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TRAY DRYING OF TAMARIND PULP USING GUM ARABIC

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ABSTRACT

Tamarind powder was obtained by tray-drying of juice squeezed from tamarind pulp by using drying aid mixture. Popular drying aid namely Gum Arabic (AG) was added to tamarind pulp (20 °brix) at 1:10; 1:7.5; 1:6 ratios. The mixture was dried in a tray dryer at drying temperatures of 80, 90, and 100 °C till powder obtained. The results indicated that the optimal drying temperature for drying tamarind pulp powder is 100 °C with gum arabic. The yield of tamarind pulp powder was best at 100 °C. The physicochemical and sensory scores indicated that samples with ratios 1:7.5 at 90 °Cand 100 °C were revealed as best samples.

KEYWORDS: *Tamarind Pulp, Arabic Gum, Tray drier*

Article History

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INTRODUCTION

Tamarind (*Tamarindusindica*L.) is one of the important fruits in India and cultivated all over India, especially in Andhra Pradesh and Tamil Nadu (Morton, 1987). The tamarind powder is an interesting product due to its characteristics. The powder can be used as an ingredient for cooking food or as a flavoring agent in some products. Tamarind powder has several advantages such as (a) a long shelf life at ambient temperature due to low water activity, (b) low logistic expenditures due to little weight and volume, and (c) easy to use compared with squeezing juice from tamarind flesh. Tamarind pulp powder product development would help to reduce the tamarind loss caused by the microorganisms, chemical and enzymatic reactions during the peak of harvesting season. (Jittanit*et al, 2011*)**.** Drying of fruit juice could produce the fruit powder that can be reconstituted rapidly to a fine product resembling the original juice (Gabas*et al.*, 2007). Nonetheless, the difficulties in drying fruit juice with high sugar content due to their thermoplasticity and hygroscopicity at high temperatures and humidity cause packaging and utilization in trouble (Bhandari *et al.*, 1997; Adhikari *et al.*, 2004; Cano-Chauca*et al.*, 2005). While drying the low glass transition temperature (Tg), high hydroscopy, low melting point, and high water solubility of these solids lead to a highly sticky product (Adhikari *et al.*,2003; Cheuyglintase and Morison 2009).

The thermoplasticity and hygroscopicity troubles occurring in the drying of fruit juice with high sugar content can be overcome by adding some drying carrier Arabic gum (AG) (Bhandari *et al.*, 1993; Cano-Chauca*et al.*, 2005; Gabas*et al.*, 2007). These drying carriers are of high molecular weights which have high Tg, accordingly, they can raise the Tg value of feed and the subsequent powder. Keeping in view of lacking in research for tamarind powder production, this study was conducted to develop and optimize the process for the production of tamarind powder with gum arabic as drying agent at different temperatures and ratios using tray dryer and analyze the quality of the tamarind pulp powder.

MATERIALS AND METHODS

Tamarind Pulp Preparation

The sour tamarind flesh was obtained at the local market nearby. The tamarind flesh was soaked and crushed. The juice was then squeezed out from the pulp by a pulp finisher. Then the soluble solid content of juice was standardized to 20°Brix (by hand refractometer) by adding distilled water. The MD had a dextrose equivalent (DE) 10-12, pH 4.7, and moisture content 5.2%. The feed material was prepared by adding the specified amount of drying agent into the concentrated tamarind juice at 20°Brix and then stirring. The ratios by weight of tamarind juice (750gm at 20 °Brix) and drying carrier at 10:1; 7.5:1 and 6:1 were applied.

Experimental Protocols

Drying experiment was carried on a tray drier or cabinet dryer in which the material to be dried was placed on trays. It mainly consists of the thermostat, fan & temperature controller. The tray drier having 12 numbers of trays placed one above another. The drying conditions are simply controlled and readily changed. The air velocity in the tray drier varies from 0.3 m/s to 2.3 m/s. Tamarind pulp was made by taking fresh tamarind flesh is soaked in water for 10 minutes in the boiler and then boils it for 10 minutes. With the help of the sieve, the pulp is squeezed from the flesh by adding water and removes the pods manually. A concentration of tamarind concentrate was adjusted to 20° Brix. 750 g of pulp was taken in 78X38 cm^2 aluminum tray and gum arabic was added in the ratios of 10:1; 7.5:1 and 6:1. Then the pulp was dried in a tray dryer at 80^0C, 90°C and 100^0C till the drying is completed. The Tamarind pulp was dried at drying temperatures of 80°C, 90°C and 100°C for 3 hours. The dried pulp which was obtained in the form thin layer flakes are removed from the tray and kept in desiccators for 5 Minutes and grounded into fine powder and sieved.

Physicochemical Properties

Moisture Content Determination

The moisture content was determined by the oven method using 2 g of powder heated at 105°C drying temperature for 2 h. Thereafter, the sample was cooled in a desiccator, weighed and re-dried for 2 hrs. The process was repeated until a change in weight between the successive dryings at 2hr intervals was not more than 2 mg (Jittanit*et al.*, 2010).

Ash Content Determination

Ash content was determined by the muffle furnace which was a front-loading box-type oven or kiln. The maximum temperature of the muffle furnace was 1400°C, place the samples in the crucibles place the same in a muffle furnace at 525°C for 6 hours. From the weight of residue left in the crucible, the total ash content can be calculated (Ranganna, 1986).

Tartaric Acid Determination

Tartaric acid was the main component of tamarind pulp powder. 5 g of sample and dissolved in 250 ml of volumetric flask. 100 ml of that solution mixed with 0.5 g of charcoal in a conical flask, stirred and filtered. 2 or 3 drops of phenolphthalein indicator added to the filtrate, the color of the filtrate changes from colorless to pink. It is titrated against 0.1N NaOH solution till the pink color changes to colorless (Winton and Winton 1985).

Bulk Density

The procedure described by Al-Kahtani and Hassan (1990) was used. About 20 g of powder was transferred to a 100 ml graduated cylinder which was mounted on a shaker compartment of the water bath. The bulk density was calculated by dividing the weight of the powder by the volume occupied in the cylinder.

RESULTS AND DISCUSSIONS

A Yield of Tamarind pulp Powder

The yield of tamarind pulp powder increased with increase in drying aid content. Since gumarabic has emulsification properties and ease of dissolution in water. The tamarind powder obtained at 80°C and 90°C temperature was very sticky. As the drying aid content was more in 1:6 ratio resulted very high yield was noticed at all temperatures as compared to the other ratios and temperatures (Figure 1). The yield of tamarind pulp powder was also noticeably high at 100 °C. The tamarind powder obtained at 80 °C temperature was very sticky and yield was also very less as compared to the other temperatures. Samples 1:10 ratio yielded low powder and also very hygroscopic.

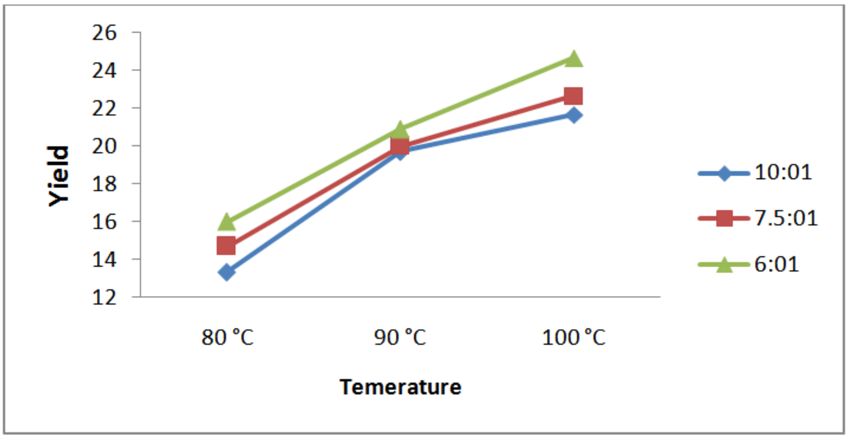

Figure 1: Yield of Tamarind Pulp Powder by Gum Arabic

Physicochemical Properties of Powder

Bulk Density

Bulk density is one of the important characteristics in designing of packaging volume and transportation volume. The bulk density results of tamarind powder were in the range of 0.416 to 0.772 g/cc similar results were obtained by Chegini and Ghobadian (2005) in spray drying of orange juice powder. The tamarind powder that had the lowest bulk densities were noticed at 1:6 ratio followed by 1.7.5 ratio. From the table 1, the results pure indicate that the bulk density of the powder decreased with the increase in temperatures and drying aid ratios.

Table 1: Physicochemical Properties of Powder

S. No	Temp (°C)	Ratio	Bulk Density (g/cc)	Moisture Content (%)	Ash Content (%)	Tartaric Acid (%)
1	80	1:10	0.772	12.30	3.03	10.35
2	90	1:10	0.509	10.10	3.10	9.95
3	100	1:10	0.590	9.00	3.50	10.89
4	80	1:7.5	0.664	11.60	3.10	10.68
5	90	1:7.5	0.599	9.40	3.20	10.85
6	100	1:7.5	0.554	7.60	3.55	8.56
7	80	1:6	0.549	10.70	3.30	9.96
8	90	1:6	0.468	8.70	3.40	8.92
9	100	1:6	0.416	6.40	3.60	8.72

Moisture Content

The results in table 1 indicate that moisture content of tamarind powders had moisture contents below 13% (db). Similar results were obtained with the dried tea powders (Sinija*et al.*, 2007). It is can be noticed clearly that at the same ratio, the higher drying temperature resulted in the lower moisture content of the dried product. As Heat and moisture transfer rates usually increased if the drying temperatures were elevated, this might be the reason for resulting in the yield of low moisture powder (Nastaj, 2000; Vongsawasdi*et al.*, 2002). It also resulted in lower moisture content powder as the ratio of drying aid increased. The ratios of 1:7.5 and 1:6 yielded better powders in terms of moisture content compared to the 1:10 ratio composition.

Ash Content

The ash content analysis shows that the temperature has a little effect on the ash content of tamarind powder. Ash content of tamarind pulp powder varies between 3.03 – 3.60%. The results of ash content are shown in table 1. The ash content of the tamarind powders increases temperature increases and as drying aid increases, ash content increases with drying aid may be due to the presence of the minerals and proteins. The results of ash content are good except for the ratio 1:10 as pulp might not be dried properly due to the less drying aid content.

Tartaric Acid Content

The tartaric acid content of tamarind pulp powder varies between 8.56 -18.89% shown in table 1. Tartaric acid had shown little effect upon increasing the temperature and as drying aid ratio increases the tartaric acid decreases. It may be due to a decrease in pulp content as the drying aid content increased which is having the low tartaric acid content.

Optimized Sample

In order to find the best sample optimization was carried out for all the samples. The samples of the ratio 1:10 resulted in low yield and also hygroscopic and also which may also effect the storage life of powder drastically. Among the remaining samples based on moisture content samples of 1:7.5 and 1:6 at 90 °C and 100 °C shown to be feasible. Based on ash content and bulk density samples of the ratio 1:7.5 at 90 °C and 100 °C and also sample ratio of 1:6 at 80 °C has shown the good results. Hence these three samples were considered to be optimized. Sensory evaluation was conducted with fresh tamarind pulp for the sensory characteristics such as color, appearance, aroma, taste, overall acceptability for the optimized samples.

Sensory Evaluation

The results of sensory evaluation for tamarind powder were shown in figure 2. It may be revealed from the figure 1 that 1:7.5 at 90 °C and 100 °C showed the best results in terms of Appearance, Taste, Aroma and Overall acceptability and close to that of the fresh samples. The other optimized treatments i.e 1:6 at 80 °C reflected less preference in terms of all sensory attributes studied when compared to fresh as well as the samples studied. Therefore, though this treatment showed similar results in terms of physicochemical characteristics could be eliminated in terms of sensory quality. Thus it was concluded that the samples with ratio 1:7.5 at 90 °C and 100 °C could be adjudged best samples and therefore these process variables were selected as the best operating parameters for the yield of tamarind powder.

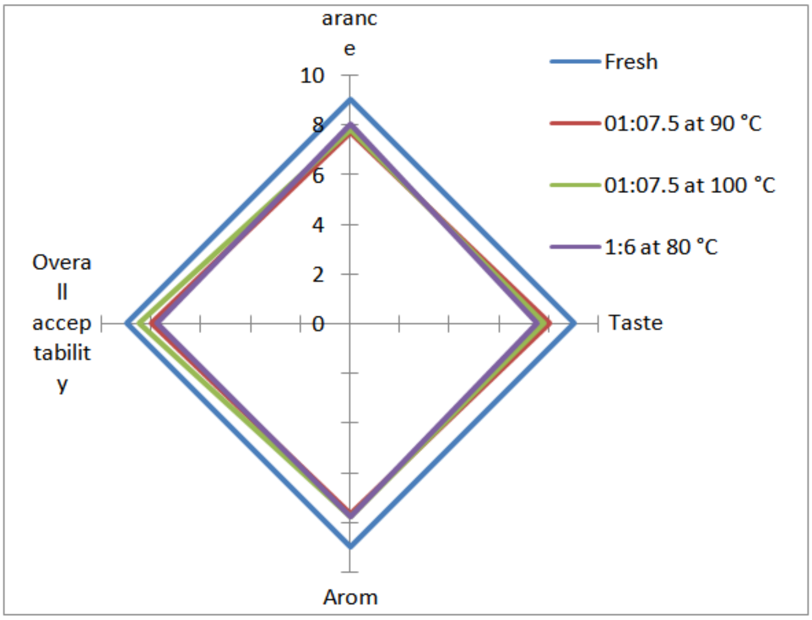

Figure 2: Sensory Evaluation of Tamarind Pulp Powder

CONCLUSIONS

The results indicated that it is feasible to produce the tamarind powder as a sour agent or flavoring additive for food. In order to obtain the tamarind powder, the optimal drying condition for drying tamarind pulp powder is 90°C for A rabic gum. The color of tamarind pulp powder produced by tray drier is changed with temperature from dark red to brown. The yield of tamarind pulp powder was better.

REFERENCES

1. *Adhikari, B., Howes, T., Bhandari, B.R. and Troung, V. 2003.Characterization of the surface stickiness of fructosemaltodextrin solutions during drying.Drying Technology.**21**: 17-34.*
2. *Adhikari, B., Howes, T., Bhandari, B.R. and Troung, V. 2004. Effect of addition of maltodextrin on drying kinetics and stickiness of sugar and acid-rich foods during convective drying experiments and modeling. Journal of Food Engineering.**62**: 53-68.*
3. *Al-Kahtani, H.A. and Hassan, B.H. 1990. Spray drying of Roselle (Hibiscus sabdariffa L.) extract. Journal of FoodScience, **55**(4): 1073-1076.*

4. *Bhandari, B.R., Snoussi, A., Dumoulin, E.D. and Lebert, A. 1993. Spray drying of concentrated fruit juices. Drying Technology. 11(5): 1081-1092.*

5. *Bhandari, B.R., Dutta, N. and Howes, T. 1997. Problems associated with spray drying of sugar-rich food. Drying Technology. 15(2): 671-684.*

6. *Cano-Chauca, M., Stringheta, P.C., Ramos, A.M. and CalVidal, J. 2005. Effect of t he carriers on the microstructure of mango powder obtained by spray drying and its functional characterization. Innovative Food Science and Emerging Technologies. 6: 420-428.*

7. *Chegini, G.R. and Ghobadian, B. 2005. Effect of spray- drying conditions on physical properties of orange juice powder. Drying Technology. 23: 657-668.*

8. *Cheuyglintase, K. and Morison, K.R. 2009.Crystal induction by dietary fiber in spray drying of fruit juice. Proceedings of the 6 Asia-Pacific Drying Conference (ADC 2009), Bangkok, Thailand, October 19-21, 2009, 606613.*

9. *Gabas, A.L., Telis, V.R.N., Sobral, P.J.A. and Telis-Romero, J. 2007.Effect of maltodextrin and Arabic gum in water vapor sorption thermodynamic properties of vacuum dried pineapple pulp powder.Journal of Food Engineering. 82: 246-252.*

10. *Jittanit, W., Niti-Att, S. and TechanuntachaikulSinija, O. 2010. Study of spray drying of pineapple juice using maltodextrin as an adjunct.Chiang Mai Journal of Science. 37(3), 498-506.*

11. *Langrish, T.A. G., Chan, W.C. and Kota, K. 2007. Comparison of maltodextrin and skim milk wall deposition rates in a pilot-scale spray dryer. Powder Technology.179: 8489.*

12. *Morton, Julia F. 1987. Fruits of Warm Climates.Wipf and Stock Publishers. pp. 115–121.*

13. *Nastaj, J.F. 2000. Numerical model of vacuum drying of suspensions on continuous drum dryer at two-region conductive-convective heat ing. International Communications in Heat and Mass Transfer.27(7), 925936.*

14. *Roos, Y. and Karel, M. 1991. Water and molecular weight effects on glass transitions on amorphous carbohydrates and carbohydrate solutions.Journal of Food Science.**56**:1676-1681.*

15. *Sinija, V.R., Mishra, H.N. and Bal, S. 2007. Process technology for production of soluble tea powder.Journal of Food Engineering.**82**:276-283.*

16. *Vongsawasdi, P., Nopharatana, M., Tangbumrungpong, D. and Apinunjarupong, S. 2002. Production of instant fruit and vegetable juice by spray dryer and microwave vacuum dryer, KMUTT Research and Development Journal. **25**(3): 257-277.*