CHAPTER I

INTRODUCTION

1.1 Background

Okara is a by-product produced from soymilk production with low economical value which usually used as stock feed, fertilizer or directly discarded. (Jiménez-Escrig, *et al*., 2009). The huge quantities of okara produced annually pose significant disposal problem (Li, *et al*., 2012). Based on Badan Pusat Statistik (2015) the productivity of soybean in 2015 is 963.183 tons which is higher than 2014 (954.997 tons) and 2013 (779.992). According to Dharmawanti (2009), since the soybean production is increase, the chance of soymilk and tofu production is bigger. Hence, the okara generated from production is higher. Vishwanathan, *et al*. (2011) reported about 1.1 kg of fresh okara is produced from every 1 kg of soybean processed for soy milk. Despite its disposal problem as a by-product, okara is also contained a lot of nutrients which are considered as a possible source of functional compounds (Mateos-Aparicio, *et al*., 2010).

Okara which generally contains 20 to 25% of protein has high potential as alternative organic protein source (Sengupta, *et al*., 2012). Under physiological conditions, okara could possibly release potential bioactive peptides. Bioactive peptides are food-derived peptides that can exhibit diverse activities, including antibacterial, antioxidant, antithrombotic, hypocholesterolemic, and blood-pressure lowering actions (Jiménez-Escrig, *et al*., 2009). Zhu, *et al*. (2008) reported that from hydrolyzed okara protein, peptides and free amino acids which have antioxidant

activity might be produced. Hydrolysis of proteins is a process that involves the cleavage of peptide bonds to give peptides of varying sizes and amino acid composition (McCarthy, *et al*., 2013).

Protease can be found in plants, animals, and microorganism. However, microorganisms are preferred due to their diversity and their susceptibility to genetic manipulation. Among microbes, molds as enzyme producers have many advantages since they are normally GRAS (generally recognized as safe) strains (Chutmanop, *et al*., 2008). Castro and Sato (2013) reported that *A. oryzae* have high protease activity. Other than that, digestibility also could be improved through fermentation with *A. oryzae* (Teng, 2012). To increase the economical value of okara by increasing its antioxidant activity, fermentation of okara by *A. oryzae* could be done.

1.2 Research Problem

Okara is a by-product from soy milk production which is high in protein (Jiménez-Escrig, *et al*., 2009). However, okara only has low economical value due to its background as a by-product of soymilk production, and its utilization for human consumption is still limited. Protein hydrolysates resulted from solid-state fermentation of molds were active biologically, since they have shown antioxidant activity. Thus, the use of *A. oryzae* to hydrolyze the protein into bioactive peptides by solid state fermentation is needed to increase the nutritional value of okara which consequently increases its market value.

1.3 Objectives

1.3.1 General Objectives

The general objective of this research was to investigate the influence of *A. oryzae* solid state fermentation on okara functional characteristics (antioxidant activities, protein content, amino nitrogen content, protein digestibility, and amino acids profile).

1.3.2 Specific Objectives

The specific objectives of this research were:

1. To study the influence of incubation temperature on *Aspergillus oryzae* growth.
2. To study the influence of *Aspergillus oryzae* initial concentrations, fermentation times, and water activity on fermented okara functional characteristics (antioxidant activity, protein content, amino nitrogen content, protein digestibility, and amino acids profile).
3. To evaluate the enhancement of okara functional characteristics due to solid-state fermentation.