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Impact of Thermovinification on Quality of Pitaya (*Hylocereus polyrhizus*) Wine

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Thermovinification is becoming more popular in the fruit wine production. Pitaya pulp was mashed and heated at 60/30, 65/28, 70/26, 75/24, 80/22, 85/20 (ºC/min) as thermovinification before fermentation under aerobic condition for 11 days at 28÷2ºC. After 6 months of ageing, total phenolic, flavonoid and sensory characteristics of pitaya wine were examined thoroughly. Results revealed that thermovinification (75/24, ºC/min) of pitaya must yielded significant difference in total phenolic, flavonoid and overall acceptance of wine. However, there was not significant difference in ethanol formation by thermovinification. This research created an ideal reference for making other phenol-rich fruit wines.

Keywords: Thermovinification, pitaya wine, phenolic, flavonoid, alcohol, overall acceptance

INTRODUCTION

Thermovinification attacked the hypodermal cell membranes and released the phytochemical constituents inside fruit tissues (Sacchi et al. 2005; Hanamantet al.2015). It can produce fruity red wines with soft tannins (Geffroy et al. 2015). It was proven to promote the extraction of phenolic and pigments from grape, strawberry, cranberry and jamun to produce better aroma wine quality (Zimmer et al. 2002; Somesh et al. 2009; Atanacković et al. 2012; Hanamant et al.2015). Pitaya (*Hylocereuspolyrhizus*) or dragon fruit was a rich source of nutrients and phytochemicals (Ruzainah et al. 2009). It had a great source of vitamins, minerals and dietary fibers. Due to containing numerous phytochemicals, it's highly appreciated for its anti-inflammatory, antimicrobial and antioxidant properties with healthy benefits for human diet (Mahattanatawee et al. 2006; Gian et al. 2012; Tenore et al. 2012; Luo et al. 2014; Suh et al.2014; Choo et al. 2016). Citramalic acid was the dominant organic acid in pitaya fruit (Yawei et al. 2020). This substance was involved in the branched-chain amino acid biosynthesis pathway acting as an acid catalyst for the Trans esterification reaction (Ilham and Saka, 2009; Leroy et al. 2015). Its abundent anthocyanin content may provide protection against certain oxidative stress-related disorders (Wu et al. 2006). It had powerful capacity to innovate an alternative plant-derived anxiolytic therapy (Sandra et al. 2020). Objective of our research evaluated the effects of thermovinification on total phenolic, flavonoid, alcohol and organoleptic attributes of pitaya wine.

MATERIALS AND METHODS

Material

Pitaya fruitswere collected from TienGiang province, Vietnam. After collecting, they were subjected to washing and treatment.The fruits were peeled by sharp knife. They were cut into small pieces. These fruit pulp was thenpressed by a screw extractor.

Researching method

The mashed pitaya pulp was heated at 60/30, 65/28, 70/26, 75/24, 80/22, 85/20 (ºC/min) as thermovinification. The must was poured into fermentation flask, adjusted to 22°Brix by sugar, fermented with 0.15% yeast under aerobic condition for 11 days at 28÷2°C. The wine was filtered, kept in dark glass bottle with cork, pasteurized at 61.5°C for 12 minutes. The bottles were preserved at 10±0.5°C as ageing. After 6 months, these bottles were sampled for chemical analysis and sensory evaluation.

Chemical and sensory analysis

Total phenolic content (mg GAE/100g) was determined through the HPLC method described by Cristina et al. (2015). Aluminum chloride colorimetric method was used for flavonoids (mg QE/100 g) quantification (Mandal et al. 2013). Alcohol content (%v/v) was determined using a flow-through infrared sensor (Dirk et al. 2010). Sensory score was evaluated by a group of panelist using 9 point-Hedonic scale.

Statistical analysis

The experiments were run in triplicate with three different lots of samples. The data were presented as mean±standard deviation. Statistical analysis was performed by the Statgraphics Centurion version XVI.

RESULTSAND DISCUSSION

Benefits of thermovinification include the limitation in the microbial contamination, inhibition of undesirable enzymes, efficient extraction of phytochemicals and time reduction in winemaking (Kourkoutas et al. 2004; Nathália et al. 2014). In our research, total phenolics of pitaya wine was significantly influenced by thermovinification (figure 1). The highest total phenolic content (287.7 mg GAE/100g) was noticed at thermovinification at 75°C for 24 minutes. Meanwhile, the lowest total phenolic content (135.19 mg GAE/100g) was achived by thermovinification at 60°C for 30 minutes. These findings are in agreement with the red wine making using thermovinification by heating grape must to 70–75 °C for 30 min to 24 h before fermentation (Geffroy et al. 2015).

Total flavonoid content of pitaya wine was significantly influenced by thermovinification (figure 2). The highest total flavonoid content (102.03 mg QE/100g) was noticed at thermovinification at 75°C for 24 minutes. Meanwhile, the lowest total flavonoid content (22.01 mg QE/100g) was achived by thermovinification at 60°C for 30 minutes. The thermovinification contributed to increased extraction of pigments especially anthocyanins responsible for phenolic stability during aging of wine (Sacchi et al., 2005). Heat treatment at 70 °C increased the anthocyanin extraction frompomace (Ngamwonglumlert et al. 2017; Silva et al. 2017).

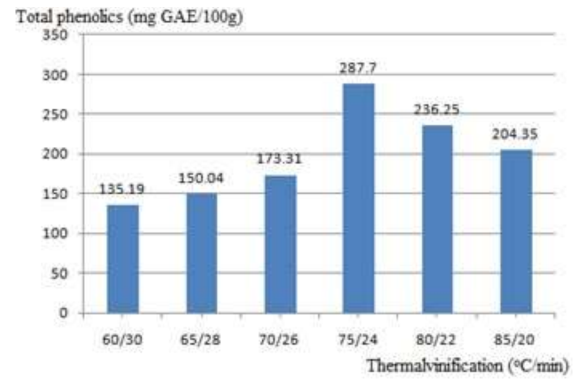

Figure 1: Effect of thermovinification (°C/min) to total phenolics (mg GAE/100g) in pitaya wine

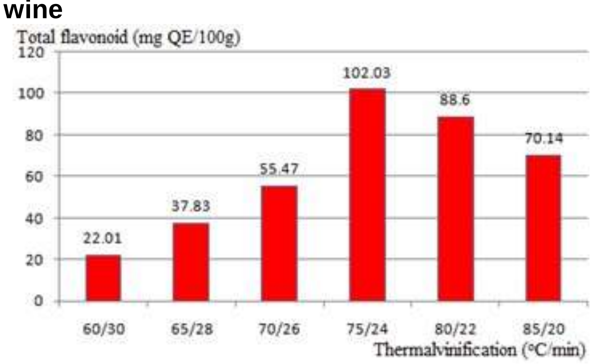

Figure 2: Effect of thermovinification (°C/min) to total flavonoid (mg QE/100g) in pitaya wine

There was no significant difference in ethanol formation by thermovinification (figure 3). High temperatures were applied regularly to advance extraction efficiency as it improved solvent penetration, compound diffusion, and solubility (Ngamwonglumlert et al. 2017; Silva et al. 2017). Thermovinification could reduce maceration time effectively (Marcos et al. 2019).

Overall acceptance of pitaya wine was significantly influenced by thermovinification (figure 4). The highest sensory score (8.24) was noticed at thermovinification at 75°C for 24 minutes. Meanwhile, the lowest overall acceptance (7.3) was achived by thermovinification at 60°C for 30 minutes. Samples with higher phenolic compounds were correlated with higher preference in sensory (Jingyinget al. 2019).

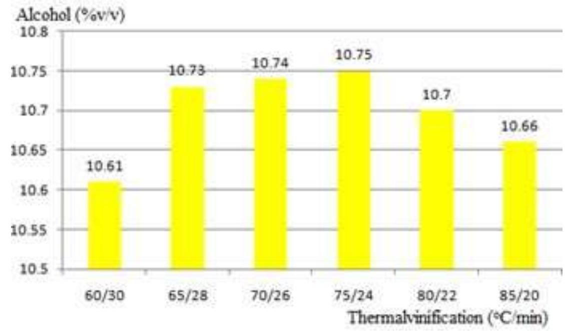

Figure 3: Effect of thermovinification (ºC/min) to ethanol formation (%v/v) in pitaya wine

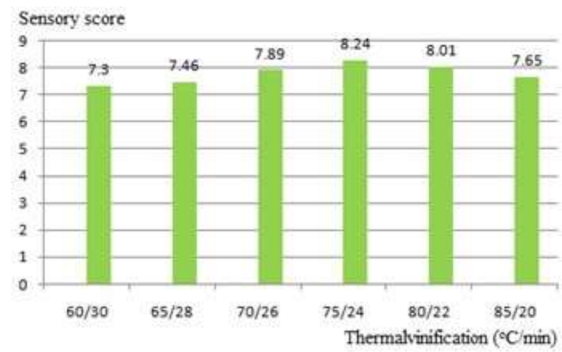

Figure 4: Effect of thermovinification (ºC/min) to overall acceptance (sensory score) in pitaya wine

Heating also denatured enzymes such as polyphenol oxidase, thereby preventing browning. Wines obtained by thermovinification were not usually used for aging (Marcos et al. 2019).

CONCLUSION

Thermovinification was a promising alternative to the traditional maceration processes for extracting pigments present in the fruit skin. This research investigated the influence of thermovinification on total phenolic, flavonoid, and alcohol and organoleptic attributes of pitaya wine. Higher phenolic contents in must resulted in higher phenolic retention in wine. Total phenolics and flavonoids are significant factors on wine quality. This research would be an ideal reference for making other phenol-rich fruit wines.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Nguyen Phuoc Minh arranged the experiments and also wrote the manuscript.

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