation in the presence of different levels of acetic acid..

Table 1. Kinetic parameters of ethanol fermentation in the presence of different amounts of furfural.

	0 g/L	0.8 g/L	1.6 g/L	2.4 g/L
g cel / g glu	0.1	0.06	0.06	0.05
g et / g glu	0.48	0.48	0.48	0.46
g et / L • h	3.6	3.7	3.18	2.94
g et / L (max.)	46	44	45	43

Table 2. Kinetic parameters of ethanol fermentation in the presence of different amounts of acetic acid.

	0 g/L	4 g/L	6 g/L	8 g/L
g cel / g glu	0.1	0.06	0.04	0.04
g et / g glu	0.48	0.47	0.45	0.45
g et / L • h	3.6	3.04	1.3	0.6
g et / L (max.)	46	45	45	43

Conclusions. The furfural concentrations tested in this work affected neither the specific nor volumetric production rate of the ethanol fermentation. In turns, acetic acid affected cell behavior, impacting more the volumetric productivity than the specific one.

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