

## CHAPTER I

### INTRODUCTION

#### 1.1 Background of the study

Surfactant plays as one of prominent classes of chemical products with high volume use in a great variety of household and industrial applications (Makkar et al., 2011). Most of these surfactants are usually petroleum based and chemically synthesized. Due to environmental issues and restrictive laws, surfactant produced naturally by microorganisms (biosurfactant) has received more demand in the industry compared to their chemical surfactant counterparts (Makkar and Cameotra, 1998). Biosurfactant is more preferred because of their properties that show higher biodegradability, lower toxicity and stable activity at extreme pH, salinity and temperature (Seydlova and Svodova, 2008).

A lipopeptide biosurfactant, surfactin is mainly produced by *Bacillus* sp. and characterized by an amino acid chain (peptide) that is linked to a fatty acid (Isa et al., 2008). This compound has the tendency to reduce the surface tension of water (72 to 27 mN/m), which is substantially lower than any biosurfactant surface tension (Wei et al.,

1998). In the last decade, surfactin has gained increasing attention as they showed great potential for several commercial applications in pharmaceutical, petroleum, cosmetic and food processing industries (Makkar and Cameotra, 2002). However, the production of surfactin has not been thoroughly commercialized because of their low yield and high production cost.

In order to achieve maximum surfactin production, one of the possible methods is by development of optimization of culture conditions and media components. At the right level of optimization of culture nutrients and conditions, certain formulation can accommodate a proper microenvironment for microorganisms and thus enhancing their growth and metabolite production (Mukherjee et al., 2006).

Response surface methodology (RSM), which includes factorial designs and regression analysis, is preferred to handle multifactor experiments. RSM is a collection of statistical techniques for designing experiments, building models and evaluating the effect of factors (Bezerra et al., 2008; Abalos *et al.*, 2002). With that regard, the aim of this research is to enhance the production of surfactin by optimization of certain condition in fermentation process by using response surface methodology (RSM). RSM technique will be used in this research to produce high yield of surfactin by optimizing several factors involved in the production. The experimental design is well figured as shown in Appendix A.

## 1.2 Problem Statement

The production of surfactin by various microorganisms has been studied extensively, and now we have a good amount of data regarding their production, types and properties. Despite possessing many commercially attractive properties and clear advantages compared with synthetic counterparts, their low yields and high production costs caused predicament for commercial purposes. Thus, it is necessary that they are produced and recovered profitably on large scale by optimization of several factors that affecting surfactin production during fermentation process.

## 1.3 Objective of the Research

The main objective of this study is:

1. To determine suitable media composition for high yield production of surfactin by local-isolates of *Bacillus subtilis* 3M via RSM
2. To enhance surfactin production by optimization of fermentation condition from local-isolates of *Bacillus subtilis* 3M via RSM.
3. To determine the mass of surfactin complex produced from the optimization process by MALDI-ToF.