

ผลของระยะความแก่แตกต่างกันและระยะเวลาเก็บรักษาต่อสารต้านอนุมูลอิสระในพริกชี้ฟ้าใหญ่
Effect of Different Maturity Stages and Storage Time on Antioxidants
of Chi-Fah Yai (*Capsicum annuum*) Fruits

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บทคัดย่อ

พริกสดที่มีขายในตลาดต่างๆ ของประเทศไทยมีหลากหลายชนิดทั้งสี ขนาดและสารออกฤทธิ์ทางชีวภาพสำคัญต่างๆ ภายใตผล ดังนั้นการทดลองนี้จึงมีวัตถุประสงค์เพื่อตรวจสอบปริมาณและศักยภาพของสารต้านอนุมูลอิสระในพริกที่มีชื่อเสียงของไทยคือพริกชี้ฟ้าใหญ่ทั้งจากระยะความแก่ที่แตกต่างกัน (ระยะ 1 ถึง 5) และระยะเวลาเก็บรักษาที่อุณหภูมิห้อง ผลการทดลองพบว่าปริมาณสารประกอบฟีนอลในพริกชี้ฟ้าใหญ่จะเพิ่มขึ้นจากระยะอ่อนไปแก่ ในขณะที่พบปริมาณฟลาโวนอยด์มากในผลระยะที่ 1 และระยะ 5 ความสามารถในการต้านอนุมูลอิสระ (DPPH free radical scavenging activity) ลดลงเมื่อผลพริกมีระยะการเจริญที่มากขึ้น นอกจากนี้เมื่อเก็บรักษาผลพริกนานขึ้น ปริมาณฟลาโวนอยด์ลดลงอย่างเห็นได้ชัดเจน ในขณะที่ปริมาณสารประกอบฟีนอลและความสามารถในการต้านอนุมูลอิสระ (DPPH free radical scavenging activity) ค่อยๆ ลดลง

คำสำคัญ: สารต้านอนุมูลอิสระ, พริกชี้ฟ้าใหญ่, ระยะเวลาเก็บรักษา, ระยะแตกต่างกัน

Abstract

There are many kinds of fresh *Capsicum* fruits in Thai local markets which generally have different sizes, colors and the bioactive compounds in the fruit. So, the purpose of this experiment was to determine the amount of antioxidant capacity and bioactive compounds in a well known Thai *Capsicum* (Chi-fah Yai) fruits from both different maturity stages (stage 1 to 5) and storage duration at ambient temperature. The results exhibited that phenolic content in Chi-fah Yai fruits increased from young to mature stages while the high amount of flavonoids was found in stage 1 and 5. The DPPH free radical scavenging activity decreased when fruits had more developmental stages. After the storage time proceeded, the number of flavonoids obviously dropped whereas phenolic content and DPPH free radical scavenging activity gradually declined.

Keywords: antioxidants, *Capsicum annuum*, storage duration, different stages

Introduction

Recently, antioxidants are obviously boomed for human health which most sources of these substances are produced from several plant parts or fruits (Sharma *et al.*, 2013; Arshiya, 2013). Vitamins, phenolics and flavinoids are concerned as antioxidants (El-Ghorab *et al.*, 2007). Traditional Thai food normally predominates with many kinds of spices such as chili, pepper, ginger and galangal. Among them, Thai *Capsicum* fruit that contains capsaicin, pungency taste, is the most popular one. The *Capsicum* in Thai market places is generally sold not only in different cultivars but also at various fruit maturity stages (color considering). Those differences in varieties and maturity stages influence the capsaicin content (Noichinda *et al.*, 2012a). Chi-fah Yai, *Capsicum annuum* cv. Jakkapad, is less pungency variety commonly using for cooking as curry or stir fry with other vegetables. We normally find this *Capsicum* cultivar varying in fruit color (green to red) in the market. Many kinds of Thai *Capsicum* fruits enrich with antioxidant substances i.e. phenolics and flavonoids, for example Chi-fah Lueang

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(Noichinda *et al.*, 2012b). It seems that those antioxidants were changed due to fruit maturity and storage time (Ozgur *et al.*, 2011; Zhuang *et al.*, 2012).

Thus, the aim of this research was to investigate antioxidant substances: phenolics and flavonoids and its ability in Chi-fah Yai at different maturity stages and their change after harvest at ambient temperature.

Materials and Methods

Green to red color stages of 'Chi-fah Yai' fruits were bought from Talad Thai (wholesale market) in Khlong Luang district, Pathum Thani Province, Thailand. Uniformity fruits were divided into two groups: group 1 contained various fruit colors from green to red in 5 stages (Figure 1A) and only green stage of fruit was in group 2. Afterward, 'Chi-fah Yai' group 1 was investigated for phenolics and flavonoids according to Chang *et al.* (2002) and Singleton *et al.* (1965) and DPPH free radical scavenging activity (Shimada *et al.*, 1992) while group 2 was kept at ambient room until its color change (to stage 2, 3, 4 and 5). Then, it was analyzed for antioxidant substances such as phenolics and flavonoids and anti-oxidative activity as mentioned earlier in group 1.

Results and Discussion

From the present experiments, it was revealed that different maturity stages had the influence on antioxidant content and its ability in 'Chi-fah Yai' fruit. This *Capsicum* variety synthesized more phenolics during fruit color developed *in situ* from green to red (Figure 1B). This was possible according to more accumulation of capsaicin (a kind of phenolic compound) when fruit ripening (Noichinda *et al.*, 2015). For flavonoid content, it was highest in mature-green stage and reduced in color breaking stage, then slightly increased until fully red stage (Figure 1C). The result also showed that the ability of antioxidant declined in color breaking stage and increased a little in reddish-orange fruit (stage 4), followed by sharply decreased in dark red fruit stage (Figure 1D).

The phenolics in Chi-fah Yai fruit reduced in accompany with peel color developing after harvest (Figure 2 A and B) that agreed with Estrada *et al.* (2000) report whereas flavonoids obviously decreased after storage for one day and then remained until fruit peel color was fully red. The outcome of DPPH ability revealed that the ripening of green stage fruit at ambient room had higher activity than those on tree ripening (Figure 1D and 2D). Therefore, it depends on the purpose of consumer. If the high phenolics and flavonoids are required, we should consume Chi-fah Yai fruit that ripened on tree. On the contrary, the stored Chi-fah Yai fruit is demanded in case that we preferred more antioxidant ability.

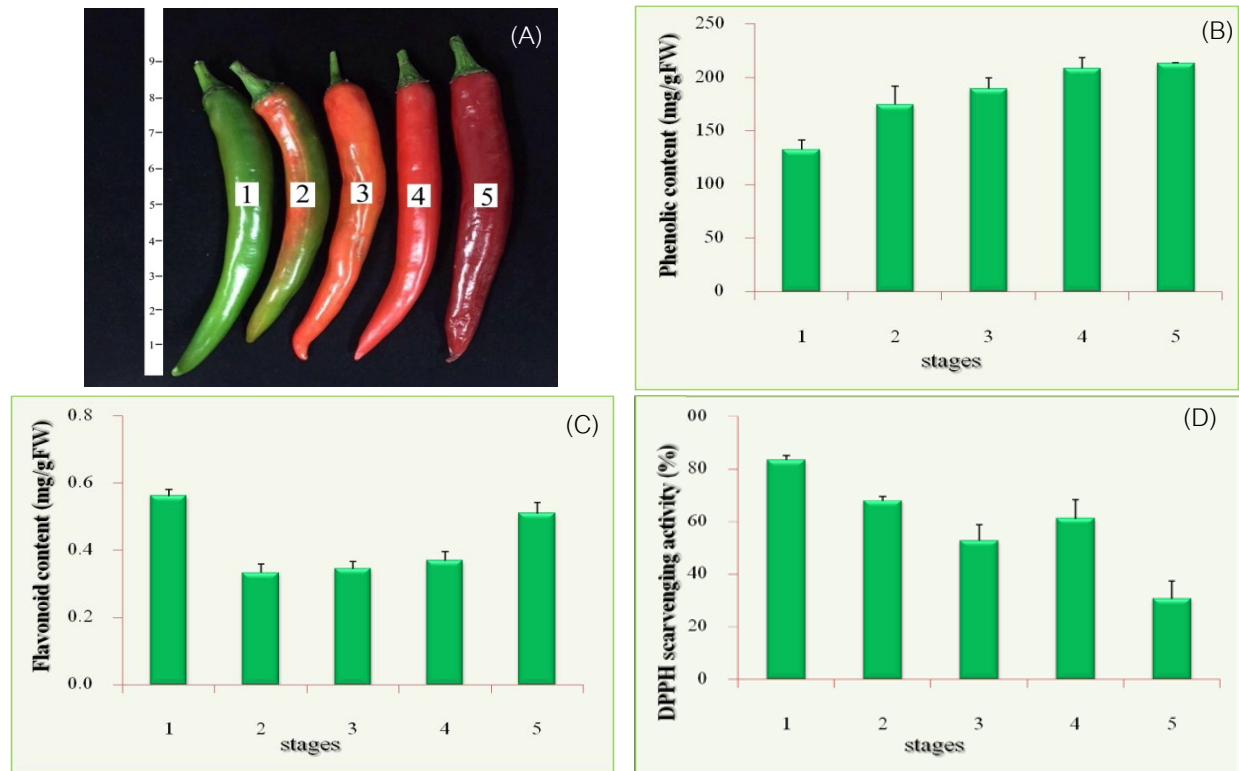


Figure 1 Chi-fah Yai fruits at differ maturity stages: 1, 2, 3, 4 and 5 (A), phenolic content (B), flavonoid content (C) and %DPPH scavenging activity (D)

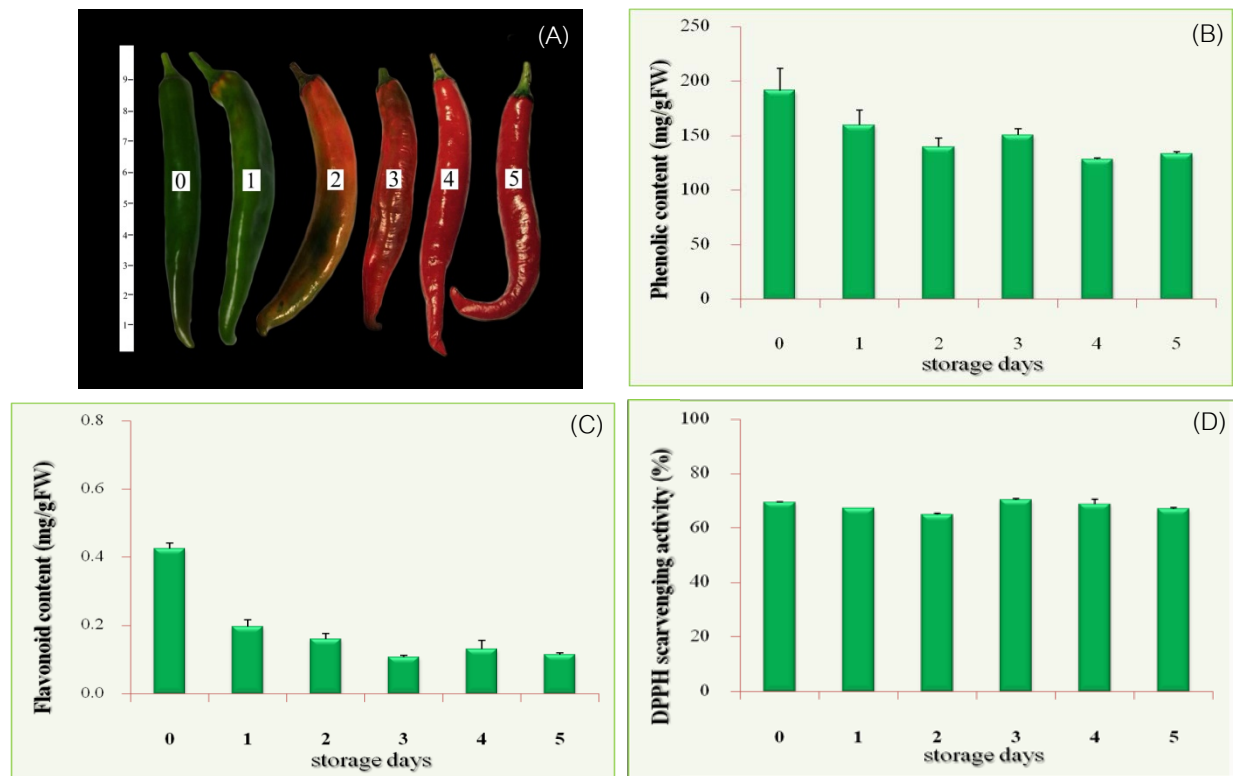


Figure 2 Chi-fah Yai fruits after storage for 5 days (A), phenolics content (B), flavonoid content (C) and %DPPH scavenging activity (D)

Conclusion

Phenolic content continuously increased throughout the fruit ripening on tree whereas the phenolics in harvested green stage fruit decreased during ripening at ambient room. Likewise, flavonoid content in tree ripe fruit was higher than those of ambient room ripe fruit as well. For DPPH scavenging activity, the average of antioxidative activity from the ambient room ripe fruit was noticeably better than those of tree ripe fruit.

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