Chapter 1: Introduction

A number of climbing cacti species have been introduced as potential fruit crops (Nerd and Mizrahi, 1997). Among these species, hemiepiphytic cactus under *Hylocereus* genus (Britton and Rose, 1963) is highly appreciated in Mexico because of its ornamental value. The plants of this new fruit crop grow up tree trunks and are anchored by aerial roots. The fruits have red thornless skins, while the juicy flesh can range from white to magenta (Le *et al.,* 2000). The seeds are small and are consumed with the flesh. The fruit can weigh up to 900 grams, but the average weight is between 350 and 600 grams (Le *et al.,* 2006).

At present, *Hylocereus* sp. is being cultivated for fruit production in many countries ranging from Australia, Israel, Japan, New Zealand, Spain to the southwestern United States (Nerd *et al.,* 2002) and also expanding to several parts of Asia such as Vietnam, Taiwan, the Philippines and Malaysia (Mizrahi *et al.,* 1997). In Asia, this fruit is often called ‘‘dragon fruit” following its bright red skin with overlapping bracts covering the fruit. In Malaysia, the two common fruit cultivated are *H. polyrhizus* (red peel and red-fleshed) and *H. undatus* (red peel and white-fleshed).

Two research groups have looked at the ripening and harvest times of dragon fruit (Le *et al.,* 2002; Nerd *et al.*, 1999) and have found that the optimal time to harvest *H. undatus* fruit grown in the dry region of Israel, was 28 to 30 days after anthesis which corresponds to full colour development. It was reported that dragon fruit is a non-climacteric fruit based on the absence of a high peak of respiration (Nerd *et al.,* 1999) and as for the sugar level it is higher in white-fleshed dragon fruit (*H. undatus*) compared to red-fleshed (*H. polyrhizus*) (Wu and Chen, 1997).

Variation of postharvest fruit quality is a natural phenomenon that occurs due to many factors such as pre-harvest conditions, cultivars, postharvest handling but is mainly due to harvest maturity. During fruit ripening, many processes are involved in changing mature fruit into edible fruit for consumption (Prasanna *et al.,* 2007). One of the issues concerning harvest maturity is the acceptable eating quality and ability to withstand long shelf life. Therefore, harvesting at the proper stage of maturity is important to accomplish fruit quality maintenance during postharvest storage. Features such as peel colour, firmness and organoleptic properties are measured to determine the fruit quality. Although immature fruit may ripen off-tree, it would not be able to attain high fruit quality as opposed to mature fruit which will ripen off-tree with better quality (Kader, 1999). Hence, one of the aspects that are investigated in these studies is about the affect of maturity for harvesting on the quality of the fruit.

Generally, one of the main alterations that occur in fruit that leads to edible fruit quality is fruit softening which is regarded as firmness loss. However, in most perishable fruit, softening can also lead to poor postharvest handling due to its susceptibility to physical injuries and pathogen. Disassembly of major structural polysaccharides in cell wall during ripening contributes to the fruit softening (Seymour and Gross, 1996) and modifications to the pectin fraction are some of the most apparent changes that take place in the cell wall during ripening (Marin-Rodriguez *et al.,* 2002). The general observation is that softening is accompanied by activity of ripening - related enzymes (White, 2002). Nevertheless, the type and magnitude of the softening processes carried out during ripening vary depending on species, and differences in cell wall thickness and composition, cell size, shape, packing, contents, and turgor (Harker *et al.,*1997).

Therefore, the main reaction that involve in fruit softening is profiled in this study by looking into the four main enzymes activity which are correlated with fruit ripening.

The changes in physiology and biochemistry are of concern for the understanding of metabolic processes of the particular fruit. This development provides base line information of the fruit in order to proceed to the maintenance of the fruit quality during postharvest storage (Wills *et al.,* 1998). Subsequent to that, optimum storage conditions were introduced for maintaining fruit quality after harvest.

Most of the biochemical reactions that take place during ripening such as respiration, starch-sugar conversion, biosynthesis of pigment and degradation of chlorophyll are temperature dependent thus manipulating storage temperature is of utmost importance. The major part of fruit response during ripening which is controlled by temperature is respiration. At high temperature, rate of respiration tends to increase and thus lead to faster deterioration of the fruit. Low temperature storage is regarded as the most effective storage to maintain fruit quality and prolong shelf life (Roura *et al.,* 2000; Watada, 1996). However, temperature effects depend on the exposure duration to the particular temperature and also the postharvest age of the fruit. Therefore, choosing the best harvest maturity in combination with adequate storage temperature is required to prolong marketing period as well as maintaining fruit quality.

Apart from manipulating storage temperature, modifying atmosphere also can contribute to the effectiveness of the fruit quality maintenance (Kader and Watkins, 2000). Modified atmosphere created by lowering the oxygen level or increasing the carbon dioxide level from the normal air consequently decreases the rate of deterioration and prolongs the shelf life of fresh fruit (Kader and Watkins, 2000). On the other hand, vacuum packaging of fruit has been studied as part of modifying atmosphere in which the air is pulled out from a package (Catherine, 2002). The creation of low oxygen atmosphere within the package will reduce deterioration by two ways; firstly by reducing respiration, hence overall biochemical reactions at the cellular level are decreased (Ke *et al*, 1991) and secondly by reducing microbial growth thus reducing infection and pathogen attack (Carol, 1996). Thus, in this study, determination of the optimum storage temperature for *H. polyrhizus* was also carried out.