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RECOVERY OF PHENOLIC COMPOUNDS BY SOLID-STATE FERMENTATION FROM GRAPE POMACE AND WHEAT BRAN

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ABSTRACT

The grape pomace and wheat bran is rich in bioactive compounds that may be conjugated to the plant cell wall, making it difficult to recover. The objective of this study was to produce an enzymatic complex concomitant to the release of phenolics from grape pomace and wheat bran, by solid-state fermentation (SSF), using the mutant strain Aspergillus niger 3T5B8. Both substrates showed potential for the production of hydrolytic enzymes, mainly for xylanase and β-glucosidase enzymes with grape pomace and wheat bran, respectively. In addition, SSF showed a more than 50% increase in the phenolic release of the substrates.

1. INTRODUCTION

Many researchers have searched for alternatives to add value to grape pomace due to the presence of bioactive compounds with high antioxidant potential in this winemaking residue (Barba et al., 2016). However, recovery of these compounds may be hindered by their binding to the cell wall of the grape pomace, requiring the hydrolysis of the polysaccharides from the cell wall for their release (Xu et al., 2014). In this sense, the present study aimed at the production of an enzyme complex containing xylanase, cellulase, β-glucosidase and polygalacturonase using grape pomace and wheat bran using solid-state fermentation for hydrolysis and release of phenolic compounds.

2. MATERIAL AND METHODS

2.1. Enzyme Production

Enzyme production was evaluated over time (24, 48, 72 and 96 hours) of SSF using two substrates: mixed grape pomace and wheat bran (1:1) and only wheat bran. The fermentation agent was the filamentous fungi mutant strain *Aspergillus niger* 3T5B8.

2.2. Determination of enzymatic activities

The activities of the enzymes xylanase, polygalacturonase, CMCase, β-glucosidase and protease, were determined according to the methodologies proposed by Couri et al. (2000) and Couri & Farias (1995), respectively.

2.3 Phenolic compounds determination

Total phenolic compounds content was measured by spectrophotometric method proposed by Singleton and Rossi (1965) and modified by Georgé et al. (2005).

3. RESULTS AND DISCUSSION

3.1. Comparison of substrates for the production of hydrolytic enzymes

The mixed substrate and the wheat bran presented differences in the enzyme production profile. While the mixed medium favored synthesis of β-glucosidase and polygalacturonase (44.86 U/ml and 23.03 U/ml, respectively) at 96 hours, wheat bran medium had the highest activity for xylanase (56.57 U/ml) in 48 hours, followed by β-glucosidase activity (41.52 U/ml) in 96 hours (Figure 1).

The activity of xylanase in wheat bran was superior to that found by Paredes et al. (2015) (46 U/ml) with *A. awamori* in sugarcane bagasse. Wheat bran showed higher activity than the mixed medium for all enzymes, except β-glucosidase. The peak of β-glucosidase activity in grape pomace in 96 hours is in agreement with the one found by Rodrigues et al. (2017), during the SSF of sugarcane bagasse with *A. fumigatus*. These results are promising since the hydrolysis of lignocellulosic matter requires multiple enzymatic activities including the activity of the enzymes xylanase and β-glucosidase.

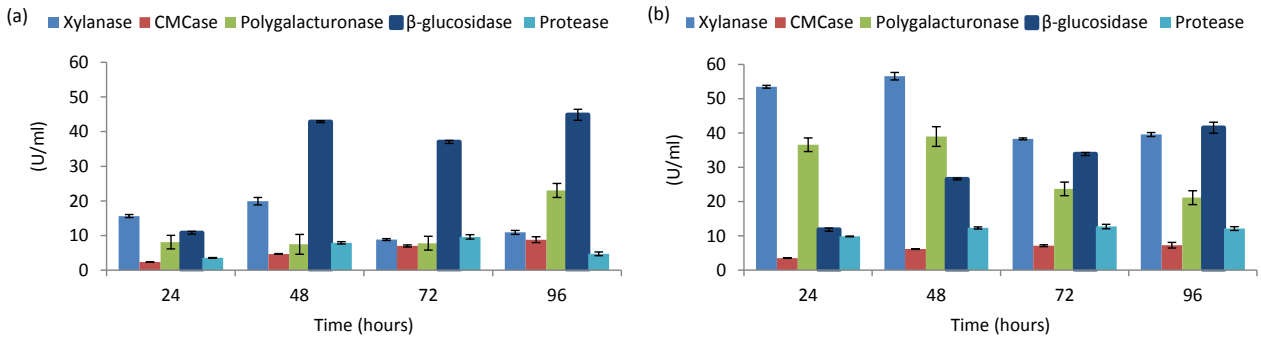

Figure 1. Kinetics of enzyme production in mixed medium (a) and wheat bran (b) with A. niger 3T5B8. Each value represents mean ± standard deviation.

3.2. Release of bioactive compounds by FES

The release of phenolic compounds into the substrate during SSF is shown in Figure 2. The content of phenolic compounds increased significantly by more than 50% by SSF, demonstrating their efficiency for the release of these compounds. The fermented mixed substrate (FMS) showed higher total phenolic concentrations compared to fermented wheat bran (FWB).

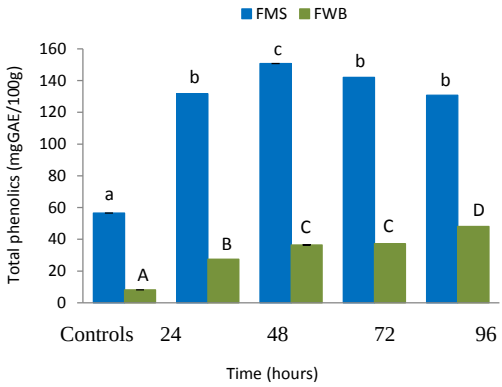

Figure 2. Effect of time on the release of total phenolics from the FMS and FWB and controls (MS and WB). Bars with different letters indicate significant differences for the phenolic release at the fermentation time (p <0.05).

The maximum phenolic release was detected at 48 hours and 96 hours, on FMS and FWB, respectively. These differences may be related to the different contents of phenolic compounds characteristic of both substrates. In addition, the enzymatic complex produced during FMS and FWB was different. SSF has been successfully used as an important step to optimize the extraction to obtain bioactive compounds using several raw materials (Dey & Kuhad, 2014). These results demonstrate the contribution of grape pomace and wheat bran to the production of enzymes with potential use for the release of phenolic compounds that are bound to the cell wall of the substrates used.

4. REFERENCES

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