CHAPTER I
INTRODUCTION

1.1 Background

The frequencies of diabetes cases are increasing every year. About 1.5 million deaths were caused by diabetes in 2012, and there are around 422 million people which have diabetes in 2014 (WHO, 2016). Consumption of dietary fiber particularly resistant starch has been one of several outcomes to solve diabetes problems, especially for diabetes type 2.

Bogor taro (*Colocasia esculenta* L. Schott) is a typical tuber that widely cultivated in the tropical and sub-tropical area especially in the areas with high rainfall, temperature ranges from 25^{o}C to 35^{o}C and wetlands with low salinity level below 5mM NaCl, such as Indonesia (Dana *et al.*, 2017). Bogor taro is a potential source with high of carbohydrate content due to its high amylose content, around 20-25%, and small granules, around 1-5 μm. Moreover, Bogor taro also rich in protein, vitamin C, thiamin, riboflavin, niacin and other minerals, results in the characteristics of Bogor taro which is easily digested by human, especially for babies with allergic and adults with indigestion (Ariyanti *et al.*, 2014). Based on the nutritional value, the utilization of Bogor taro as starch is expected to be used as wheat flour substitutes. However, to be applied as a product, native starch of Bogor taro is known to have significantly low quality of physicochemical characteristics.

Starch modification is known to be a process to enhance the functionality of the starch by converting the native starch into resistant starch, results in the changed of physicochemical characteristics of the starch including the stability, solubility,

viscosity, swelling properties, gelatinization properties, and others (Raina *et al.*, 2006). One of the starch modifications that could be used is by using chemical modification by acetylation. Acetylation of starch is a substitution method done by reacting acetic anhydride with starch. The hydroxyl groups of the starch is replaced by acetyl groups, results in the increasing thermal stability and rougher surface (Xu *et al*., 2004).

According to Robertson *et al.*, (2005), intake of resistant starch might modulates the insulin sensitivity through alterations of fatty acid flux. Resistant starch enhances the production of short-chain fatty acids (SCFAs) which is produced during the colonic fermentation, results in the adipose tissue lipolysis inhibition. Thus, lower the concentration of blood glucose, insulin and epinephrine after consumption (Sajilata *et al.*, 2006). Therefore, by using the chemical modification to transform the Bogor taro starch into resistant starch, the modified starch of Bogor taro is expected to have benefit towards diabetes mellitus problems.

1.2 Research Problem

Starch modification is became a way to enhance the potential uses of natural sources especially tubers, such as potato and cassava (Moorthy *et al.*, 2018). Chemically modification of starch by using acetylation method has been known to be a beneficial method by modifying the starch without affecting the granule size distribution and the morphology of the starch, which results in the changes of the psychochemical characteristics especially the chemical structure, due to the esterification of starch which is occurred during the acetylation process. Moreover, acetylation method is also known to modify the structure of starch groups and

changes the native starch into resistant starch type 4, thus will change the resistant starch percentage in the starch (Alcazar-Alay and Meireles, 2015).

Bogor taro (*Colocasia esculenta* L. Schott), is one of potential tubers in Indonesia in which the starch has high nutritional value, but has low stability and low physicochemical characteristic to be utilized as flour substitute (Raina *et al.*, 2006). However the problem is that there is no any studies reported regarding to the acetylated starch of Bogor taro, especially towards the acetyl percentage, degree of substitution and physicochemical characteristics.

1.3 Objectives

1.3.1 General Objective

The general objective of this research is to produce resistant starch type 4 from Bogor taro through acetylation based chemical modification.

1.3.2 Specific Objectives

The specific objectives of this research are:

1. To evaluate the influence of concentration of acetic anhydride, temperature and reaction time towards acetyl percentage and degree of substitution of Bogor taro starch.
2. To study the physicochemical characteristics (viscosity, color, resistant starch percentage, starch content, amylose and amylopectin, solubility and swelling power and FTIR) of modified Bogor taro starch through acetylation.