1 INTRODUCTION

1.1 Background

Nowadays, the cultivation of cassava keep growing serve as a staple crop in the most tropical countries located in the equatorial belt which indicates to its suitability to an extensive of ecosystems. It is the world's fourth most important main food source after rice, wheat and maize and is a major element in the diet of over one billion population. Cassava is widely used in tropical Africa and South America, and in parts of Asia, particularly Indonesia and Thailand (FAO, 2000). The cassava crops have some of the hinge features which are its efficiency in producing carbohydrate, its resistance to drought and to destitute soils, even though it thrives on fertile, sandy-clay soils, and its high flexibility with respect to the timing of planting and harvesting. Hence, cassava plays a vital role for food security, especially in dry areas and marginal soils.

Cassava is grown for its enlarged starch- filled roots while the fresh root contains less protein and ash. Typical composition of cassava root is moisture (70%), starch (24%), fiber (2%), protein (1%) and other substances including low content minerals and vitamins (3%) (Tonukari, 2004). The starch content in the cassava root has many industrial applications, including food processing and in the paper, wood, textile, pharmaceutical, chemical and feed industries. In the traditional settings of North and South America, the tubers are grated and the sap is extracted through squeezing or pressing. The cassava is further dried over a fire to make a meal, or it is fermented and cooked. The meal can then be rehydrated with water or added to soups or stews. In Africa, the tubers are processed into some different ways. Firstly, they may be fermented in water. Then they are either sun-dried for storage or grated and made into dough that is cooked. Alcoholic beverages can be made from the roots (O'Hair, 1995).

Cassava contains two cyanogenic glucosides, linamarin and a small amount of lotaustralin, which are catalytically hydrolysed to release toxic hydrogen cyanide (HCN) when the plant tissue is crushed (Conn, 1981; Balagopalan et al., 1988; McMahon et al., 1995). The intake of large amounts of cyanogens from consumption of high cyanide cassava roots, high cyanide cassava flour and poorly processed cassava leaves can lead to cyanide poisoning with symptoms of headache, nausea, dizziness,
diarrhoea, vomiting and sometimes death (Nhassico et al., 2008). However, cassava starch is mostly used to produce cassava flour which is an important food source in the world. Production of flour with high nutrient content and minimal amount of toxic factor by the extraction of starch from cassava becomes the important issues. Thus, the aim of this study is to produce flour from cassava starch through enzymatic treatment by A. niger.

1.2 Motivation and statement of problem

Flour has a big demand in global since several decades and it is expected has a very steady growth in future especially wheat flour. This is because flour is one of the major food supplies for human. The products available in market such as bread and noodle are the products made from flour. According to Global Agricultural Information Network, total production of wheat flour in Malaysia was 75,000 tonnes in 2012 increased by 0.56% in 2011 which totalled at 74,500 tonnes. However, the wheat flour is not enough to consumer in Malaysia due to the growth of the baking industries. Moreover, consumers nowadays are opting for high-fibre whole meal bread. All these factors are boosting wheat imports in Malaysia. This situation is not good in Malaysia may cause economic loss due to the importation of wheat. Thus, using cassava as the raw material to produce flour will be studied.

Cassava is the well-known traditional crop that contributes to the Malaysia food sector. Cassava roots rich in starch content to produce cassava flour. Starch is the most abundant carbohydrate that can be found from various natural sources such as potato, rice, corn, wheat and cassava. Kallabinski and Balagopalan (1991) stated that to obtain high recovery of cassava starch; attempts have been made to replace the traditional mechanical method by the use of commercial cell wall degrading enzymes to release starch from cassava roots. So, using the pectinase enzyme derived from A. niger to produce cassava starch to flour will be studied.

Cassava is a starchy food but contains no gluten. There has benefit for those based on gluten-free diets, people diagnosed with celiac disease and allergies on the gluten can use cassava to make food. Hence, cassava is a good substitute to using wheat, rye or barley, which is the food items that contain gluten. Because of this reason, we use cassava starch to produce the flour. Wheat flour is substituted by the cassava flour
which is more nutrients and no gluten. Even products produced of this flour such as noodles or pasta, are gluten-free. Although baking cakes, bread and other foods requires gluten to enable them to swell in size, it can be substituted with guar and xanthan gum. Due to economic and large resource availability of cassava plant, production of flour from cassava starch is interesting to be studied. Demand of "ready-made" products depends on quality of product itself. Nowadays, educated consumers would prefer to concern on the nutrition of product instead of the price and brand of the product. Hence, nutrition values of cassava starch was analyzed.

1.3 Objectives
The objectives of this research are shown as following:

- To produce flour from cassava by using enzyme derived from *A. niger*
- To perform analysis on characteristics of cassava flour

1.4 Scope of this research
Several scopes have been identified to achieve the objectives of this research:

i) To culture *A. niger* for the production of pectinase enzyme
ii) To study the parameter for the extraction of cassava starch
iii) To obtain the starch recovery after enzymatic conversion
iv) To test the nutritional profile of cassava starch

1.5 Main contribution of this work
The main contribution of this work is to determine the potential of pectinase to be used as enzyme to liberate the starch which could eventually help to produce flour that meets standard specifications.

1.6 Organisation of this thesis
The structure of the reminder of the thesis is outlined as follow:

Chapter 1 provides a brief introduction about the cassava plant. The current issues related to the cassava flour are studied where it leads to the motivation and problem