Production of β-poly (malic acid) by Microorganism with *in situ* Membrane Separation

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INTRODUCTION

β-poly (malic acid) (PMLA) is a polymer with extensive biomedical and pharmaceutical applications. It can be used as the medicine carrier which has significant applications in targeted therapy, and can be used as tiny capsule materials, medical bio-materials, absorbent water materials and cosmetic products. PMLA is also considered as a novel environmental friendly material, because it can be easily degraded into malic acid which is a natural molecule and harmless. The current bottleneck for production of PMLA via microbial fermentation is how to improve the yield. In this project PMLA will be synthesized and separated *in situ* by membrane technology coupled with PMLA fermentation in order to improve its productivity.

METHODS

During the fermentation process of producing PMLA, the functionalized part is the metabolic pathways by *Aureobasidium pullulans*. However, a higher concentration of PMLA is not only harmful to cell growth, but inhibits a continuous production of PMLA. A possible approach to reduce inhibition effect is to separate part of PMLA in a fermenter. In this project, ultrafiltration membrane (UF) was coupled with fermentation to remove part of PMLA and to recycle the cells in retentate to fermenter to improve the productivity of PMLA during fermentation.

EXPERIMENTS

The fermentation was conducted by *A. pullulans* at 25 ℃ with repeated batch cultures in a sterile 7.5 L fermenter with a working volume of 4 L. The pH was maintained at 6.0. The initial glucose concentration was 190 g/L. When the fermentation reached the logarithmic growth phase, a membrane with 300kDa molecular weight cutoff was used to move the permeate containing high concentration of PMLA, while at the same time recycle the cells and add raw cultures to the fermenter to maintain a working volume of 4 L. The whole process was shown in Figure 1. The experiments were conducted at Institute of Process Engineering (IPE), China.

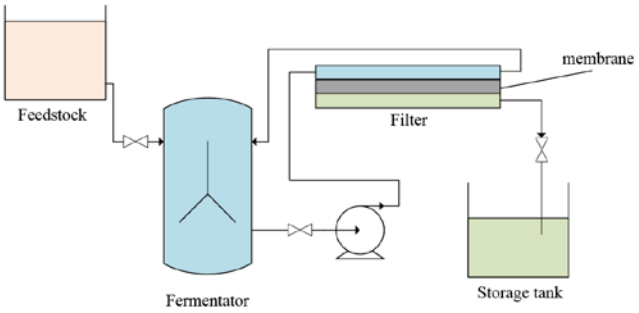

Figure 1 Schematic flowsheet for membrane *in situ* separation during PMLA fermentation

RESULTS

In a convertional batch cultivation, the final concentration of the produced PMLA is 43.12 g/L and the productivity is 0.74 g/L•h. While by repeated batch cultures with cell-recycle by *in situ* membrane separation, the yield and the productivity of PMLA are increased by 33.2%.