SPRAY DRIED BATUAN POWDER

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ABSTRACT This study was conducted using a spray dryer to produce Spray Dried Batuan (Garcinia Binucao). Batuan pulps were extracted under optimum condition. The extract undergone the same processing parameters: Feed rate/ Feed Pressure=450psi, inlet temperature=210-240C, outlet temperature=80-95C. Spray Dried Batuan was subjected to sensory evaluation, microbial analysis and chemical/physical analysis. Results revealed that the product was very much liked by the respondents as to the taste, color and flavor while slightly like in odor/aroma. In terms of the microbial analysis, it was found out that it has an Aerobic Plate Count of<10cfu/g sample, an Escherichia coli Count which is <1.8 MPN/g sample and Molds and Yeast Count of 210 cfu/g sample. For chemical/physical analysis, the result showed that in a 100g sample in a plastic package of Spray Dried Batuan Powder the pH = 2.36, water activity = 0.34, total titratable acidity as acetic acid = 9.49% and moisture content = 5.31%.

Keywords: Spray Drying, Batuan Powder

INTRODUCTION

Batuan is common and widely distributed throughout Luzon and the Visayan Island. In the island of Panay, the attractive tree grows tall and abundant, much so that the fruit found its way into the local sinigang dishes and the Visayan palette. These are used as a souring agent while cooking fish, beef and other foods. A local would readily prefer a Batuan sinigang than any cooked with other pampaasim. The young leaves are also used for this purpose if no fruits are available.

In food industry, Spray-drying is the transformation of liquid state feed into a dried particulate from. It is a technique to guard food ingredients from volatile loses and premature interaction with other ingredients. Under the optimum processing conditions, it has been proven to be an effective method to obtain products (Farimin, 2009). Transformation of fruit juices into dry particulate form results in much reduced volume and longer shelf-life. Spray-drying is achieved by atomizing the fluid into a drying chamber, where the liquid droplets are passed through a hot-air stream (Masters, 1991, Siddick 2014). It also provides the advantage of weight and volume reduction. Parameters like concentration of juice, addends, feed flow rate and also the inlet/outlet air temperatures have a significant role in the yield of Fruit powder.

Objectives of the Study

This study aimed to: (1) Develop batuan powder using spray drying method; (2) Conduct sensory evaluation of spray dried batuan powder as to the following: odor, taste, aroma and flavor, and (3) Conduct biological test and chemical analysis of batuan powder such as: Aerobic Plate Count (APC), yeast molds, E.coli contents, water activity, moisture contents, pH and total titratable acidity.

METHODOLOGY

Procurement of the Materials. The materials needed in the experiment were procured locally from the batuan growers while the conduct of the study was held in the Western Visayas Food Innovation Center.

Method of preparing Batuan extract. Batuan fruits were thoroughly washed with cleaned water. These were of 2 phases – the pre and final washing, this is to ensure that the samples are clean. Preliminary experiments were carried out to establish the best extraction procedure to give the best product. These were:

1. Fresh batuan fruits were macerated using a pulper, mixed with water and were gripped using a stainless steel gripper. The ratio of 6:1 (6 kgs. Of batuan fruits to 1 liter of distilled water), after which the batuan juices were extracted through the using of electric juicer.

2. The juice produced were filtered /strained to separate the solid particles. All of the pulps and seeds that has been separated during the extraction process were subjected to cabinet drying and sun drying for product adding while the juices were stored overnight in a refrigerator.

Spray Drying. Maltodextrin was added to the batuan extract. The mixture was stirred for 5 minutes and ready to spray dry. A spray dyer was employed for the spray dying process. The unit is self-contained and supplied complete and ready for immediate operation. All major components are housed within stainless steel tube/cabinet. All sample treatment undergone the same processing parameters: Feed rate/Feed pressure=450-500 psi, inlet temperature =210-2400C, outlet temperature=80-950C. Maltodextrin was added according to the mass of the batuan extract. The dryer was washed with water at desired parameter settings for 10-15 minutes before spray dying process. The powders produced were collected in a plastic pouch/container, sealed tight, weighed according to desired mass and stored at 4 oC in dark.

Product Performance Evaluation and Testing:

Sensory Evaluation. The 9 point Hedonic Scale was used for sensory evaluation to assess the product as to its odor, taste, aroma and flavor. Fifteen (15) students and fifteen (15) faculty and staff members were taken as respondents.

Microbial Analysis. The 100 gram spray dried batuan powder sample was subjected to microbial analysis to determine the Aerobic Plate Count (APC), yeast and molds, and Escherichia coli contents of the product.

Chemical Analysis. The spray-dried batuan powder was analyzed for moisture content, dissolution, water activity and hygroscopicity.

RESULTS AND DISCUSSION

Sensory Evaluation. This was done to 30 faculty and staff and students of GSC in order to determine the acceptability level of Spray Dried Batuan in reference to its: color, taste, aroma & flavor. A 9-point Hedonic Scale was used. These were: Extremely Like (9), Very much Like (8), Moderately Liked (7), Slightly Liked (6), Neither Liked or Disliked (5), Slightly Disliked (4), Moderately Disliked (3), Very much Disliked (2) and Extremely Disliked (1). As to its color, the product was identified by the respondents as creamy/lightly brown having the mean of 7.63 (Like very much). For its aroma, the product has the mean of 5.71 (Slightly Liked). As to the product's flavor, it was evaluated by the respondents as desirable with the mean of 7.27 while for the taste, it was evaluated as sour with the mean of 7.13. Results revealed that the product was very much like of respondents as to the flavor, color, and taste while slightly like in odor. This implies that the product was generally acceptable.

Table 1. Results on Sensory Evaluation

Sensory	Characteristics	Mean	Acceptability
Color	Creamy/lightly brown	7.63	Like very much
Aroma	Not desirable	5.73	Slightly like
Taste	Sour	7.13	Like very much
Flavor	Desirable	7.27	Like very much
Overall Mean		6.9425	Like very much

Microbial Analysis. Spray Dried Batuan was analyzed as to the Aerobic Plate Count (APC), yeast and molds and Escherichia coli contents. The results revealed that a 100 grams Spray Dried Batuan Powder has an estimated Aerobic Plate Count of < 10cfu/g sample, Escherichia coli Count which is < 1.8 MPN/g sample and Molds and Yeast Count of 210 cfu/g sample. This implies that the product passed the standard of food safety in terms of estimated Aerobic Plate Count.

Table 2. Results on Microbial analysis

Sample Description	Characteristics	Mean
Spray Dried Batuan Powder, 100g	Creamy/light brown	<10cfu/g sample (estimated)
2 packs @ 100g/pk	Escherichia coli Count	<1.8 MPN/g sample
MDF: 07/30/2018	Molds and Yeast Count	210 cfu/g sample

Chemical Analysis. The spray-dried batuan powder was analyzed for moisture content, dissolution, water activity and hygroscopicity. In chemical analysis for pH of the product, the result showed that in a 100g sample in a plastic package of Spray Dried Batuan Powder the pH = 2.36. A pH value of 2.25 to 5.5 tends to prolong the shelf life of fresh fruit and inhibit the multiplication of micro-organisms. Likewise for vegetables with a more neutral pH IN THE 4.6 TO 6.4 range (The importance of pH in Food Quality and Production, 2018). This implies that the spray dried batuan powder has an extended shelf life since that it has a pH value of 2.36.

In terms of water activity, the analysis also revealed that a 100 gram spray dried batuan has 0.34. Most "spoilage" microorganisms are inhibited by αw values lower than 0.90 for bacteria, 0.88 for yeast and 0.80 for molds (Food and Drug Administration, 2018). This implies that spray dried batuan powder can able to prevent spoilage due to its lower water activity.

The analysis also showed that the 100 gram spray dried Batuan powder sample has 9.94% total titratable acidity as acetic acid. This implies that the spray dried batuan powder has a high percentage of acetic acid in terms of total titritable acidity.

For moisture, it was found out that the spray dried batuan powder has 5.13% moisture. Dried and powdered products have a target moisture content of 5-15% to preserve the shelf life of the product. This implies that the spray dried batuan powder has a lower moisture content which is a good factor to extent shelf life of the product.

Table 3. Results in Chemical Analysis

Sample Description	Parameter	Results
100g sample in a plastic	pH	2.36
Packed labeled as Spray Dried	Water Activity	0.34
Batuan Powder	Total Titritable Acidity as Acetic Acid	9.46%
	Moisture	5.13%

CONCLUSION

The 15 kilograms of fresh batuan fruit can produce approximately 7.16 kilograms of batuan extract based on the processes conducted by the researchers. The TSS of batuan extract was approximately 4.8% as conducted by the researchers which might vary depending on the condition and processes being implemented. Moreover, approximately 493.5 grams of batuan powder was obtained from 7.25 liters of extract with a TSS of 20%. Further study would be conducted by varying the volume of maltodextrin added to the batuan extract and another study on batuan powder obtained from different drying methods.

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A PROCESS OF PREPARING SPRAY DRIED PICKLED MANGO

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ABSTRACT Mango is one of the most important tropical fruits in the world and currently ranked 5th in total world production among the major fruit crops. As mango is a seasonal fruit, about 20% of fruits are processed for products such as puree, nectar, leather, pickles, canned slices, and chutney. These products experience worldwide popularity and have also gained importance in national and international market. Processing of mango helps in preserving the fruit for future use especially during off season, it also adds value to the product for food and other industrial use. Mango as a popular fruit in the province of Guimaras helps in the industry and is a significant economic player in the province. It provides an income not just for the benefit of the community but also for the government to continuously offer public services and promote agri-tourism in the island. Thus, this study was conducted to produce pickled green mango powder as seasoning. Specifically the study aims to determine the general acceptability of spray dried pickled green mango as seasoning. Results of the study reveals that Appearance, Aroma and Color is very much liked by the respondents, while texture is moderately liked, Mouth Feel and Flavor is Slighly liked by the respondents when evaluated as powder. However, when the powder was used as seasoning for Fish Sinigang, results revealed that sample C with 30g Spray dried Picked Mango ranked 1st with mean of 2.1. The results of the microbial analysis conducted by the DOST for the project Sray Dried Pickled Mango with methods used are as follows: Aerobic Plate Count. Pour Plate Method, 35˚C 48 hours, result shows that there are <250 cfu/g sample g/100g (estimated). Coliform Count. Multiple Tube Fermentation Technique, that there are <1.8 MPN/g sample per g/100g. Mold and Yeast Count. Pour Plate Method, 25˚C, 5-7 days, result shows that there are <100 cfu/g sample (estimated) which means that the product or the sample given is safe for the growth of microbial organisms. Laboratory analysis conducted by the Department of Science and technology the following are the product properties found in the spray dried pickled mango; moisture content is 5.34 by Air Oven method. Official Method 925.45B, total titratable acidity as acetic acid is 2.27% by using the Acidity (Titratable) by Indicator Method. Official Method 942.15A, its pH level is 5.46 this was tested through Electrometric Method (10% solution), and water activity is 0.33 by Novasina Water Activity Meter. The maturity of mangoes is an important factor in processing the spray dried green pickled mango. It was observed that the green mango approximately 110-120 days is the better quality of mango to produce spray dried powder. Spray dried pickled mango is acceptable as seasoning and can be used as best choice for cooking different recipes at home for it was made in fresh raw materials without any synthetic preservatives and additives.

Keywords: Spray Dried, Mango, Food, Processed, Fruit

INTRODUCTION

Background of the Study

Mango is one of the most important tropical fruits in the world and currently ranked 5th in total world production among the major fruit crops. As mango is a seasonal fruit, about 20% of fruits are processed for products such as puree, nectar, leather, pickles, canned slices, and chutney. These products experience worldwide popularity and have also gained importance in national and international market. During processing of mango, by-products such as peel and kernel are generated.

Mango peels and seeds are rich in valuable bioactive compounds such as polyphenols, carotenoids, dietary fibres, enzymes phytosterols and tocopherol; whereas and the peel extract exhibits potential antioxidant properties. Processing of mango by-products reduces waste disposal problem, adds value to the product for food and other industrial use, and the isolated active component can be used in food fortification. Green mangoes in India are mostly used as pickles and chutneys. Pickles are prepared in almost every Indian home and also commercially. Mango pickles are classified as salt pickle or oil pickle or sweet pickle based on the type of preservation used. They are made from peeled or unpeeled fruit with or without stones and with different kinds of proportions of spices.

Mango pickle refers to a variety of pickles prepared using mango. This is a very popular pickle in South Asia. Pickles are main side dishes and many varieties of vegetables are used. However, raw mango or tender mango is the most popular variety of fruit used for pickling. There are multiple variety of mango pickles prepared depending on the region and the spices used but, broadly there are two types of - whole baby mango pickle or cut mango pickle. Whole baby mango pickle is a traditional variety very popular in Southern India and uses baby mangoes that are few weeks old. There are special varieties of mangoes specifically used just for pickling and they are never consumed as ripe fruit. Baby mangoes are pickled using salt, vegetable oil and a blend of hot spices, in a very careful process which ensures pickles are preserved for years.

Mango pickle inoculated with salt tolerant strain of Aspergillus niger got spoiled at 10% salt, 40% oil and 4.2% native acidity. Salt concentration of 15% protected the pickles against spoilage by the inoculated organism as well

as the native flora of the pickles. It was observed that groundnut oil did not have any preservative effects against microbial spoilage. Preservation of raw mango slices for use in pickle and chutney was also studied by Sethi (1991). Preservation in a chemical solution containing 5% salt, 1.2% acetic acid and 0.01% KMS was found to be better than dry salting. Addition of 0.5% calcium chloride helped to retain texture of slices during subsequent storage. Chemical changes and microbial growth during green mango fermentation for pickling was studied by Yunchalad et al. (2003). Spray drying of sugar-rich foods such as fruit juice has great economical potential. However, fruit juice powders obtained by spray drying have some drawbacles in their functional properties, such stickiness, solubility and higroscopicity making their packaging and utilization difficult. The possibility of reaching a highly organized structure during spray drying could reduce the stickiness phenomena, considering the fact that crystalline sugar has a lower water sorption potential. This work aimed the induction of crystallization on powder mango juice during the process of spray drying.

Objective of the study

This study was conducted to produce pickled green mango powder as seasoning. Specifically the study aims to determine the general acceptability of spray dried pickled green mango as seasoning.

MATERIALS AND METHODS

Materials:

Guimaras Green mango is selected and purchased from mango sellers in the province. The fruits will be washed and peeled then will be sliced into 1/2 inch slices. Then this will be mixed with the pickling solution for different days of the week. First is 3 days, second will be 5 days and the last treatment will be 7 days. After the absorption of the pickling solution to the mango, it will be processed into a blender and will be squeezed and strained. Next, is to process the pickled mango together with its pickling solution to the spray dryer.

Quantity	Unit	Ingredients
15	kg	green mango
Pickling Solution		
1/2	kg	hot pepper
1/2	kg	red sweet pepper
1/2	kg	green sweet pepper
1/2	kg	onion
1/2	kg	ginger
15	cups	vinegar
15	cups	sugar
5	cups	salt

Procedure:

1. Prepare tools, utensils and equipment needed.
2. Wash and drain mango and other raw materials.
3. Slice mango into 1/2 inch thick slices.
4. Slice hot pepper, red sweet pepper, green sweet pepper, onions, and ginger into strips.
5. Measure pickling solution and boil. Add other raw materials.
6. Pour boiled pickling solution with other ingredients in mixing bowl with mango.
7. Pack mango pickles in a jar with pickling solution.
8. Cover, seal and label.
9. After pickling time take out the mangoes from pickling solution and blend/extract to liquefy.
10. Add an amount of Malto Dextrin to the blended pickled mango
11. Process the blended pickled mango with malto dextrin together with the pickling solution to the spray dryer.

*Pickling solution recipe based on TESDA- Standardized Recipe

Methods:

a. selecting of mango;
b. washing of said selected mango;
d. preparing of pickling solution;
e. soaking of said cut mango into said pickling solution
f. storing said pickling solution containing said cut mango for about 3 days;
g. removing said cut mango from said pickling solution to obtain a pickled mango;

h. blending of said pickled mango to obtain an extract;
i. adding malto dextrin in the said obtained mango extract
j. processing of said extract in a spray dryer to obtain a powder; and
k. packing of said powder.

Tools and Equipment Needed

- 3 Mixing bowl- medium sized stainless bowl used as container of raw materials.
- 2 Chopping board- medium sized chopping board used for chopping ingredients.
- 3 Knives- used for cutting raw ingredients. Casserole/ cooking pot- Large size casserole or cooking pot used to cook pickling solution.
- Gas Range- used for cooking
- Blender- used to purée the pickled mango
- Spray Dryer- an equipment with special technology used to process the raw materials into powder.

Maturity of the raw material. The maturity of mangoes is an important factor in processing the spray dried green pickled mango. It was observed that the green mango approximately 110-120 days is the better quality of mango to produce spray dried powder.

Pickling Solution. Pickling solution should be measured properly and must be followed according to its standard recipe.

RESULT AND DISCUSSION

Sensory Evaluation of Spray Dried Pickled Mango

Data in table 1 presents the acceptability of spray dried pickled mango. Results revealed that the appearance, aroma and color was rated very much liked by the evaluators with mean of 7.5 for appearance, 7.72 for aroma, 7.84 for color. While texture was rated as moderately liked with 6.8 mean and mouth feel and flavor was rated slightly liked with mean of 6.42 for mouth feel and 6.32 for flavor.

Table 1. Summary of Sensory Evaluation of Spray Dried Pickled Mango

Properties	Mean	Description
Appearance	7.5	VML
Aroma	7.72	VML
Color	7.84	VML
Mouth Feel	6.42	SL
Texture	6.8	ML
Flavor	6.32	SL

Scale: 9 (Extremely Liked), 8 (Very Much Liked), 7 (Moderately Liked), 6 (Slightly Liked), 5 (Liked or Disliked), 4 (Slightly Disliked), 3 (Moderately Disliked), 2 (Very Much Disliked), 1 (Extremely Liked)

Data in table 2 presents the ranking of fish sinigang seasoned with different amount of spray dried pickled mango as evaluated by the evaluators. Results revealed that the recipe with higher amount of spray dried pickled mango of 30g ranked first among the three preparations evaluated by the evaluators. This means that it was the best amount to be used a recipe of 450 kg. of fish in 1.5 liter of water.

Table 2. Ranking of FIsh Sin igang with Spray Dried Mango Powder as evaluated by the Evaluators

	A	B	C
Mean	1.88	2.02	2.1
Rank	3rd	2nd	1st

A- 10g Spray dried Picked Mango
B- 20g Spray dried Picked Mango
C- 30g Spray dried Picked Mango

Table 3 shows the results of the different trials made for Spray Dried Pickled Mango with different parameters; results shows that out of 4 trials, trial number 2 fails during the process and has the least amount of the powder yield among all the trials. All other trials are acceptable and have meet the higher yield when processed as powder. All trials were processed in a constant temperature and time.

Table 3. Results of the different trials made

	Trial no. 1	Trial no.2	Trial no.3	Trial no.4
Weight of Raw Materials	5 kilos green Mangoes	5 kilos green Mangoes	10 kilos green Mangoes	10 kilos green Mangoes
Total weight	2,762.7 g	3137.5g	5,891.5g	5055.1
TSS w/o water & malto	18%	15%	12%	9.5%
Water (50%)	1,381g	1568.4 g	2,945.75	2527.5g
TSS w/ water	12.2%	15.8%	7.7%	6.1%
Malto	1,056g	968.07g	2,815.30g	2589.9g
Final weight	4,961.2 g	5612.9g	11,374.1g	10,978g
TSS (target: 30%)	30.4%	30.1%	30.1%	27.7%
Powder Weight	609.9g	54.4 (FAIL)	1,523.9 g	683.8g
Temperature	Inlet:212 °C Outlet: 85° C	Inlet: 212° C Outlet: 85° C	Inlet: 212 ° C Outlet: 85 ° C	Inlet: 212 ° C Outlet: 85 ° C
Time	2 hours	2 hours	2 hours	2 hours

Table 4 shows the results of the microbial analysis conducted by the DOST for the project Spray Dried Pickled Mango. Methods used are as follows: Aerobic Plate Count. Pour Plate Method, 35˚C 48 hours, result shows that there are <250 cfu/g sample g/100g (estimated). Coliform Count. Multiple Tube Fermentation Technique, that there are <1.8 MPN/g sample per g/100g. Mold and Yeast Count. Pour Plate Method, 25˚C, 5-7 days, result shows that there are <100 cfu/g sample (estimated) which means that the product or the sample given is safe for the growth of microbial organisms.

Table 4. Result of Microbial Analysis

Sample Description	Parameter	Result g/100g
Spray Dried Pickled Mango, ~100g (2 packes @ ~100 g/pack MFD: 08/01/2018	Aerobic Plate Count *Escherichia coli* Count Molds and Yeast Count	<250 cfu/g sample (estimated) <1.8 MPN/g sample <100 cfu/g sample (estimated)

Table 5 shows the result of the Analysis for Moisture content, Total Titratable Acidity, pH, and Water Activity. Based on the result of the laboratory analysis conducted by the Department of Science and technology the following are the product properties found in the spray dried pickled mango; moisture content is 5.34 by Air Oven method. Official Method 925.45B , total titratable acidity as acetic acid is 2.27% by using the Acidity (Titratable) by Indicator Method. Official Methods of Analysis of AOAC International (2016) 20th ed. Official Method 942.15A, its pH level is 5.46 this was tested through Electrometric Method (10% solution), and water activity is 0.33 by Novasina Water Activity Meter.

Table 5. Result of Analysis for Moisture content, Total Titratable Acidity, pH, and Water Activity.

Sample Description	Parameter	Result g/100g
~150 g sample in a plastic bag labeled as: Spray Dried Pickled Mango	Moisture Total Titratable Acidity as Acetic Acid pH Water Activity	5.34 2.27% 5.46 0.33

CONCLUSION

Spray dried pickled mango is acceptable as seasoning and can be used as best choice for cooking different recipes at home for it was made in fresh raw materials without any synthetic preservatives and additives.

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