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Production of Formulated Juice Beverage from Soursop and Grapefruit

Nguyen Phuoc Minh

Faculty Faculty of Food Technology - Biotech, Dong A University, Da Nang City, Vietnam
**Corresponding author*

Abstract

Soursop and grapefruit are two kinds of fruit which contained numberous valuable compounds for human health. Soursop is prized as its very pleasant, sub-acid, aromatic and juicy flesh. Meanwhile grapefruit is known for its sour to semi-sweet somewhat bitter fruit. However these raw fruits are normally consumed in fresh appearance. With the purpose to enhance the added value of these ones, we conducted one research to create a new formulation of the concentrated fruit juice beverage from soursop juice and grapefruit peel. Our results showed that ratio of soursop juice: water (30%:70%), grapefruit peel supplementation (15%), carrageenan 0.3%, and final beverage concentration (65^{o}Bx) were approriated for its preservation. Further investigation should be focused on shelf-life and packaging for consumer attraction.

Keywords: Soursop, grapefruit, beverage, supplementation, concentration, formulation

INTRODUCTION

Soursop (*Annona muricata*) and grapefruit (*Rutaceae*) are important tropical fruits those contribute to the economic growth of some tropical countries, including Vietnam. Soursop is prized as its very pleasant, sub-acid, aromatic and juicy flesh. Meanwhile grapefruit is known for its sour to semi-sweet somewhat bitter fruit. Grapefruit peel is rich of polyphenols and exhibit high antioxidant activity *(*M. Karsheva et al., 2013). The soursop pulp is widely used for manufacturing various juice blends, nectars, syrups, shakes, jams, jellies, preserves and ice creams. Grapefruit flesh can be juiced, canned or frozen; the skin can be dried or sugared or used for the production of oils; the white membranes are used for pectin production.

Raphael N Okigbo and Omokaro Obire (2009) conducted on the mycoflora associated with the different parts of fresh and rotten fruits of soursop (*Annona muricata* L.) and the potential of using both indigenous yeast flora and commercial yeast extract for wine production. Sunday P. Ukwo, Chidi F. Ezeama (2011) investigated the proliferation of acetic acid bacteria during various stages of soursop juice fermentation. Preliminary experiment was carried out to identify the genera and species of acetic acid bacteria associated with soursop fruits. The effect of pH, temperature and momentary aeration on the growth of acetic acid bacteria and its effect on the growth of *Saccharomyces cerevisiae* were studied. Imade, E.E. *et al*. evaluated the changes in the microbial profile, physico-chemical and nutritional attributes during the bioconversion of soursop (*Annona muricata*) must to wine. Soy-based beverages which were formulated with soy protein isolate (SPI) and soursop juice were conducted by Luiz Henrique Fasolin and Rosiane Lopes da Cunha (2012). In this research, they concluded that soybean soluble polysaccharide was effective in stabilizing fibers and proteins in acidic suspensions due to the increase in viscosity and steric effect caused by the formation of complexes between the soybean soluble polysaccharide and soy protein isolate. Nwachukwu, E. and Ezeigbo, C.G. (2013) investigated the microbial quality of locally produced soursop juice and the effect of pasteurization, acidification and chemical preservative on the juice. I.E. Mbaeyi-Nwaoha, C.N. Ajumobi (2015) carried out a production and microbial evaluation of table wine from tamarind (*Tamarindus indica*) and soursop (*Annona muricata*). In 2015, Nguyen Phuoc Minh approached one production of fermented beverage from soursop fruit. He focused on the investigation of technical factors affecting to soursop juice fermentation.

In respect of grapefruit studies, there were several approaches. Abdel Moneim E. Sulieman et al. (2013) extracted of pectin from lemon and orange fruits peels and its utilization in jam making. M. Karsheva et al., (2013) compared some citrus fruits' peels: mandarins and grapefruits, as sources of polyphenolic compounds, to determine the antioxidant activity of the extracts and to fnd the effect of the operational conditions on the fnal extract properties. Khan, A. A. et al. (2015) performed one research of extraction and characterization of pectin from grapefruit (*Duncan cultivar*) and its utilization as gelling agent.

Soursop and grapefruit are available in Mekong delta region. However these raw fruits are normally consumped in fresh appearance. With the purpose to enhance the added value of these ones, we conducted one research to create a new formulation of the concentrated fruit juice beverage from soursop juice and grapefruit peel.

MATERIAL & METHOD

Material

We collected soursop and grapefruit fruits in Mekong River Delta, Vietnam. They were in ripening stage without rotten or

damage. Apart from raw fruits, we also used water, refined sugar, $CaCl_2$, carrageenan and pectinase for this investigation.

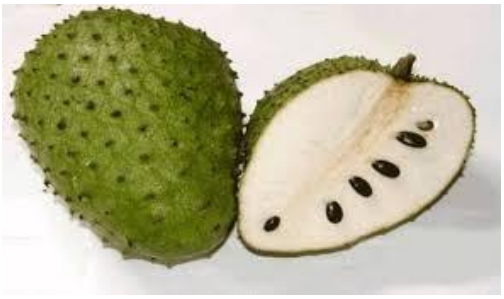

Figure 1: Soursop pulp and grapefruit peel

Research method

Investigation of soursop pulp compose with water

Soursop pulp was treated with pectinase 0.15% and hydrolized in 40°C in 60 minutes. After hydrolization, treated soursop pulp was crushed to get its juice. Each sample was 500 gram. Combination of soursop juice with water was investigated in different formulas A_1 (20%:80%); A_2 (30%:70%); A_3 (40%:60%); A_4 (50%:50%); A_5 (60%:40%). Carrageenan was added with 0.2%. Soursop pulp was then homogenized in 20 minutes. Then we added the refined sugar 30°Bx, salt 1.2%, grapefruit peel 15% to soursop juice and concentrated to the final concentration 65°Bx. Samples were evaluated as color, flavor and taste.

Investigation of grapefruit peel supplementation

After finding the optimal results as above experiment, we studied the ratio of grapefruit peel supplementation. Soursop juice was supplemented with 0.2% carrageenan and homogenized in 20 minutes. Then we added the refined sugar 30°Brix, salt 1.2%. Grapefruit peel was supplemented with different formulas: B_1= 5%, B_2= 10%, B_3= 15%, B_4= 20%, B_5= 25% and concentrated to 65°Bx. Samples were evaluated as sensory characteristics by Hedonic scale.

Investigation of Carrageenan supplementation

After finding the optimal results as two above experiments, we studied the ratio of carrageenan supplementation as follow: C_1=0.1%, C_2=0.2%, C_3=0.3%, C_4=0.4%, C_5=0.5%, homogenized in 20 minutes. Fruit juice was added the refined sugar 30°Bx, salt 1.2% and concentrated to 65°Bx. Samples were evaluated the their appearance after evaporation.

2.2.4 Investigation of sugar supplementation before evaporation

After finding the optimal results as three above experiments, we studied the ratio of sugar supplementation to get the final juice concentration: D_1=50°Bx, D_2=55°Bx, D_3=60°Bx, D_4=65°Bx, D_5=70°Bx. Samples were evaluated as color, flavor and taste.

Statistical analysis

All data are processeed by ANOVA.

RESULT & DISCUSSION

Soursop pulp compose with water

Combination of soursop juice with water was investigated in different formulas A_1 (20%:80%); A_2 (30%:70%); A_3 (40%:60%); A_4 (50%:50%); A_5 (60%:40%). Sensory characteristics of these samples were evaluated as color, flavor and taste. Our results were showed in table 1

Table 1: Sensory characteristics of experimental samples by different water addition

Soursop: water	Sample	Description	Color	Flavor	Taste
100%:0%	A_0	Natural color of soursop juice. Strong flavor of soursop and slight flavor of grapefruit peel. Sharply acidic taste	1.17^e	1.20^e	1.24^e
20%:80%	A_1	Slight color of soursop juice Mind flavor of soursop and grapefruit peel Slightly acidic taste of soursop	3.38^c	3.06^c	3.13^b
30%:70%	**A_2**	**Bright color of soursop Mind flavor of soursop and grapefruit peel Sweet and slighly acidic taste of soursop**	**4.17^a**	**4.38^a**	**4.31^a**
40%:60%	A_3	Slighly darker color Mind flavor of soursop and grapefruit peel Slightly sweet taste.	3.90^b	4.10^b	3.02^{bc}

50%:50%	A_4	Darker color Mind flavor of soursop and grapefruit peel. Less sweet, rather acidic taste	3.85[b]	2.80[d]	2.83[c]
60%:40%	A_5	Strong darker color Mind flavor of soursop and grapefruit peel. Acidic taste	2.56[d]	2.78[d]	2.28[d]
F			**	**	**
CV (%)			14.41	13.87	13.90

From the above results, we concluded that water supplementation into soursop pulp affected to color, flavor and taste of samples after evaporation. Ratio of soursop pulp and water was selected as 30%: 70% for further experiments.

Grapefruit peel supplementation into beverage

Grapefruit peel was supplemented with different formulas: B_1= 5%, B_2= 10%, B_3= 15%, B_4= 20%, B_5= 25%. Our results were elaborated as in table 2.

Table 2: Sensory characteristics of experimental samples by different grapefruit peel ratios

Grapefruit peel	Sample	Description	Hedonic score
5%	B_1	Grapefruit peel was slightly dispensed in juice. Mind flavor of grapefruit peel	5.73[c]
10%	B_2	Grapefruit peel was evenly dispensed in juice. Mind flavor of grapefruit peel	6.52[b]
15%	**B_3**	**Grapefruit peel was evenly dispensed in juice. Harmony flavor of grapefruit peel and soursop**	**7.44[a]**
20%	B_4	Grapefruit peel was fully dispensed in juice. Harmony flavor of grapefruit peel and soursop	6.55[b]
25%	B_5	Grapefruit peel was fully dispensed in juice. Stringent flavor of grapefruit peel	5.66[c]
F			**
CV (%)			10.75

From the above results, we concluded that grapefruit peel supplementation into soursop pulp affected to color, flavor and taste of samples after evaporation. Ratio of grapefruit peel was selected as 15% for further experiments.

Carrageenan supplementation into beverage

Carrageenan was supplemented with different formulas: C_1= 0.1%, C_2= 0.2%, C_3= 0.3%, C_4= 0.4%, C_5= 0.5%. Our results were elaborated as in table 3.

Table 3: Sensory characteristics of experimental samples by different carrageenan ratios

Carrageenan (%)	**Sample**	**Description**	**Appearance score**
0.1	C_1	Less smooth, opaque, and floated grapefruit peel	2.65[d]
0.2	C_2	Rather smooth, clear, evenly dispensed grapefruit peel	4.02[b]
0.3	**C_3**	**Smooth, clear and fully dispensed grapefruit peel**	**4.34[a]**
0.4	C_4	Slightly smooth, clear and fully dispensed grapefruit peel.	3.06[c]
0.5	C_5	Slightly smooth, clear and randomly dispensed grapefruit peel.	2.87[cd]
F			**
CV (%)			13.6

From the above results, we concluded that carrageenan supplementation into beverage strongly affected to color, flavor and taste of samples after evaporation. Ratio of carrageenan was selected as 0.3% for further experiments.

Sugar supplementation into juice for evaporation

Refined sugar was supplemented with different formulas so that the final concentration of beverage would be as follows: D_1=50°Bx, D_2=55°Bx, D_3=60°Bx, D_4=65°Bx, D_5=70°Bx. Our results were elaborated as in table 4.

Table 4: Sensory characteristics of experimental samples by different sugar ratios to get the final juice concentration

Final juice concentration after evaporation (^oBx)	Sample	Description	Appearance	Color	Flavor
50^{o}Bx	D_1	Less smooth, clear and adequately dispensed grapefruit peel Rather bright color Slightly sweet, less acidic taste	3.65^b	4.05^{bc}	3.73^c
55^{o}Bx	D_2	Smooth, clear and adequately dispensed grapefruit peel Rather bright color Slightly sweet, mind acidic taste of soursop	3.80^b	4.12^{bc}	4.24^b
60^{o}Bx	D_3	Smooth, clear and adequately dispensed grapefruit peel Bright color Sweet, mind acidic taste of soursop	4.33^a	4.19^{ab}	4.32^b
65^{o}Bx	**D_4**	**Smooth, clear and adequately dispensed grapefruit peel** **Natural color** **Sweet and characterized taste of soursop**	**4.55^a**	**4.38^a**	**4.56^a**
70^{o}Bx	D_5	Smooth, obaque, evenly dispensed grapefruit peel Darker color Sweet and characterized taste of soursop	3.88^b	3.91^c	3.83^a
F			**	**	**
CV (%)			11.7	10.4	11.2

From the above results, we concluded that sugar supplementation into beverage strongly affected to color, flavor and taste of samples after evaporation. Final concentrated beverage was selected as 65^{o}Bx after evaporation

Nutritional value of some key elements in the combo beverage

Nutritionnal value of some key elements in the combo beverage was depicted in table 5

Table 5: Nutritionnal value of some key elements in the combo beverage

Criteria	Amount
Total sugar (%)	57.13
Reduced sugar (%)	40.48
Acidity (g/l)	9.04
Brix	65
pH	2.5
Vitamin C (mg %)	4.5

Microorganism was also analyzed to verify food safety (table 6)

Table 6: Microbial parameters in the combo beverage

Criteria	Colony (CFU/ml)
TPC	Not detected
Yeast - mold	Not detected
E. coli	Not detected
Coliforms	Not detected

Sensory evaluation of the final products was also monitored to meet the comsumer acceptance (table 7)

Table 7: Sensory evaluatiion for the combo beverage

Criteria	Average score	Important ratio	Average score with important ratio
Color	4.35	0.8	3.48
Flavor	4.38	1	4.38
Taste	4.55	1.2	5.47
Appearance	4.52	1	4.52
Tổng			17.85

From above depicted results, we concluded that the final beverage with 17.85 score adapting to the consumer acceptance.

CONCLUSION

We successfully established a formulated beverage using soursop pulp and grapefruit peel by investigating different parameters such as water, grapefruit peel, carrageenan, and sugar addition affecting to the quality of the combo beverage. Further investigation should be focused on shelf-life and packaging for consumer attraction.

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