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Short Communication

An optimized industrial fermentation processes for acarbose production by *Actinoplanes* sp. A56

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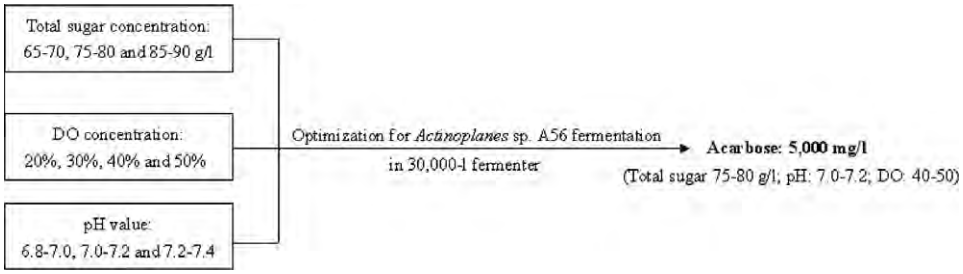
HIGHLIGHTS

- Reported literatures of acarbose fermentation mainly focused on lab or pilot scale.
- We previously reported the scale-up acarbose fermentation by Actinoplanes sp. A56.
- Therefore, the industrial acarbose fermentation was further optimized in this paper.
- Five thousand milligrams per liters of acarbose was obtained, which was highest in all reported literatures.

GRAPHICAL ABSTRACT

The environmental parameters (total sugar concentration in fermentation broth, pH and DO) were optimized for the industrial acarbose fermentation by *Actinoplanes* sp. A56 in a 30000-l fermenter, as a result, approximately 5000 mg/l of acarbose was obtained.



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ABSTRACT

Acarbose, a competitive α-glucosidase inhibitor, is clinically and widely used in the treatment of type II diabetes mellitus. In order to improve the industrial acarbose productivity by *Actinoplanes* sp. A56, the classical fermentation conditions such as total sugar concentration in broths, pH value and dissolved oxygen (DO) level were systematically investigated in a 30000-l fermenter, respectively. It was observed that a high-concentration total sugar (75–80 g/l), 7.0–7.2 of pH value and 40–50% of DO concentration were favorable for acarbose production. As a result, the final acarbose yield was elevated to approximately 5000 mg/l at 168 h of fermentation.

1. Introduction

Acarbose, a pseudotetrasaccharide, is produced by strains of the genus *Actinoplanes* (Choi and Shin, 2004), which is composed of an aminocyclitol and valienamine via a nitrogen bridge to C-4 of a 6-deoxy-D-glucose (Mahmud, 2003). The core structure of acarbose is the pseudodisaccharide acarviosine (valienaminyl-4-amino-4,6-dideoxyglucose), which is α-1,4-bound to a maltose residue and is the active pharmacophore that is responsible for the inhibition of intestinal α-glucosidase and sucrase (Wehmeier and Piepersberg, 2004). As a competitive α-glucosidase inhibitor, acarbose has clinically and widely been used since 1990 in the treatment of type II diabetes mellitus (Schnell et al., 2007; Uzui et al., 2011).

It was reported that the osmolality of fermentation broth was crucial to the acarbose production (Beunink et al., 1997). Jiang et al. (2010) investigated the effect of medium osmotic pressure on acarbose production in *Actinoplanes* sp., and it was found that a significant increase of acarbose production (reached 3360 mg/l in a 50-l fermenter) was achieved when osmotic pressure was kept at 300 mOsm/kg in the basal medium and at 400–500 mOsm/kg during the fermentation process. Similarly, through controlling the broth osmolality during the fermentation processes of acarbose-producing strain *Actinoplanes* sp. CKD485-16, Choi and Shin

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