

# CHAPTER I

## INTRODUCTION

### 1.1 Background

In Indonesia, soybean considered as important food supply. Soybean and soy products are relatively inexpensive source of protein that are widely recognized for their high nutritional and excellent functional properties (Vishwanathan *et al.*, 2011). Soymilk and tofu are popular products from soybean as low cost substitutes of traditional dairy products for common masses. Soymilk also commonly used in food products as ideal nutritional supplement for lactose intolerants. According to Kementerian Pertanian (2013), average consumption per capita of tempeh and tofu increased 0,09% each year, followed by high production of soybean based product. Commonly soybean based product using soymilk have by-product called as Okara.

Okara is a by-product of soybean processing for soymilk which is either under utilized or unutilized. Raw okara also called soy pulp, it is a white-yellowish material consisting of insoluble parts of the soybean seed remaining in the filter sack when pureed soybean seeds are filtered in production of soymilk (Jimenez-Escrig *et al.*, 2008). In Indonesia, Okara known as *ampas tahu* and been used for livestock fodder and organic compost, it is also made into traditional food known as *tempe gembus* by fermentation process. Recently research about okara, its characterization, properties and health effects, has been assessed and shown significant result.

According to Bowles and Demiate (2006) okara have good source of protein and dietary fiber. Okara is rich in protein and also a good source of dietary fiber, dried okara contain 22.33% protein and 23.52 fiber (Sengupta *et al*, 2012). Recent study by Amin and Mukhrizah (2006) also shown that okara is a potential source of antioxidant components showing that protease hydrolysate from okara yielded antioxidant activity.

One of method to increase okara utilization is using solid state fermentation by enzymatic reaction. Due to high protein content of okara, solid state fermentation by enzymatic reaction could be used is protease. Protease from several microorganisms could be used such as *Mucor sp.*, *Aspergillus oryzae*, *Rhizopus oryzae*, *Aspergillus niger*, *Bacillus subtilis* and *Bacillus licheniformis* that commonly used in soybean product making. Protease enzymatic process is hydrolyzation, proteins are cut to smaller molecules into smaller peptides and free amino acids through hydrolyzation in result of nutritional quality improvement.

## **1.2 Research Problem**

Okara is considered as by-product from soymilk or tofu that have protein source that grows in Indonesia. However, okara utilization is still limited, to improve utilization of okara, *Rhizopus oryzae* known could hydrolyze protein into peptides and amino acid through solid state fermentation. The result of solid state fermentation could increase antioxidant activity okara nutritioral value that will increase the okara market value.

## 1.3 Objectives

### 1.3.1 General Objectives

The general objective of this research was to investigate the effect of solid state fermentation by using *Rhizopus oryzae* on okara functional properties (antioxidant activity, protein content, amino nitrogen, protein digestibility, and amino acid profile)

### 1.3.2 Specific Objectives

The specific objectives of this research were:

1. To determine temperature and concentration of *Rhizopus oryzae*'s growth
2. To determine the influence of fermentation time and *Rhizopus oryzae* concentrations on okara antioxidant activity and degree of hydrolysis of okara.
3. To determine the influence of water activity ( $A_w$ ) on antioxidant activity and degree of hydrolysis of okara.
4. To determine the enhancement of okara functional properties due to solid state fermentation.