Different enzymatic conditions and methods for producing maltoheptaose

邱琬軒(5109)

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Outline

1. Introduction
2. One-pot production of maltoheptaose (DP7) from starch by sequential addition of cyclodextrin glucotransferase and cyclomaltodextrinase
3. Efficient biotransformation and synergetic mechanism of dual-enzyme cascade reaction in nonreducing maltoheptaose synthesis
4. Conclusion

Abstract

Maltoheptaose is a maltooligosaccharide containing seven glucose units, characterized by lower osmotic pressure, higher viscosity, better moisturizing effect, and more robust film-forming properties, it has been widely used in fields such as food, medicine and cosmetics industries. Cyclomaltodextrinase (CDase) is an enzyme, which hydrolyzes cyclodextrins (CDs) efficiently. Using CDs as a substrate, maltodextrin is formed via CDase and subsequently hydrolyzed to prepare maltose heptasaccharide. Therefore, this study aims to explore the characteristics and synergetic mechanism between enzymes for the preparation of maltoheptaose. The cyclodextrin glucotransferase (*Ga*CGT) from *Gracilibacillus alcaliphilus* and cyclomaltodextrinase (*Bs*CD) from *Bacillus sphaericus* catalyzed the one-pot cascade reaction to produce maltoheptaose, the results showed that the optimal conditions were at pH 7.0 and temperature 30°C, in the presence of Ca^{2+}. Furthermore, the optimum enzyme units for the reaction were 80 U/g of *Ga*CGT and 1 U/g of *Bs*CD, and sequential addition of the enzymes exhibited a 5-fold higher conversion rate over simultaneous addition. On the other hand, cyclodextrinase (CDase) from *Bacillus sphaericus* E-244 and maltooligosyltrehalose synthase (MTSase) from *Arthrobacter* sp. Q36 exhibits optimal conditions at pH 7.0 and 40°C for one-pot synthesis of nonreducing maltoheptaose (N-G7). Simultaneously adding CDase and MTSase at 40°C for 4 hours have maximum yield of N-G7 at 77.3%, the conversion efficiency of the sequential treatment is lower than that of the simultaneous method, which further proves that the simultaneous reaction of the two enzymes contributes to the improvement of conversion efficiency. In summary, the method of dual-enzyme cascade reaction treatment has great potential for synthesizing N-G7 and application in the food industry.