



HYDROLYSIS OF CORNCOBBS AND FERMENTATION OF SUGAR MIXTURES TO ETHANOL USING ETHANOLOGENIC *ESCHERICHIA COLI*

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Introduction. Corncobs are a potential source of fermentable sugars, but few studies had been performed with this lignocellulosic material. Furthermore, a sequential physicochemical treatment (at moderate temperatures) and enzymatic hydrolysis of the hemicellulosic and cellulosic fractions could produce syrups with low concentration of the toxic compounds furans⁽¹⁾ (F: furfural and HMF: Hydroxyl-Methyl-F) and a syrup with a mixture of hexoses (C6) and pentoses (C5). Since homo-ethanologenic yeasts are unable to ferment pentoses a metabolic engineered homo-ethanologenic strain of *Escherichia coli* was used in this work⁽²⁾.

The purpose of this work was to produce ethanol from a mixture of C6 and C5 sugars obtained from the sequential thermochemical and enzymatic hydrolysis of corncobs.

Methods. Dry and milled corncobs (in %: 38.2 cellulose, 32.5 hemicellulose, 22.2 lignin, 4.9 extractives and 2.2 ash) were thermochemically pretreated with diluted H₂SO₄ (1.5%, 118°C, solid to liquid ratio of 1:5.7 during 30 min). The pH of whole slurry was adjusted to 4.8 and the cellulosic fraction was hydrolysed using commercial cellulases (Accellerase 1500 and XY; Genencor Inc.⁽³⁾). The resulting syrup, that contained a mixture of C5 and C6 sugars, was supplemented with nutrients⁽²⁾ and the pH was adjusted to 7.0 to be fermented with the ethanologenic *E. coli* strain MS04⁽²⁾ (200-mL minifermentors, 100 rpm, 37 °C). The concentrations of sugars and ethanol were measured using an enzymatic analyzer and Gas Chromatography, respectively.

Results. The pretreatment conditions used in this work generated slurries rich in C5 sugars, with low amounts of Furfural and no HMF (Table 1). The enzymatic treatment enables increasing the amount of released glucose, but without further increment in the furans concentration. Fig. 1 depicts substrate and ethanol concentrations for the fermentation of main sugars present in the syrups obtained from the sequential thermochemical and enzymatic hydrolysis of corncobs. *E. coli* MS04 simultaneously consumes glucose and xylose, producing 35 g/L of ethanol in least than 24 h.

Table 1. Composition of slurries obtained from the sequential pretreatment and enzymatic hydrolysis of corncobs.

Component	(A) (g/L)	(B) (g/L)
Glucose	3.29	40.90
Xylose	25.47	38.21
Arabinose	6.84	6.84
HMF	0.00	0.00
Furfural	1.26	0.25
Acetic acid	6.41	3.73
Lignin	23.88	28.89

(A) Pretreated corncobs. (B) Pretreated and enzymatic hydrolysed corncobs

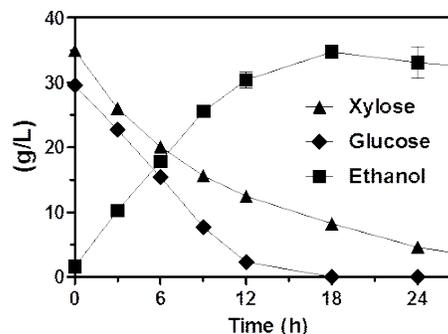


Fig.1 Fermentation kinetics of syrups from hydrolysed corncobs with the ethanologenic *E. coli* strain MS04

Conclusions. No significant amounts of inhibitors (5HMF and furfural) for microbial growth were produced under the pretreatment and enzymatic hydrolysis conditions used in this work.

The ethanologenic *E. coli* strain MS04 consumes C5 and C6 sugars producing ethanol with a yield close to the maximum theoretical.

References.

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