1 INTRODUCTION

1.1 Motivation and statement of problem

Orthosiphon stamineus, Benth (Lamiaceae) or Cat’s Whisker is well known as ‘Misai kucing’ by the locals in Malaysia. This handful herb can be found in South East Asia such as Malaysia, Indonesia, Thailand and Philippines. This plant is commonly used traditionally by the medicine practitioners for the treatment of joint inflammation. Other than that, O. stamineus is also used for the treatment of gout, arthritis, rheumatism and remedy for kidney stones. Commercially, O. stamineus is famous because of its slimming property. O. stamineus is known as Java Tea in the market for its safe and effective mild herbal diuretic that throws out excess fluids, nitrogen substances and sodium chloride (Pouralinazar et al., 2012). Pharmacological effects of O. stamineus are attributed to presence of polyphenolics, glycosides, lipophilic flavones, rosmarinic acid (RA) and caffeic acid derivatives, triterpenes, and diterpens. The lipophilic flavones of O. stamineus including sinensetin (SIN), eupatorin (EUP) and 3′-hydroxy-5, 6, 7, 4′ tetramethoxyflavone (TMF) have been given considerable interest as markers of pharmacological activity by several researchers (Aisha, Majid, & Ismail, 2014).

1.2 Ultrasonic-assisted extraction

This extraction method is an easy and highly feasible method for extraction of O. stamineus and the operation can be applied rapidly in most solvents for large-scale preparations equipped for industrial purposes. This extraction method also favored and fetches interests of many when dealing with extraction from plant material in pursuing bioactive substance content.

1.3 Microencapsulation

Microencapsulation is one technique proposed to preserve flavonoid content from degrading. Microencapsulation is one of the methods to preserve the antioxidant properties and the flavonoid content in O. stamineus. Microencapsulation technique is an effective way to protect the food ingredients from being deteriorated or having any
volatile losses. Microencapsulation is defined as a process in which tiny particles or droplets are surrounded by a coating, or embedded in a homogeneous or heterogeneous matrix which providing a physical barrier between the core compound and the other components of the product (Ling, 2013). Microencapsulation is defined as a process in which small particles are enclosed by a coating, or embedded in a homogeneous or heterogeneous matrix by wall material or encapsulating agent. The wall material selection also a main concerns for microencapsulation process.

1.4 Spray Drying

Spray drying is an important method used by the food industries in the production of microencapsulated flavors to improve handling and dispersion properties. For decades, spray drying has been applied to encapsulate food ingredients such as carotenoids, flavors and lipids. During the drying process, the evaporation of solvent, and the entrapment of the favored compound occurs instantaneously.

1.5 Response Surface Modelling (RSM)

Response surface modelling (RSM) as an effective statistical tool can be used for investigating the influences of various variables, affecting the responses (Division, 2002). The interactions of variables in this optimization technique affecting the dependent variables are considered accurately. Many parameters could be affecting the response. Therefore it is essential to choose the best statistical model so that the number of experiments can be minimized, as well as evaluating the effects of important variables and interactions among them in multivariable system.

1.6 Objectives

The following are the objectives of this research:

- To minimize thermal degradation of O. stamineus compound by spray drying and microencapsulation method.
- To develop spray drying process to convert the extract O. stamineus into powder solid form.
- To perform microencapsulation technique by encapsulating the bioactive compounds in O. stamineus extract using microencapsulating agent such as whey protein isolate (WPI) and maltodextrin (MD) during spray drying.
To develop spray drying process to extract O. stamineus using ethanol assisted with ultrasonic extraction method.

To optimize the microencapsulation process and minimizing thermal degradation of O. stamineus compound by manipulation the selected parameters.

1.7 Scope of this research

In this study the parameter that will be manipulated during the spray drying microencapsulation are the inlet temperature of air, the size of the nozzle, total solid content, and the ratio of maltodextrin and whey protein. Inlet temperature of air to the spray dryer will be at minimum point of 140 °C to the maximum point of 190 °C. The size of spray dryer nozzle that will be used are 0.5, 1.0, and 2.0 mm. Total solid will be set at 5% and 20%. Initially, the percentage of maltodextrin will be 10% while whey protein is 90%, and the ratio will be changed until the percentage of maltodextrin is 90% and whey protein is 10%. The set of experiment that comes out with the lowest polyphenol degradation is the most optimum for the microencapsulation.

1.8 Organisation of this thesis

The structure of the reminder of the thesis is outlined as follow:

Chapter 2 provides a description of each aspect touched in this research project based on different past research or articles that are available in the literature. The description of the main material of this project, O. stamineus was discussed by many researchers. The flavonoid content, extraction method, microencapsulation method and the optimization which done by them also was reviewed.

Chapter 3 gives a review of the method on carrying out from the early stage of experiments to the end. It goes from extraction, microencapsulation, drying process and analysis of the samples for total solid, particle size distributions and also UPLC analysis after spray drying.

Chapter 4 is devoted to the analysis of the data obtained from the samples. The analysis involved will be total phenolic content, total flavonoid content, and the antioxidant activity.