

Studies on biosynthesis of polylysine

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ABSTRACT

-polylysine (-PL) is a naturally occurring bio-material produced by microbial fermentation. It is water soluble, biodegradable, edible and nontoxic toward humans and the environment. -Polylysine (-PL) is a homo-poly-amino acid characterized by the peptide bond between the -carboxyl and -amino groups of L-lysine. -PL shows a wide range of antimicrobial activity and is stable at high temperatures and under both acidic and alkaline conditions. -PL has strong antimicrobial activity against most gram-positive and gram-negative bacteria, fungi and also some kinds of viruses. In Japan, -PL is now widely used as a food preservative. Attractive properties of -PL are that it is antimicrobial and cationic, features that also make it of interest for applications in fields as diverse as medicine, environmental protection, pesticides, and electronic material design. Medium M3G was a foundation medium for production of -PL by *Streptomyces albulus* IFO 14147. In this study, response surface methodology (RSM) was employed to optimize the effect of yeast extract, glucose, (NH₄)₂SO₄ and initial medium pH on the production of -PL, in shaken flask culture. The use of jar fermentor to study the production of -PL by batch culture was also described. When *Streptomyces albulus* IFO 14147 was cultivated in medium M3G, at 30 and 160 rpm, the amount of -PL produced was only 0.75 g/L. In the investigation of carbon and nitrogen sources in medium M3G for the production of -PL, it was found that (NH₄)₂SO₄ had significant effect on -PL production. The effect decreased in the order of glucose, yeast extract. In addition, the yeast extract had significant effect for cell growth. It was concluded that yeast extract, glucose and (NH₄)₂SO₄ were still the most suitable carbon and nitrogen sources for the production of -PL by *Streptomyces albulus* IFO 14147. The results of optimum production study have show that there is significant 10 fold, from 0.75 g/L to 8.1258 g/L, improvement of -PL production by *Streptomyces albulus* IFO 14147 through response surface methodology. The maximal -PL appeared at the regions where respective concentrations of yeast extract, glucose and (NH₄)₂SO₄ were around 2.867 g/L, 23.8 g/L, 0.14 g/L respectively. *Streptomyces albulus* IFO 14147 batch culture in a 5-L jar fermentor was carried out. The cultivation was divided into two control phases. In phases I, cell growth was accelerated by maintaining the pH at 6.8; in phase II, -PL production was increased by maintaining the pH at 4. To avoid an increase in the pH during phase II as a result of glucose depletion, the glucose concentration was kept at around 10 g/L by glucose feeding. This control strategy enhanced the production of -PL to 5.16 g/L from 1.4468 g/L in the case of batch culture. The completion of this study, has set a foundation for the future industrial production of this valuable biomaterial.

Keywords : -polylysine ; jar fermentor ; response surface methodology ; batch culture

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