

ORIGINAL PAPER

Production and application of amylases of *Rhizopus oryzae* and *Rhizopus microsporus* var. *oligosporus* from industrial waste in acquisition of glucose

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Amylases from *Rhizopus oryzae* and *Rhizopus microsporus* var. *oligosporus* were obtained using agro-industrial wastes as substrates in submerged batch cultures. The enzymatic complex was partially characterised for use in the production of glucose syrup. Type II wheat flour proved better than cassava bagasse as sole carbon source for amylase production. The optimum fermentation condition for both microorganisms was 96 hours at 30 °C and the amylase thus produced was used for starch hydrolysis. The product of the enzymatic hydrolysis indicated that the enzyme obtained was glucoamylase, only glucose as final product was attained for both microorganisms. *R. oligosporus* was of greater interest than *R. oryzae* for amylase production, taking into account enzyme activity, cultivation time, thermal stability and pH range. Glucose syrup was produced using concentrated enzyme and 100 g L⁻¹ starch in a 4 hours reaction at 50 °C. The bioprocess studied can contribute to fungus glucoamylase production and application.

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Introduction

Amylases represent an important enzymatic class with several biotechnological and industrial applications. The class currently accounts for approximately 25 % of the world market (Kumar et al., 2012). The group is significant due to its extensive area of application in the food, chemical, and pharmaceutical industries, in breweries and distilleries, and for detergent, paper, textiles, and medicinal purposes (Mitidieri et al., 2006; Pandey et al., 2000; van der Maarel et al., 2002). Amylases are a variety of enzymes which act

synergistically to hydrolyse starch into glucose (Castro et al., 2010). They mainly refer to α -amylases, β -amylases and glucoamylases and are classified according to their point of action (Pandey et al., 2000).

Glucoamylases (EC 3.2.1.3) hydrolyse α -1,4 and α -1,6 linkages from the non-reducing ends of amylose and amylopectin, which are components of the starch, and produce glucose as the sole end-product (Anto et al., 2006; Norouzzian et al., 2006). Glucoamylases are industrially important biocatalysts, with extensive use in the manufacture of crystalline glucose or glucose syrup either as soluble or immobilised enzymes

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