CHAPTER I

INTRODUCTION

The applications of microfiltration membrane have been widely used in engineering industries, especially in biotechnology processes such as cell harvesting or antibiotics clarification. A great advantage of membrane microfiltration over the competing techniques of centrifugation and conventional filtration is that separation of the biomass is essentially 100 %. Another previous example of the use of membrane microfiltration is in sterilization of product in solution, for example, an extracellular enzyme, passes freely through the membrane so that the product losses are small. It is also an advantage if the rate of filtration is constant with time, or at least that any decrease is relatively small. There is also interest in the use of this process for the separation of cell debris following cell disruption in the recovery of intracellular enzymes [1].

A major problem for membrane microfiltration is fouling effects caused by cake formation on the membrane surface and plugging of the pores of membrane, caused rejection of macromolecular solutes, high feed flow velocity was offered to remove fouling by shearing action and a high permeate flux can be maintained. However, the microorganisms were sometimes damaged and that the macromolecular solutes such as enzymes were deactivated by the shear stress of the feed pump [2]. Alternative technique to minimal cake buildup and reduce membrane fouling was demonstrated by using a rotating-disk dynamic filtration system, creating high shear rates, however, for large scale production, high cell density associated with high viscosity would limit the performance of the system [3].

In recent, the processes of membrane separation with ultrasonic irradiation have been demonstrated that ultrasound can be capable of increasing the permeation performance [2,4]. Another advantage of ultrasonic microfiltration is that cleaning and production can simultaneously occur. However, the apparatus used in their experiments was an ultrasonic cleaning bath immersed with the membrane which suffered many drawbacks such as low intensity and fixed frequency. This type of ultrasonic source is also unsuitable for the existing module used. Therefore, a system of microfiltration in tubular module attached with an ultrasonic source will be studied as our objective.

1.1 Thesis objectives

1. To study the tubular module cross-flow microfiltration attached with ultrasonic system.
2. To study the effects of ultrasonic waves on the permeation performance of the interested system.

1.2 Scopes of study

1. The laboratory scale tubular module cross-flow microfiltration attached with an ultrasonic transducer will be built.
2. The effective parameters to the permeation performance of cross-flow microfiltration in separating yeast from suspensions will be studied:
   2.1 the applied pressure
   2.2 the sound frequency
   2.3 the sound intensity
   2.4 the irradiation time
3. To study the effect of ultrasound on the membrane.
4. To study the effect of ultrasound on the yeast.
5. To compare the permeation performance of the system with and without ultrasonic irradiation.