

Optimization of Food Acidulant to Enhance the Organoleptic Property in Fruit Jellies

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Abstract

Citric acid, tartaric acid and malic acids are the commonly used additives in confectionary industries. Their acidity helps in increasing the organo-leptic property of the food product. Other than the flavour, they are also used for their health benefits. They play a major role in boosting renal health, revitalizing skin, fighting free radicals etc. Every individual additive mentioned above has a wide range of health benefits. Initially these additives were used individually to obtain their source fruit's taste. Later, they were mixed to obtain unique flavours. Different level of additive mix gave different level of enhanced taste. This research work aims in appropriate optimization of these additives to provide an enhanced organoleptic property in fruit jelly. The following ratio of citric acid (CA) to malic acid (MA) to tartaric acid (TA) was used in this research work. The ratio was finalized from literature studies. (Sample-S) S1-40:35:25, S2-40:40:20, S3-33.30:33.30:33.30, S4-32.50:50:17.50. Sensory analysis was made to select the best tasting sample and mixed with stabilizers. Sodium citrate, sodium tartrate and a mix of both sodium citrate and sodium tartrate were used to make three samples using the winning proportion of (CA: MA: TA) acids. Sensory analysis was made to select the best among them and they were mixed with fruit pulp finally. Papaya pulp was used in this research work. This final sample was taken for sensory evaluation again to know the feedback on taste of the fruit jelly, which was a positive result where most of the evaluators liked it. The results were analysed using SPSS software. Thus, this research work proves that the organoleptic property of a fruit jelly can be enhanced if the additives were used in an optimized proportion as in sample S1.

Keywords: Acidulant; Citric acid; Malic acid; Tartaric acid; Optimization

Introduction

Food acidulants are commonly used to increase the acidity of the food product. Increasing the acidity of the food helps in preservation, flavour enhancement, anti-pathogenic etc. Two or more acids are combined to produce a unique flavour. Citric (E330), malic (E296) and tartaric acids (E334) are the commonly used additives in food sector. The reason behind their common use are, they are organic. They are obtained from fruits (Citrus fruits, apple, grapes, tamarind etc.) through various extraction and fermentation techniques. Hence they are easily available and economically convenient for the food sectors. Their acidity acts as a preservative. Increased acidic environment in the food kills the microbes and pathogens thus making the food safe [1]. They are Generally Regarded as Safe (GRAS) hence they act as a substitute for the chemical preservatives, since prolonged use of chemical preservative results in health hazards. Citric acid has a very long history in food industries. They are most commonly used and it is one of the conventional food additive too [2]. The health benefits obtained on using these naturally derived food additives are remarkable. Citric acid found to be a very powerful weapon against kidney stone formation. They also help in soothing sore throat, improving mineral absorption, curbing nausea etc. Similarly, tartaric acids are known for their anti-oxidant and anti-inflammatory properties. Malic acid is good for liver. It is known for its effectiveness in reducing toxicity. Initially, it was used to obtain the taste of their source fruit. Later, food sectors realized their wide range of use when they used different combinations of these additives to produce unique flavours. Tartaric acid is the least used additive when compared to citric and malic acid. It is because, it has a strong flavour which tastes absolute tangy [3]. Also, the cost price of tartaric acid is higher when compared to the other two additives. Still, they are preferred in some food product where strong tangy flavour is required. Appropriate combination of citric, malic and tartaric acid can produce a unique enhanced level of taste. [4,5]. This combination of acidulant has citric acid as a major constituent followed by malic

and tartaric acid. They produce an enhanced organoleptic property to the food product and are economically convenient too. This research work focuses on optimising the combination of this additives to find the appropriate ratio of the additives which will produce enhanced organoleptic property to fruit jellies. Combination of additives were arrived from literature studies [6,7].

Initially, four combination of acidulants are arrived and using the combinations, four samples of fruit jellies are produced without any stabilizers and fruit pulp. The samples are taken for sensory evaluation and the winning sample is selected for further addition with stabilizers. Three samples are then produced along with stabilizers and sent for sensory evaluation again. The winning sample is selected and added with papaya fruit pulp. Now, the sample with winning combination of acid and stabilizers are produced with the fruit pulp and again taken for sensory evaluation to know the feedback on their taste. The sensory results are analysed using SPSS software. Papaya is used as a fruit pulp because it is easily available and blends with any type of flavour to produce the similar flavour.

Materials and Methods

Sample preparation

Fruit jellies are generally produced by heating appropriate proportion of water, sugar, liquid glucose, stabilizers until it dissolves.

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It is then followed by adding fruit pulp. It is cooked up to 90°C. Then pectin and permitted colour solutions are added. The total solids will be checked by refractometer till 80-81 TS achieved. Steam is cut off after this stage and permitted flavours, acids are added and mixed. It is then allowed to cool and thus jellies are produced [8]. We followed the similar procedure to prepare our sample.

Citric (E330), malic (E296) and tartaric acid (E334) were purchased from Tirumalai chemicals. Four combinations of these additives were made based on literature studies [6,7]. Four samples of fruit jellies are produced using the arrived combination of additives in a hygienic manner. The combinations are represented in Figure 1.

Four samples were taken for sensory analysis. The winning sample's combination is used to produce fruit jellies with stabilizers. Sodium citrate (E331), sodium tartrate (E335) were used. Three samples of fruit jellies are produced using the winning additive combination and stabilizers. The three stabilizers used are represented in Figure 2. Three sample of fruit jellies were taken for sensory analysis. The winning sample's combination of acidulants, stabilizers are used to produce the final jelly with the fruit pulp. Papaya pulp is used in this research work as they are easily available and blends with any flavour to produce the desired flavour. Fresh papaya pulp is obtained by extracting from ripened fruit .750 mg of papaya pulp is used per gram of the jelly. Thus, every single fruit jelly produced, contains 60 mg of acidulants, 15 mg of stabilizers, 750 mg of pulp and other additives. The samples are assessed for physical characteristics (Like, shape, appearance, colour and moisture content of the fruit jelly), chemical characteristics (Like, water activity, reducing sugars, pH/acidity, and sucrose content), and

micro characteristic (Using Total Plate Count, Yeast and Mould count, general pathogen analysis) as per FSSA procedure before sending it to sensory analysis.

Sensory analysis

Three sensory analysis was made. One for the samples with acidulants, one with acidulants +stabilizers and one with acidulant + stabilizer + papaya pulp. Sensory analysis was made by 80 volunteers from VIT University. Volunteers were from varying age group (ranging from 18-55 years old) and were asked to analyse upon their consent. They were asked to taste the samples and rate their characteristics (Like, texture, flavour and overall acceptance.) on a five point hedonic scale as shown in Table 1 [9].

Statistical analysis

The test data generated from the sensory evaluation was subjected to find the mean value, standard deviation, analysis of variance (ANOVA) and the Tukey test for multiple comparison and hence the homogenous subset from the Tukey test to find the highest value of alpha. These were performed to identify difference between the means of the samples and to find the difference at probability level $p < 0.05$ were considered to have difference between the variance in the population, also to establish a significant difference in the sample under sensory analysis. Then Tukey honesty significant difference (HSD) was calculated, to establish which sample exhibited significant difference from one and another [10]. For analysis of the data SPSS statistics 20.0 software was used.

Results and Discussion

Statistical analysis of trail-1 results over flavour

The proximate composition of the flavours in the samples for the trail test are Sample A (citric acid-40%, Malic acid-35%, Tartaric acid-25%) Sample B (Citric acid-40%, Malic acid-40%, Tartaric acid-20%) Sample C (Citric acid-33.3%, Malic acid-33.3%, Tartaric acid-33.3%) Sample D (Citric acid-32.50%, Malic acid-50%, Tartaric acid-17.5%) (Table 2). So here the *null hypothesis is rejected*, the *p*-value as Sig. is less than that of the significance value 0.05 which concludes that there is a difference between the variances in the population. It shows there is significant difference in the flavour combination of among at least three of the four formulations.

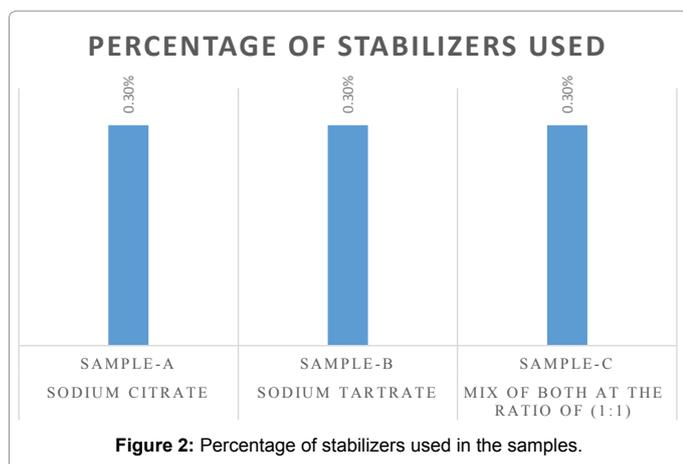
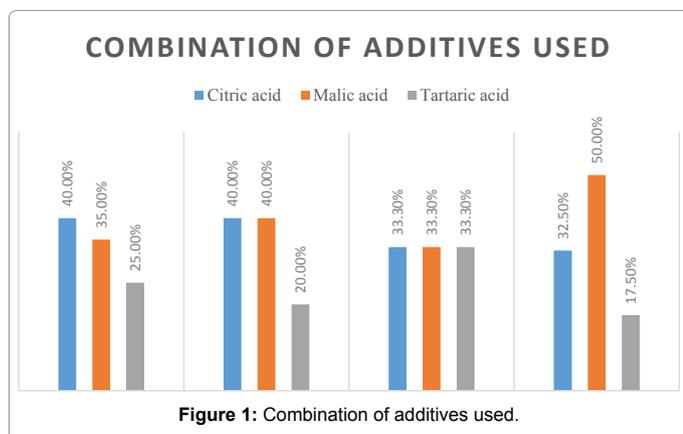
Homogeneous subsets

From the first trail, we conclude that the panellist preferred Sample A (Citric acid-40%, Malic acid-35%, Tartaric Acid-25%) over the other samples (Table 3).

Statistical analysis of trial-2 results over stabilizer from the optimized flavour sample: Stabilizers as mentioned in the literature has an influence on the sensory attribute of flavour on the fruit jellies, so three different stabilizer sodium citrate, sodium tartrate and combination of both sodium citrate and tartrate and coded as (T1, T2, T3) were used on the optimized sample from flavour trail test (Table 4).

Conclusion

From the Table 4, it can be concluded that the ANOVA result shows a higher significance value than 0.05, which shows there isn't any significance difference in the sample when the stabiliser is added. This proves that the stabilisers did not influence as of sensory and texture is concerned. And the Tukey test confirms that T3 (combination of sodium citrate and sodium tartrate) was preferred more by the population than the rest (Table 5).



Ratings	Comment
5	Excellent
4	Good
3	Moderate
2	Fair
1	Poor

Table 1: Hedonic scale rating and their interpretation.

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	7.057	3	2.352	2.679	0.047
Within Groups	242.314	276	0.878	-	-
Total	249.371	279	-	-	-

Table 2: ANOVA results for trail-1.

Tukey's HSD ^a			
Acid combinations	N	Subset for alpha = 0.05	
		1	2
Sample D	80	3.63	-
Sample C	80	3.87	3.87
Sample B	80	3.91	3.91
Sample A	80	-	4.07
Sig.		0.274	0.587

Table 3: Turkey HSD^a result for trail-1.

ANOVA					
	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2.155	2	1.077	1.298	0.275
Within Groups	169.275	204	0.830	-	-
Total	171.430	206	-	-	-

Table 4: ANOVA results for trail-2.

Tukey HSD ^a			
Formulation of stabilizers	N	Subset for alpha = 0.05	
		1	
T1	80	3.57	
T2	80	3.72	
T3	80	3.81	
Sig.		0.253	

Table 5: Turkey HSD^a results for trail-2.

Trail-3 was made using the sample prepared with the composition of the winning sample of trail-1 and trail-2. Thus, it was made with 40% of citric acid, 35% of malic acid, 25% of tartaric acid and a mix of both sodium citrate and sodium tartrate as stabilizers mixed with papaya pulp. About 95% of the panellist rated the sample as good. This is represented in Figure 3.

From Figure 3, we can interpret that our sample with 40% citric acid, 35% malic acid, 25% tartaric acid, mixed stabilizers of sodium citrate and sodium tartrate along with papaya pulp has been liked by 95% of the panellist (on a total of 80 people). They rated this sample as GOOD. We have got a positive result and thus we can conclude that the above-mentioned ratio of acidulants produced enhanced organoleptic property of the fruit jelly in an economically convenient way than the generally used additives to obtain such enhanced organoleptic property.

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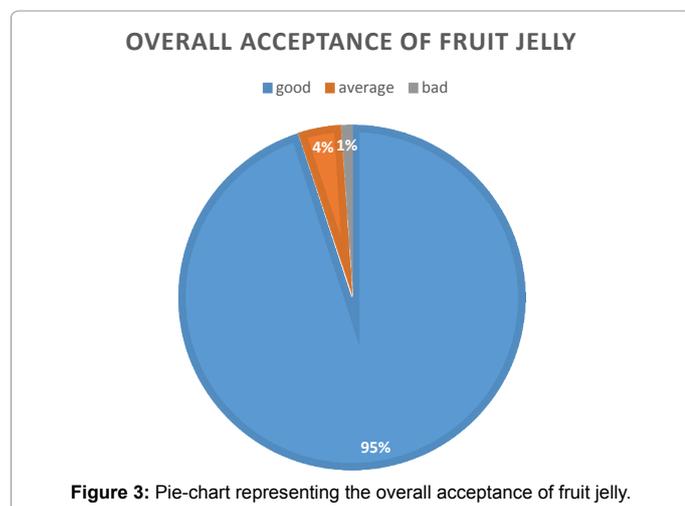


Figure 3: Pie-chart representing the overall acceptance of fruit jelly.