CHAPTER 1
INTRODUCTION

1.1. Principles, Theory, Rationale and Hypotheses

Orange juice is one of the popular fruit juices in Thailand. Thai consumers like this juice because of its high vitamin C content and the unique, delicate and desirable flavour. Orange juice is reported to be a source of carotenoids, pro-vitamin A. Consumption of this vitamin has been correlated with a reduction in the incidence of certain cancers (Vinson *et al.*, 2002). In Thailand, orange juice is usually purchased in glass jars, cans or flexible containers that are kept in refrigerators or in boxes containing ice cubes as low temperature storage. Consumer's demand for food products that inherent superior sensory and nutritional qualitities have always been rising. The recent trends show that the consumer preference towards a non-pasteurised orange juice is increased due to its superior taste, aroma and nutritive values. However, the juice is less stable during storage and may become unsafe due to the growth of food-born and spoilage bacteria. The shelf life of an unpasteurised orange juice is 12 days at 4.4°C (Fellers, 1988). The orange juice itself is susceptible to chemical and microbial degradation by heat, microorganisms, enzymes, oxygen, and light during processing and storage.

Nisin is a bacteriocin that is produced naturally from a microbial fermentation and has an antimicrobial activity against some bacteria. It is a peptide made by a bacterium called *Lactococcus lactis* subsp. lactis and is reported to be effective in controlling Gram-positive bacteria, including *Bacillus*, *Clostridium* and *Listeria.* Therefore, several scientific researches have been conducted for the bacteriocin to be used as a preservative in food products that have problems from these bacteria. Generally, nisin is applied to improve the keeping quality of some heat processed and low pH foods.

Nisin was awarded as a Generally Regarded as Safe (GRAS) compound by the U.S. Federal Register on April, 1988 and has been approved as a permitted food

preservative in the United States. The compound is also allowed to be used as a preservative in more than 48 other countries, including the Food and Agriculture Organization/World Health Organization (FAO/WHO) and the European Union (Thomas *et al.*, 2000).

The purpose of this study is to improve the keeping quality of orange juice by an application of nisin. Although nisin has been widely studied in milk and milk products, but in the area of fruit juices there is still a demand to have more research. It has also been calculated that the addition of nisin in orange juice will only add the orange juice producers an approximate cost of 0.0025 baht/ml or 0.625 baht for 250 ml orange juice. However, before applying nisin in orange juice, it is also necessary to have a clear understanding about the desirable characteristics of the orange juice and their spoilage problems in order to effectively maximize their superior quality while at the same time minimizing the problems through processing. Changes in the orange juice quality are particularly important to be understood, so the research activities can be concentrated to produce a high quality orange juice that were attractive and valuable for its consumers.

This project also carried out because of the concern of consumers about synthetic chemicals that are normally used as preservatives to increase the shelf life of fruit juices. At the same time, there is a trend to reduce the intensity of heat treatment that are given to food products. Although applying a mild heat treatment, such as pasteurisation, will increase the safety of pasteurised food products, the products still have a limited shelf life and need to be combined with a low temperature storage. In order to extend further the shelf life of orange juice the project proposes to use a natural antimicrobial compound, nisin. The compound has been shown to be effective against Gram positive bacteria, including *Lactobacillus* and *Leuconostoc*, which are the spoilage microorganisms in orange juice. Beside that, nisin is also safe for human consumption because it can be degraded by enzymes. Although nisin is reported not to have a direct effect against *Salmonella*, a pathogenic microorganism that is associated with orange juice, the presence of nisin during a pasteurisation process may enhance the chances to kill the bacterium. In addition, some countries, such as Papua New Guinea, permit the use of nisin in tomato products, including canned tomato juices (Thomas *et al.*, 2000). Therefore, applying nisin to improve the

keeping quality of orange juice was a good option to prolong the shelf life of orange juice. It is the objective of this research to maintain the high quality of orange juice, either fresh and frozen, based on their sensory, chemical and microbiological characteristics by applying nisin.

1.2 Research objectives

1) To study the specific physical, chemical, microbiological and sensory properties of the fresh orange juice from cv. Sai Nam Pung and cv. Khieo Waan after harvest and during their storage periods at different storage temperatures.
2) To study the shelf life of orange juice at 4, -18°C, and room temperature.
3) To study the effect of storage condition on carotenoids contents in orange juice.
4) To study the combination effect of nisin and pH values on the effectiveness against spoilage microorganisms and quality of orange juice.

1.3 Useful of the Research

1) The study will extend the shelf life of fresh orange juice by the addition of nisin, which benefit the orange juice companies in expanding the product's distribution period.
2) The study will increase the safety of orange juice.
3) The study will extend marketing of oranges.

1.4 Research Location

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