CHAPTER 1

INTRODUCTION

One of the symptoms of senescence in harvested horticultural crops is the loss of greenness that comes with the degradation of chlorophyll (Chl). With senescence, the chlorophyll-degrading enzyme activities such as chlorophyllase (Chlase) (Shimokawa et al., 1978; Amir-Shapira et al., 1987), Mg-chelatase (MD) or Mg-dechelation activity (Langmeier et al., 1993; Kaewsuksaeng et al., 2010), a new chlorophyll-degrading enzyme, pheophytinase (Schelbert et al., 2009), pheophorbidase and chlorophyll-degrading peroxidase (Yamauchi et al., 2004), which are involved in chlorophyll degradation, affected greatly in stored horticultural crops. The chlorophyll derivatives, especially chlorophyllide (Chlide), pheophytin (Phein), pheophorbide (Pheide) and $C13^2$-hydroxychlorophyll are accumulated as intermediates of chlorophyll degradation. In addition, chlorophyll degradation by the chlorophyll-degrading enzymes seems to occur in the thylakoid and envelop membrane of chloroplast and/ or the vacuole.

Qualities in limes (Citrus latifolia Tan. and Citrus aurantifolia Swingle cv. Paan) deteriorate quickly after harvest. The most visible deterioration factor is the loss of peel greenness that usually occurs together with Chl degradation (Drazkiewice, 1994; Srilaong et al., 2011). Maintenance of the green colour in the peel of lime is desirable during storage.

An early step of Chl *a* degradation seems to be the removal of the side chain attached to the tetrapyrrole macrocycle to form Chlide *a* by chlorophyllase (Chlase). Chlide *a* formed still retains a green color (Shimokawa et al., 1978; Amir-Shapira et al., 1987). The elimination of Mg^{2+} from Chlide *a* to produce Pheide *a* is induced by a Mg-

dechelatase (MD) (Langmeier et al., 1993; Kaewsuksaeng et al., 2006, 2007) or Mg-dechelating substance (MDS) (Shioi et al., 1996; Aiamla-or et al., 2010; Kaewsuksaeng et al., 2010), and the Pheide *a* formed loses its green color. Finally, Pheide *a* is decomposed to fluorescent Chl catabolites, which are primary colorless, via a red Chl catabolite by both Pheide *a* oxygenase and red Chl catabolite reductase (Matile et al., 1999). Chl-degrading peroxidase (POX) (Yamauchi et al., 2004; Kaewsuksaeng et al., 2007) is also suggested to be involved in Chl degradation as the first step enzyme with oxidizes Chl *a* to form 13^2-hydroxychlorophyll *a*. In addition, a new Chl degrading enzyme, pheophytinase (pheophytin pheophorbide hydrolase, PPH) which would dephytylate the Mg-free Chl pigment, Phein *a* to give Pheide has been recently reported (Schelbert et al., 2009).

The UV treatment as an advance technique is required to maintain in postharvest quality of horticulture crop in order to delay the Chl degradation. UV-C, especially, seems to be effective in maintaining postharvest quality of strawberries (Erkan et al., 2008) and in inhibiting Chl degradation in stored broccoli florets (Costa et al., 2006a). Aiamla-or et al. (2010) found that UV-B treatment effectively delayed Chl degradation of broccoli during storage. Srilaong et al. (2011) also reported that UV-B treatment effectively suppressed Chl degradation and retarded the reduction of the Chl derivative levels in mature green lime during storage.

The heat treatment is frequently used to maintain the postharvest quality of many horticulture crops. Much research has been performed on the maintenance of quality in heat-treated citrus *nagato-yuzukichi* fruit (Yamaguchi et al., 2003), broccoli (Funamoto et al., 2002; Kaewsuksaeng et al., 2007), leek (Tsuvaltis et al., 2006) and celery (Viňa and Chaves, 2007).

However, the effect of the UV-B on Chl-degrading enzymes activities and postharvest quality in lime fruit has not been determined. In this paper, we therefore examined the effect of UV-B irradiation on Chl-degrading enzymes activities and the resultant quality control.

Moreover, the effect of the heat treatment on postharvest quality in lime fruit has not been yet applied. We, therefore, examined the effect of hot water treatment on Chl degradation with Chl-degrading enzyme activities changes. We also evaluate the physiological changes and the resultant quality control during storage in heat-treated lime.

Objectives

1 To study the mechanism of chlorophyll degradation in lime fruit.

2. To study the effect of UV-B irradiation on chlorophyll degradation and postharvest quality of lime fruit.

3. To study of effect of heat treatment on chlorophyll degradation and postharvest quality of lime fruit.