Enhancement of Enzymatic Digestibility of Sugarcane Biomass Using Feruloyl Esterase

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Introduction: Ferulic acid residues (FA) covalently linked to hemicelluloses may polymerize with the lignin and other ferulic acid residues interconnecting polymers. Such cross-linkages hinder the attack of hydrolases reducing the saccharification efficiency. Feruloyl esterases may be used to potentiate the action of these enzymes. It acts synergistically with xylanases removing the links between FA esterified to arabinoxylans, improving the efficiency of cell wall digestibility.

Material and Methods: Feruloil esterase (AcFAE) from Aspergillus clavatus was expressed in Escherichia coli BL21 vector pET-28a. The bioactive proteins were recovered from inclusion bodies and purified by size exclusion chromatography. Soluble sugars-free bagasse of sugarcane was incubated in sodium phosphate buffer 100 mM, pH 6.4, AcFAE 0.04 mg.ml⁻¹ and xylanase 125 U.g⁻¹ (Novozyme) at 30° C. After 24 h, supernatant was analyzed and FA esterified to cell wall was extracted with sodium hydroxide. Content of FA was analyzed by HPLC and total reducing sugars (RS) was determined by 3,5-dinitrosalicylic acid method. Data were submitted to Student-t test (Microsoft Office Excel). Results and Discussion: Treating bagasse with AcFAE alone released 110,19±9,46 nmol of FA g⁻¹ of bagasse while combined application of AcFAE and xylanase released 569,08±29,96 nmol of FA g⁻¹ of bagasse (n=6, p=6.89E-6), about 5 times more. We also observed the increased production of RS when comparing the action of xylanase alone (5.77±1.04 mg g⁻¹ of bagasse) and xylanase plus AcFAE (11.31±0.41 mg of FA g⁻¹ of bagasse; n=6, p=9.51E-4). The amount of FA extracted by alkali after treatments with AcFAE plus xylanase or AcFAE differed not (7.29±0.42 and 6.21±0.57 mg of FA g⁻¹ of bagasse n=5, p=0.37, respectively). Conclusions: The application of AcFAE from A. clavatus was effective in FA release from sugarcane bagasse and its concomitant application with xylanase showed synergy with both the release of FA as in the production of RS.

Palavra chave: Ferulic acid, feruloylated oligosaccharide
Patrocínio: CNPq