Study on Curdlan Production by Agrobacterium sp.in a Fermentor

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ABSTRACT

Curdlan is an extracellular microbial insoluble polysaccharide composed entirely of 1,3-β-D-glucosidic linkages and synthesized mostly by Agrobacterium species and Alcaligenes faecalis under nitrogen-limited conditions. Curdlan is an alkali-soluble β-1,3-glucan polysaccharide and curdlan aqueous is heating an aqueous slurry to about 55°C and letting it cool to form a thermo-reversible gel or by heartiong the slurry to＞70°C to form a thermo-irreversible gel. Therefore, curdlan was applied to food industry as food additives. Moreover, in a clinical trial, researchers used curdlan sulfate as an antiviral agent for the inhibition of human immunodeficiency virus (HIV)-1 infection. Because curdlan could use extensively, therefore, the dosage of curdlan would increased in the future. Consequently, it places important on decreasing the production costs of curdlan. The main aim of the research was to determine the effects of aeration and agitation on the production of curdlan by Agrobacterium species in the fermentor. In addition, effect of different extract methods for curdlan and the rheological properties of curdlan solution were studied. Finaly, we identify structure of purified sample from the fermentation liquid. The description of this is divided into four sections.

In the first section, we culture Agrobacterium sp. strain in the batch culture in the 5-L jar fermentor, study the effect of the different aeration rate and stirred rate on the curdlan production. The operation condition of aeration rate for fermentor was 0.0 vvm、0.5 vvm、1.0 vvm and 1.5 vvm; the stirred rate condition for fermentor was 150 rpm、300 rpm and 600 rpm. As aeration rate or stirred rate were increased (aeration rate from 0.0 vvm to 1.5 vv and stirred rate form 150 rpm to 600 rpm),both cell concentration and curdlan production increased, indicating that higher oxygen transfer efficiency is required for a higher production of curdlan.

The second section is focused on the effect of different methods for curdlan extract. It is found that concentration of alkali solution is a factors in the curdlan purified. The highest curdlan concentration was produced by the NaOH solution concentration (from 0.2 N to 2 N) increased and high volume rate (alkali solution/fermentation broth). Additional, the different acid solution also could influence the curdlan product. However, the reaction time with the NaOH solution didn’t influence the extract of curdlan.

The third section is focused on the rheological properties of different concentration of curdlan solutions (1~6%) using a rotational viscometer at several temperatures (10-50°C) and rotational speed (22-40 rpm). The modified of power law model were found to be the good agreement with the rheological properties of purified curdlan solutions. Activation energy was determined using the Arrhenius equation and it was found that the activation energy of curdlan increased with the addition of curdlan.

The fourth section is focused on the structure of purified sample from the fermentation liquid. The purified sample was characterized by fourier transform infrared (FTIR) spectroscopy and nuclear magnetic chromatography (NMR). The results show that the purified sample from the fermentation liquid was curdlan.

Keywords : glucan、Agrobacterium sp.、jar fermentor、purification、rheologica

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