CHAPTER I
INTRODUCTION

Surfactants, surface active compounds, are able to reduce surface and interfacial tension between liquids, solids, and gases. Currently, most of the widely-used surfactants are exclusively synthesized from petroleum and natural gas; however, some of them are not environmentally friendly. Therefore, the surface-active microbial products or biosurfactants, which are naturally produced from microorganisms such as bacteria, fungi, and yeast, have recently been considered as an alternative to synthetic surfactants. Biosurfactants have several advantages, including biodegradability, low toxicity, and biocompatibility (Kosaric, 2001). Furthermore, biosurfactants can be produced from cheap and renewable substrates, and they are also effective under extreme conditions of pH, temperature, and salinity.

Although biosurfactants have shown potential use in many applications (agriculture, food processing, detergents, personal care products, cosmetics, pharmaceuticals, paints, bioremediation of hydrocarbons, and enhanced oil recovery (Banat et al., 2000)), the biosurfactant production on a commercial scale has been restricted because of low yields and high production costs. Therefore, it is necessary to develop an efficient and cost-effective bioprocess for the biosurfactant production (Wei et al., 2005). Normally, there are three economical factors involving the biosurfactant production: use of cheaper substrates to lower initial raw material costs; development of efficient bioprocesses and optimization of the culture conditions; and use of capable microorganisms for enhance biosurfactant yields (Mukherjee, et al., 2006).

The bioprocesses are effectively in substantially increasing the biosurfactant production. In this regard, two identical of sequencing batch reactors (SBRs) were used in the present work because the fill-and-draw operation of SBRs showed better reactor performance and greater biosurfactant production, resulting in the enhancement of the microbial growth (Cassidy and Hudak, 2001). Likewise, the SBR operating conditions (such as cycle time, agitator speed, aeration rate, medium composition, and concentration of nitrogen and carbon source) also influenced the

biosurfactant production (Nitschke et al., 2005). To obtain the highest biosurfactant yields, these operating factors should be optimized.

From the point of view of surfactant properties, one of the most surface active biosurfactants is rhamnolipid, a glycolipid-type biosurfactant produced by *Pseudomonas aeruginosa* strains. The two major types of rhamnolipids are consisted of one or two molecules of rhamnose linked to one or two molecules of β-hydroxydecanoic acid, which are known as mono-rhamnolipid and di-rhamnolipid, respectively (Wei et al., 2005). *Pseudomonas aeruginosa* strains are able to grow on various carbon sources, especially vegetable oils (like palm oil, olive oil, sunflower oil, and grape seed oil). However, palm oil can serve as the cheapest raw material in Thailand because of its abundant availability.

In this present study, the production of rhamnolipid type biosurfactant was carried out in two identical units of lab-scale aerobic SBRs. An indigenous bacterial strain was isolated from petroleum-contaminated soil in Thailand. The strain, identified as *Pseudomonas aeruginosa* SP4, was used to produce the biosurfactant. Palm oil and mineral medium were used as carbon and nutrient source, respectively. The aim of this study was to optimize the rhamnolipid surfactant production by observing the effect of cycle time at the optimum oil loading rate. The effect of the carbon/nitrogen ratio on rhamnolipid production was also investigated.