The Study of Production of Hyaluronic acid Using Streptococcus zooepidemicus

魏秀真、吳建一

E-mail: 9607835@mail.dyu.edu.tw

ABSTRACT

The effect of different culture variables on the molecular weight and properties of hyaluronic acid (HA) by Streptococcus zooepidemicus BCRC 15414 was investingated in the batch culture. The culture conditions contained different glucose concentrations (0-40 g/L), agitation rate (50 and 150 rpm), aeration rate (0.5 and 2 Lmin-1), obligate anaerobic and added various concentrations of NaCl (0-5%). The experimental results showed that HA production was maximum (1.79 g/L) and molecular weight of HA was 1.76×106 Da when agitation rate was controlled at 150 rpm and glucose concentration was 20 g/L at pH 9. When aeration rate was 2 Lmin-1, HA concentration reached 2.05 g/L and molecular weight of HA was 1.97×106 Da. Therefore, different agitation speeds and aeration rates were found to be an important effect on cell growth and HA production. Additionally, HA production using immobilized S. zooepidemicus beads in batch fermentation, the maximum HA production by immobilized-cell beads was 1.0 g/L. Moreover, the purified samples were characterized by a nuclear magnetic resonance (NMR), gel permeation chromatography (GPC) and elemental analyzer (EA). The results showed that the purified sample from the fermentation broth was HA. During HA fermentation, the viscosity of culture broth increased because of the accumulating HA, which produced obviously decrease of oxygen mass transfer. For culture, the oxygen mass transfer coefficient (kLa) played an important role. Hence, the effects of agitation rate, aeration rate and viscosity of HA solution on kLa were studied. The results exhibited that kLa increased with the increase of aeration rate and agitation rate. The maximum kLa values was 0.3787 min-1 at agitation rate of 300 rpm; the maximum kLa values was 0.1328 min-1 at aeration rate of 2.0 Lmin-1. Furthermore, the fermentation kinetics of an extracellular polysaccharides by S. zooepidemicus was investigated in a batch system. The study used a simple model induced Logistic equation for growth, the Luedeking-Piret equation for HA production and Luedeking- Piret- like equations for glucose and oxygen consumptions to simulate HA fermentation.

Keywords : Streptococcus zooepidemicus ; hyaluronic acid ; immobilization ; oxygen mass transfer coefficient

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