CHAPTER 1

Introduction

1.1 Rationale

Vegetables are perishable living products which still alive even after detachment from the parent plant. When produces are harvested, they are cut off from their source of water and nutrition and soon start to deteriorate. They lose quality and potential storage life including weight, texture, flavor, nutritive value and appearance. Produce temperature is one of the most important factors affecting the postharvest life and quality of vegetables which affect the rate of quality loss caused by physiological and biological processes, it is necessary not only to reduce produce temperature but to cool it as quickly as possible after harvest to maintain a level of quality that meet the needs of customers. Precooling is the method for removal of field heat from freshly harvested produce in order to slow down metabolism and reduce deterioration prior to transport or storage (1).

Rapid cooling of the produce helps to prolong its storage life and reduction in the require refrigeration capacity of the storage room. Vacuum cooling is a rapid evaporative cooling method for porous and moisture foods to meet the special cooling requirements, which is achieved through evaporating part of the moisture of the produce under vacuum condition (2). Vacuum cooling has been used as an effective method for precooling certain type of horticultural produces such as vegetables and fruits to prolong their storage life by reducing postharvest thermal deterioration (3). Including other varieties of lettuce, spinach, cauliflower, bok choy, bean sprouts, mushroom, celery, artichokes, green onions, cabbage and other leafy vegetables (4).

Fruit and vegetables are important components of a healthy diet, and daily consumption of them could help prevent major diseases, such as cardiovascular diseases and certain cancers. These beneficial effects of fruits and vegetables have been attributed to non-essential food constituents, which are known as phytochemicals or bioactive

compounds, the biological activity associated when they are usually consumed as part of a normal diet. Generally, these compounds may have an antioxidant capacity (AOC), anti-inflammatory, lipid profile modification and antitumor effects (5, 6). Lettuce (*Lactuca sativa* var. *longifolia*) is one of the most popular vegetables in salads that are consumed in increasing amounts due to their perception as "healthier" foods. The healthy properties are attributed to a large supply of antioxidant compounds (e.g., vitamins C and E, carotenoids, polyphenols) and fiber content. Other phytochemicals of lettuce such as anthocyanins and chlorophylls are contributing to both the sensory and health-promoting properties. Moreover, the nutrient content of lettuce includes useful amount of some minerals such as folates calcium and iron. Artificial neural networks (ANNs) are a set of mathematical methods, often encompassed with artificial intelligence, which in some way attempt to mimic the functioning of the human brain (7). Recently ANNs have received more attention to problem solving algorithms which can perform mapping, regression, modeling, clustering, classification and multivariate data analysis. The flexibility of neural network predestines them to deal with highly non-linear problems and any kind of data. The artificial neural networks are applicable to a number of types of food products quality control, including, wine, beer and other alcoholic beverages (8). Moreover, there are several research were studied about application of artificial neural networks (ANNs) for predicted the qualities change of fresh products during process such as the prediction kinetics of ascorbic acid degradation in asparagus during blanching, predicted the shrinkage percentage and rehydration ratios of dried carrot and predicted antioxidant activity and phenolic compounds contents from banana submitted to different drying treatments. Alternatively, the so-called "electronic tongues" have gained a growing popularity in recent years, especially in the field of food quality control. An electronic tongue is defined as "a multisensor system, which consists of a number of low selective sensors and uses advanced mathematical procedures for signal processing based on the pattern recognition (PARC) and/or multivariate data analysis" (9). The existing literature on electronic tongues is extensive and comprises the combination of different sensors, such as electrochemical, potentiometric, conductimetric, optical, and piezoelectric transducers (10, 11). Coularray can be viewed as an electronic tongue that utilizes the response across adjacent coulometric detectors as a molecular fingerprint. Pattern

recognition procedures can be then applied for the identification of the samples (12-15). Although more than 1000 redox species have been detected with Coularray detector, these reported protocols are somewhat tedious, requiring columns and complex gradient elution profiles (16) . Moreover, Coularray is rarely used with simple flow injection systems and its application as electronic tongue for solving pattern recognition problems is surprisingly unusual. Furthermore, despite the extensive research on pattern recognition, to the best of our knowledge no study has used electronic tongues with Coularray detector for investigating the effects of cooling techniques on lettuce quality

The objective of this study was to investigate the use of vacuum cooling technology as precooling method to reduce temperature of baby cos lettuce and to determine the effect of vacuum cooling on physico-chemical quality as well as bioactive compound of baby cos lettuce during storage. In addition, the study evaluates the possibility of applying artificial neural networks for predict the optimum parameter and quality of baby cos lettuce through the precooling by vacuum system and exploring the effects of different cooling technologies on the resulting quality of lettuce contribute to the growing area of research that is dealing with the rapid method development by electronic tongues.

1.2 Research Objectives

1.2.1 To investigate the optimum parameters for vacuum cooling of baby cos lettuce

1.2.2 To study the effect of vacuum cooling on physico-chemical qualities and bioactive compounds of baby cos lettuce during storage

1.2.3 To determine the possibility of artificial neural networks for prediction of the optimum parameters and qualities of baby cos lettuce using the vacuum cooling system

1.2.4 To explore the effects of different cooling technologies on the antioxidant activity of lettuce by Coularray detector