

## CHAPTER 1

### INTRODUCTION

#### 1.1 Introduction of Angkak

Angkak or red-yeast rice is a fermented product made by culturing *Monascus* spp. on cooked rice. It has been used extensively in Asia as a natural food colorant in fish, Chinese cheese, red wine and sausages (Went, 1895; Hesseltine, 1965; Blanc *et al.*, 1995; Pinthong and Pattanagul, 2004). *Monascus* can produce six primary pigments (two yellow, two orange, and two red) which are the main constituents of the characteristic colors of angkak (Rosenblitt *et al.*, 2000). Moreover, angkak was produced by *Monascus* fungi, an organism which can convert a starch substrate into several metabolites such as enzymes, alcohols, organic acids, vitamins, flavor compounds, fatty acids, antibiotic agents, flocculants, antihypertensives, ketones, and pigments (Yongsmith, 1999). Thus the implementation of *Monascus* pigment as a coloring agent in food provided an additional advantage of specific flavor in the products. Most of angkak products could be used in the powder form or pigment extracts for developing the color of products.

At present, the interest in red-yeast rice is increasing not only for its natural pigments for food industries but also as a source of substances that can lower blood cholesterol. The substance is referred as Mevinolin (Monacolin K), an inhibitor of the 3-hydroxy-3-methylglutaryl coenzyme A (HMG Co-A) reductase, that was accounted for reducing cholesterol which is a risk factor for the development of coronary artery disease (Li *et al.*, 2004).

Angkak also has a pharmaceutical characteristic. The ancient Chinese pharmacopoeia, *Ben Cao Gang Mu-Dan Shu Bin Yi*, published during the Ming Dynasty (A.D. 1368-1644), described medicinal function of angkak for the treatment of indigestion and diarrhea, anthrax, bruised muscles, hangovers, colic dyspepsia in children and post-partum problems. Besides, it has been used for improving blood

circulation and promoting the function of the spleen and stomach. Moreover, several books including *Materia Medica for Daily Use*, *Supplements on Developments of Herb Medicine*, and *Compendium of Material Medica* also described the utilization of this pigment as a coloring agent and medicine in the treatment of various diseases (INPR, 2006).

However most of the *Monascus* strains have a potential to biosynthesize citrinin, another secondary metabolite (Ganrong *et al.*, 2000) which is known as hepato-nephrotoxin (Sabater-Vilar *et al.*, 1999). This metabolite is a serious problem for using angkak as a food additive and dietary supplement. Adlay, a new substrate developed adlay angkak products, does not produce citrinin in the products at the detection limit of 1 µg/g (Chang, 2001; Yang *et al.*, 2004). Adlay angkak was composed of 14.2% of moisture, 37% of carbohydrate, 6.87% of crude ash, 15.4% of crude fat, 15.9% of crude fiber and 24.8% of crude protein. Whereas, using rice as a substrate would produce a rice angkak with a composition of 6.0% moisture, 73.4% carbohydrate, 0.8% fiber, 2.8% fatty acid and 14.7% protein (Ma *et al.*, 2000; Yang *et al.*, 2004).

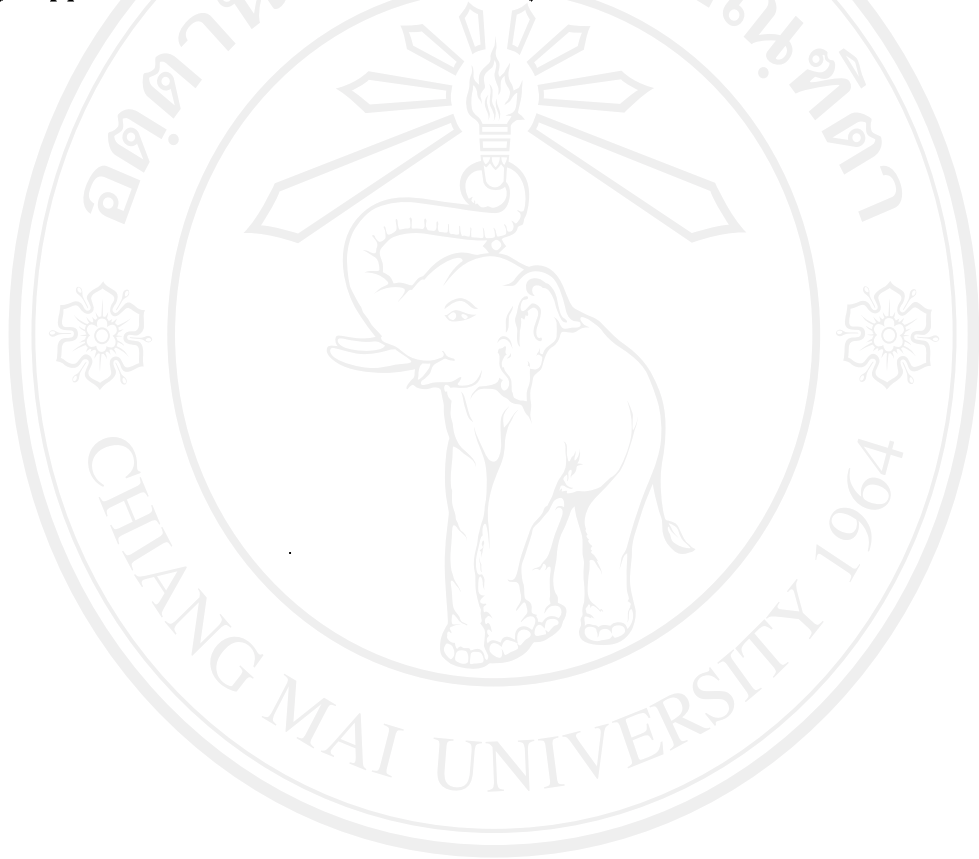
Therefore, it might be interested to focus investigations on *Monascus* strains and cultured nutritional sources to synthesize a highly mevinolin content and red pigment but a low citrinin level for the development of adlay angkak. These investigation will be beneficial for food and drug industries in the future.

## 1.2 The Objectives of this study

- 1.2.1 To find out strains of *Monascus* which produce low citrinin, high mevinolin and red pigment by using adlay as a substrate.
- 1.2.2 To study kinetic behavior of *Monascus* fermentation on adlay.
- 1.2.3 To find out the quantities of the suitable carbon and nitrogen source inducing a high quality of adlay angkak.
- 1.2.4 To study on effect of carbon and nitrogen sources on adlay angkak production
- 1.2.5 To compare physical and chemical properties between a final adlay angkak product with a commercial rice angkak.

### 1.3 Application advantages of this study

Application advantage of this study was to be able to choose both a suitable strain of *Monascus* and nutrients in order to produce low citrinin, high mevinolin and red pigment of adlay angkak. The kinetic behavior of *Monascus* fermentation will show both the quantitative fungal cells, as glucosamine, and the maximum *Monascus* metabolites. The high quality adlay angkak may be a new product that can be used as dietary supplement and a food additive made by a new substrate other than rice.



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