Chapter 1

Introduction

Lime (*Citrus aurantifolia*) is a favorite ingredient used to accent the flavors in Thai foods and beverages. Several species of citrus lime were investigated in vitamin C, total phenolic, and flavonoid compounds which are sources of natural phytochemical antioxidants. Because of an excellent source of ascorbic acid and its antioxidant activity related to flavoniods, and phenolic contents, lime has many functional health benefits and nutritional properties such as preventing vitamin C deficiency diseases, heartburn and nausea, cooling fever, and easing coughs and reliefing variuos respiratory disorders. Phenolic compounds from citrus lime are reported in the antioxidant capacity. Flavonoids in lime have shown the potency in preventing some forms of cancer. Citrus lime also contains significant quantities of aroma compounds such as camphene and limonene, which are the predominance composition in citrus oils highly found in lime juice. The total antioxidant capacity of these compounds depends on their stability during food processing and storage, including in digestive conditions. Therefore, it is of great interest to transform lime juice into dry powder with preserving their health potential properties and protect their quanlities under undesirable conditions.

1.1 Research problem and its significance

The healthy properties of citrus lime have been attributed to ascorbic acid, and phenolic compounds, mainly to flavonoids. Its health-promoting capacity depends strictly on the processing. There are many processing techniques that must maintain or enhance the nutritional quality of lime juice. Of various processing methods, spray drying is a technique applied to efficiently perform dry sugar- and acid-rich fruit juice with different drying agents due to economical concerns, heat short-contact time, microbial growth inhibition, and storage stability (Largo Avila, Cortes Rodríguez, &

Velásquez, 2015). By means of contacting a drying hot air to evaporate water from small droplet, it diminishes heat sensitive compounds in citrus juice resulting in decreased total antioxidant capacity (Fazaeli, Emam-Djomeh, Kalbasi Ashtari, & Omid, 2012).

The entrapment of antioxidant compounds inside appropriate food-grade drying agents such as maltodextrin, gum Arabic, pectin, modified starch, or cellulose etc. combined with spray drying technique has been pronounced to protect the entrapped core against caking and stickiness, temperature and enzymatic changes. Using only maltodextrin causes caking of dried powder. Gum Arabic has become an entrapment aid for essential oils due to its emulsifier properties. A combination of maltodextrin and gum arabic for encapsulation of polyphenol compounds using spray drying technique, was used well as a combined drying agent. Fang and Bhandari (2012) used low addition rate of protein compare to maltodextrin to minimize the stickiness problem by forming a thin film over the surface of the particles, which consequently reduce the surface adhesiveness among the particles. This process influences good re-constitutional characteristics in terms of particle shape and size, water solubility, hygroscopic phenomenon including physicochemical and functional properties of spray-dried powder.

The excessive use of drying agents causing a portion of the nutrient components change, a whitish appearance, and an off-flavor or medicine-like taste and the conditions of spray drying result in unaccepted and chemical quality changes in the final powder. Drying operations must therefore be carefully optimized to minimize the loss of the dried powder's properties.

1.2 Objectives

The aim of the present study was to develop lime powder utilizing a combination of maltodextrin/gum Arabic and a high shear homogenization in use for spray drying technique and to evaluate the effect of this entrapment process on its physicochemical properties and functionality in terms of color, solubility, hygroscopicity, vitamin C, total phenolic and flavonoid contents, and antioxidant capacity.

1.3 Hypothesis

The entrapment technology with high shear homogenization is hypothesized to encapsulate and protect heat sensitive bioactive components of lime juice through food processing against thermal degradation, aggregation and to maintain their health promoting abilities, which can be applied before spray drying production.

1.4 Expected outcome

The production of spray-dried lime powder utilizing a combination of maltodextrin/gum Arabic and homogenization, which produce lime powder with preventing phytochemical compounds from thermal degradation.

1.5 Scope of research

This research made lime powder using spray-drying technology with the purpose of protecting its nutritional and physical properties. A combination of maltodextrin/gum Arabic as encapsulating agent and homogenization was performed before spray drying to dry fresh lime juice. Spray-dried lime powder was analyzed for moisture content, color, solubility, hygroscopicity, particle size, morphology, vitamin C, total phenolic and flavonoid contents, and antioxidant activity. The production rate and drying agent used were optimized to reach the highest quality of lime juice powder.