CHAPTER 1

INTRODUCTION

1.1 Background information

Pennywort (*Centella asiatica*), is locally known as 'Buabok' in Thailand. It is also called Indian Pennywort; Indian Water Navelwort; Asiatic Pennywort; Gotu Kola; Pegaga. It contains triterpenoid saponins, including asiaticoside, madecassoside and their respective aglycones (asiatic and madecassic acids). Pennywort also contains volatile oil, pectin, trace of alkaloids, etc (Department of Medical Sciences, 2007). It has been widely consumed as a health beneficial herb and vegetable because of its content of bioactive compounds. Pennywort has potentially been developed into a range of commercial products (Mohamad Faisal, 2000) such as green tea and Buabok juice. These processed products attract consumers due to the convenience and appeal of the products. Pennywort juice is well-known as a healthy vegetable drink and traditionally available in the form of fresh juice.

Pasteurized pennywort juice has been increasingly accepted in recent years because of its exceptional nutritional properties. It is promoted as a recommended product of One Tumbol One Product (OTOP) by Thai government. The juice is normally kept cool to maintain its flavour and beneficial compounds. As the consumer demand for the juice has been increasing, a more stable form of the juice has been developed. Pasteurization has been applied in the juice production. Haruethaitanasant (1978) reported that some components of this juice were in suspension form and might be precipitated by thermal processing at a temperature of 160˚F (71˚C). However, heat treatment is required to inactivate enzyme activity and destroy the spore-forming bacteria for storage purposes. Moreover, heat treatment is one of the most efficient and economical processes in perishable liquid foods, but it cannot be used to treat heat-labile compounds. Furthermore, high temperature may lead to undesirable effects such as off-flavours, non-enzymatic browning and denaturing of certain vitamins and proteins (Wuytack *et al*., 2002; Vachon *et al*., 2002). There are several alternatives to preserve these compounds from heat damage,

for example ultra-high pressure, freezing and high-temperature short time (HTST) processing.

Nowadays, pasteurized pennywort juice is commercially manufactured in Thailand. It can be obtained in local markets and supermarkets. Extensive research regarding the use of pennywort and its juice production has been carried out since several decades. However, there has not been a report of any novel and safe pasteurized pennywort juice. A novel technique should provide a good quality juice, containing rich flavour, colour and composition like a fresh juice. Therefore, a new processing method for gentle preservation with no or minimal heat treatment is required.

High pressure processing is known as a non thermal method. It is frequently applied in juice processing because of its microbial destruction ability with minimal damage to heat sensitive compounds. This method is capable of securing the freshness and ensures that the nutritive values (vitamin content, biologically active components, etc.) is maintained (Houlka *et al*., 2006). The European Commission (EC) No 258/97 (EC, 1997) has included products obtained by high pressure in the group of novel foods and there are covered under the power of Novel Foods Legislation.

There is a demand from consumers and retailers for minimally processed foods but they must be safe at the same time. Applications of high pressure in food processing ensure the high quality level of the products which should be similar to fresh raw materials. However, because of the higher cost of high pressure processing compared with the existing heat treatment, its applications are limited to high value products. Pennywort is regarded as one of many healthy plant products which contain a high content of bioactive compounds. These compounds are heat sensitive. Therefore, the use of high pressure for pasteurized pennywort juice processing will generate a new natural healthy product. This research is proposed to develop a high quality pennywort juice using an ultra-high pressure technique to maintain its active compounds. Investigations on the effects of high pressure on quality of pennywort juice have been conducted. Various aspects such as influence of processing techniques on total phenolics content: asiaticoside and madecassoside will be the main considerations and their several functional properties of the processed product will be included as major focuses.

Theoretically, processed juice is expected to have a lower health benefit level than the fresh juice, but this research has investigated to what extent ultra-high pressure processing can minimize any undesirable changes.

1.2 Research Objectives

The general objectives of this work are to investigate the effects of extraction, sugar addition and processing on physicochemical properties and microbial quality of pennywort juice. This research will allow the optimum conditions of processing by ultra-high pressure, pasteurization and sterilization to be determined.

Specific research objectives include the following:

1) To investigate the physicochemical properties of fresh pennywort, including some proximate analysis, colour, percentage of yield, pesticide residues, carotenoid content, chlorophyll content, ascorbic acid and active compounds (asiaticoside, asiatic acid, madecassoside and madecassic acid).

2) To investigate the effects of ultra-high pressure, pasteurization and sterilization on microbial quality including total plate count, *Staphylococcus aureus*, *Clostridium perfringens*, *Escherichia coli*, yeasts and moulds of pennywort juice with and without sugar addition.

3) To investigate the effects of ultra-high pressure, pasteurization and sterilization on triterpenes, active compounds including asiaticoside, madecassoside, chlorophyll content, ascorbic acid, total phenolic compounds, ferric reducing antioxidant power (FRAP) assay, pH and total soluble solids of pennywort juice with and without sugar addition.

4) To investigate the effects of storage time on the physicochemical quality including colour, viscosity, pH value, asiaticoside, madecassoside, total phenolics, ferric reducing antioxidant power (FRAP) assay, total soluble solids (TSS), ascorbic acid content (vitamin C), chlorophyll content and microbial quality including total plate count, *S. aureus*, *C. perfringens*, *E. coli*, yeasts and moulds of pennywort juice.

5) To investigate the flavour profiles of pennywort juice (fresh and processed juices).