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Pectinolytic Cocktail: Induced Yield and its Exploitation for Lignocellulosic Materials Saccharification and Fruit Juice Clarification

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Abstract

Bio-based natural macromolecules are primarily composed of complex polysaccharides that strengthen microbial growth for the production of industrially relevant enzymes. In this study, an initial range of natural materials was used as fungal growth and solid substrates for the support of enzyme production. After the stipulated fermentation time (72 h), a large quantity of pectinolytic cocktail complex, composed of polygalacturonase (PG), pectin lyase (PL), and pectin methylesterase (PME), was obtained. Following the initial solid substrate screening, the effects of the different parameters were optimized through response surface methodology (RSM) by adopting a central composite design (CCD) using the best-yielded material. The crude pectinolytic cocktail complex showed commendable results in the de-bittering of the investigated fruit juices. A considerable color and turbidity reduction from 100% to 45.0% and 32.5%, respectively, was recorded for apple juice. For orange juice, the color and turbidity significantly decreased by up to 38.2% and 31.6%, respectively. In conclusion, the maximum production of the pectinolytic cocktail complex in the presence of a cheaper substrate at a low concentration makes the enzyme useful for industrial sectors, especially in the juice industry.

Keywords: Aspergillus niger; Lignocellulosic materials; Pectinolytic; Enzyme consortium; Applications

1. Introduction

The pectic material is a generic name used for glycosidic macromolecules that are complex, acidic, negatively charged, and high in molecular weight. Moreover, pectin-based polysaccharides are a group of complex colloidal polymeric materials (Burton *et al.* 2005). There are numerous naturally occurring complex polysaccharides in most plant material, including cellulose, hemicellulose, and pectin. The basic structural unit of pectin is D-galacturonic acid. A wider spectrum of pectin-based substances has different molecular weights. For example, apple and lemon pectins have molecular weights in the range of approximately 200 to 360 kDa. In contrast, orange-based pectin has a comparatively low molecular weight, approximately 40 to 50 kDa (Irshad *et al*. 2014). Pectin forms cohesive layers between young plant tissues and gives structural integrity (Alkorta *et al*. 1998).

Pectinolytic materials have considerable potentialities for broader industrial and biotechnological applications. Overall yield enhancement of the products of interest, detailed understanding of the entire fermentation processes, and various recovery