

## Effect of carbonation on physical and chemical attributes of lime juice

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Received: 12.01.2013; Revised: 20.05.2013; Accepted: 24.05.2013

■ **ABSTRACT** : Citrus fruits like sweet limes, lemon, oranges and limes are rich sources of vitamin 'C' and they contain flavonoids which act as antioxidants. However, indoles found in citrus fruits protect against cancers. The beverage industry is the largest outlet for fruit juice and concentrates absorbing over 80 per cent of fruit production in India. More over 60 per cent of the fruit produced are used in fruit based beverages such as fruit juice drinks, squashes, cordials, punches etc. The fresh fruit juice is best in taste, aroma and colour. Therefore, in fruit juice industry, it is necessary to use such methods that would help to retain their properties up to maximum extent. In view of this, in the present study attempts have been made to standardize preparation of lime juice beverage, its palatability, acceptability and storability. The lime juice prepared by using 140 ppm potassium metabisulphate with carbonation at 80 psi pressure was found superior in respect of retention of all quality attributes like colour, taste, texture and flavour and was found acceptable upto 90 days of storage over the non-carbonated lime juice prepared by using 40 ppm potassium metabisulphate. The lime juice having the highest ascorbic acid contained the longest storability upto 90 days and better sensory qualities. However, further decreases in ascorbic acid content indicated the acceptable storability upto 75 days of storage.

■ **KEY WORDS** : Citrus, Beverage, Storability, Palatability

■ **HOW TO CITE THIS PAPER** : Lande, R.A. (2013). Effect of carbonation on physical and chemical attributes of lime juice. *Asian J. Home Sci.*, 8 (1): 197-199.

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In India a little over 16 per cent of fruit produced is used in fruit based beverages. (Manay and Shadaksharaswamy, 2005). Fruit juice is a natural juice pressed out of a fresh fruit. This is unaltered in its composition during preparation and preservation such as fresh juice and canned natural fruit juice. The fruits generally used for making juice are oranges, limes, grapes, apple, pomegranate, melons, mango etc. The manufacture of squashes on a commercial scale has made some progress. Raw whole or cut fruit or juice is frequently served as an appetiser, a salad or for desert. Citrus fruits like sweet limes, lemon, oranges and limes are the rich sources of vitamin C and also they contain flavonoids which act as antioxidants. Indoles found in citrus fruits protect against cancers (Srilakshmi, 2007).

The beverage industry is the largest outlet for fruit juice and concentrates absorbing over 80 per cent of production in India. A little over 60 per cent of the fruit produced is used in fruit based beverages such as fruit juice drinks, squashes, cordials, punches, etc. Fruit juices are best in taste, aroma

and colour when freshly expressed. The most important problem therefore, in the fruit juice industry is to use such methods as would help to retain these properties to the maximum extent. Therefore, attempts have been made to standardization of preparation of lime juice its palatability, acceptability and storability.

### ■ RESEARCH METHODS

Freshly pricked, sound and suitable fruits were selected and thoroughly washed, The juice is extracted by pressing fruits. The juice should not be unduly exposed to air. The extracted juice was immediately deaerated by subjecting it to a high vacuum. After deaeration, the vacuum was released with nitrogen gas and the juice was transferred into containers, sealed and kept in deep fridge or frozen. The standardization of the process for juice preparation, the following four treatments/methods were adopted:

T<sub>1</sub> - Addition of potassium metabisulphate with carbonation at 80 PSI.

- T<sub>2</sub>-Addition of potassium metabisulphate without carbonation at 80 PSI.
- T<sub>3</sub>-By pasteurization method – Juice was boiled at higher temperature (68.3°C for 20 min.) followed by rapid cooling.
- T<sub>4</sub>-By sterilization – Juice was packed tightly in bottles with sealing devices and then bottle was sterilized in boiling water for 30 min. and immediately cooled by dipping in cold water
- T<sub>5</sub>-Without any treatment (control).

In preparation of juice the TSS was maintained at 15 degree bricks for all samples and stored at ambient storage. The observations on chemical changes and sensory evaluation were recorded at every after 15 days interval till the juice remains acceptable for consumption.

**RESEARCH FINDINGS AND DISCUSSION**

The results of the present study as well as relevant discussions have been presented under following sub heads:

**Sensory evaluation :**

The statistically analysed data on the sensory score evaluation for all the four quality attributes *i.e.* colour, taste, flavour and texture of lime juice (Table 1) indicated significant differences. However, storage periods for all the quality attributes and overall

acceptability were found non– significant.

The data analyzed for one year storage observed that the juice prepared by using potassium metabisulphate with ..... °C PSI pressure recorded the highest score for all quality attributes and found maximum acceptability and followed by the juice without carbonation, while the juice prepared and treated by pasteurization and sterilization of 85 °C showed the lowest consumer acceptability and remained acceptability up to 30 days and followed by control product which remained acceptable only upto 15 days. After that they were spoiled (Table 2).

**Chemical evaluation :**

Chemical attributes significantly influenced during the storage period and the increasing and decreasing trends of chemical parameters were recorded during storage (Table 3).

**Total acidity :**

Acidity was also maintained initially at 0.33 per cent in all the treatments. It was found that titratable acidity was slightly increased with increase in storage period. During storage upto 90 days, acidity was increased upto 0.40 and recorded highest acidity (0.40) in control product and followed by sterilized and pasteurized product (0.39, 0.38, respectively). Comparatively lowest acidity was found in the lime juice

**Table 1 : Treatment wise sensory evaluation of lime juice at ‘0’ days at ambient temperature**

Treatments	Colour	Taste	Flavour	Texture	Totally
T <sub>1</sub> Carbonated with potassium metasulphite	6.62	6.65	6.65	6.94	26.86
T <sub>2</sub> Non-carbonated with potassium metasulphite	6.49	6.57	6.45	6.67	26.18
T <sub>3</sub> Pasteurized	6.38	6.49	6.48	6.58	25.93
T <sub>4</sub> Sterilized	5.12	5.75	5.20	6.20	22.27
T <sub>5</sub> Control	4.50	5.32	5.12	5.81	20.75

**Table 2 ; Changes in sensory qualities of lime juice during storage at ambient temperature**

Treatments	Storage period (days)													
	Taste							Colour						
	0	15	30	45	60	75	90	0	15	30	45	60	75	90
T <sub>1</sub>	6.65	6.53	6.47	6.32	6.28	6.10	6.00	6.62	6.48	6.39	6.28	6.15	5.89	5.70
T <sub>2</sub>	6.57	5.50	6.43	6.38	6.26	6.17	6.08	6.49	6.37	6.21	6.15	5.27	5.08	5.00
T <sub>3</sub>	6.49	6.40	6.32	6.28	6.22	6.19	6.10	6.38	6.29	6.23	6.18	6.01	5.83	5.65
T <sub>4</sub>	5.75	5.68	5.59	5.44	5.37	5.22	5.11	5.12	5.07	5.01	4.94	5.89	5.70	5.28
T <sub>5</sub>	5.32	4.97	4.79	4.63	4.40	4.01	3.92	4.50	4.44	4.28	4.19	4.07	3.98	3.77
	Flavour							Texture						
	0	15	30	45	60	75	90	0	15	30	45	60	75	90
T <sub>1</sub>	6.94	6.88	6.82	6.78	6.70	6.56	6.41	6.94	6.88	6.82	6.78	6.70	6.56	6.41
T <sub>2</sub>	6.67	6.56	6.48	6.39	6.32	6.28	6.19	6.67	6.56	6.48	6.39	6.32	6.28	6.19
T <sub>3</sub>	6.58	6.49	6.41	6.34	6.26	6.18	6.11	6.58	6.49	6.41	6.34	6.26	6.18	6.11
T <sub>4</sub>	6.20	6.13	6.08	5.98	5.87	5.72	5.68	6.20	6.13	6.08	5.98	5.87	5.72	5.68
T <sub>5</sub>	5.81	5.79	5.65	5.58	5.49	5.35	5.21	5.81	5.79	5.65	5.58	5.49	5.35	5.21

Table 3 : Changes in chemical attributes in lime juice at ambient temperature

Treatments	Storage period (days)													
	0	15	30	45	60	75	90	0	15	30	45	60	75	90
	T.S.S. (°B)													
T <sub>1</sub>	14.50	14.71	14.89	15.01	15.09	15.15	15.19	0.33	0.35	0.35	0.36	0.365	0.368	0.357
T <sub>2</sub>	15.50	14.68	14.71	14.79	14.71	14.89	15.15	0.33	0.33	0.34	0.34	0.35	0.36	0.37
T <sub>3</sub>	14.50	14.59	14.62	14.69	14.79	14.92	15.14	0.33	0.34	0.34	0.36	0.37	0.38	0.39
T <sub>4</sub>	14.50	14.62	14.70	14.76	14.85	14.99	15.15	0.33	0.35	0.35	0.36	0.37	0.37	0.38
T <sub>5</sub>	14.50	14.60	14.66	14.68	14.79	14.95	15.11	0.33	0.34	0.36	0.38	0.39	0.39	0.40
	Ascorbic acid (mg/100g)													
T <sub>1</sub>	3.81	3.75	3.69	3.50	3.26	3.13	2.98	13.98	14.02	14.12	14.19	14.28	14.39	14.41
T <sub>2</sub>	3.90	3.88	3.78	3.62	3.48	3.24	3.01	14.00	14.05	14.18	14.22	14.32	14.45	14.48
T <sub>3</sub>	3.36	3.23	3.03	2.91	2.75	2.59	2.43	13.90	13.98	14.05	14.18	14.26	14.39	14.43
T <sub>4</sub>	3.76	3.68	3.51	3.23	3.03	2.88	2.79	13.82	13.89	13.94	14.01	14.14	14.28	14.39
T <sub>5</sub>	2.05	1.89	1.71	1.58	1.41	1.28	1.19	13.68	13.71	13.85	13.93	14.02	14.11	14.27
	Total sugar (%)													
T <sub>1</sub>	3.81	3.75	3.69	3.50	3.26	3.13	2.98	13.98	14.02	14.12	14.19	14.28	14.39	14.41
T <sub>2</sub>	3.90	3.88	3.78	3.62	3.48	3.24	3.01	14.00	14.05	14.18	14.22	14.32	14.45	14.48
T <sub>3</sub>	3.36	3.23	3.03	2.91	2.75	2.59	2.43	13.90	13.98	14.05	14.18	14.26	14.39	14.43
T <sub>4</sub>	3.76	3.68	3.51	3.23	3.03	2.88	2.79	13.82	13.89	13.94	14.01	14.14	14.28	14.39
T <sub>5</sub>	2.05	1.89	1.71	1.58	1.41	1.28	1.19	13.68	13.71	13.85	13.93	14.02	14.11	14.27

prepared by using 140 ppm potassium metabisulphate with carbonation (0.35).

#### Ascorbic acid :

The ascorbic acid was found in the range of 2.05 mg / 100 to 3.9 mg/100 g in the juice prepared by various treatments .Overall the ascorbic acid content was continuously decreased during storage. Ascorbic acid content was maximum at fresh product and being minimum at 90 days storage. Maximum ascorbic acid was recorded in the sample where carbonation not used (3.01 mg) and minimum in control sample 1.19 mg at 90 days storage.

#### Total sugars :

Total sugar was found significantly increased (14.00 % to 14.48 %) with increase in storage period from 0 to 90 days in all the treatments. Total sugar appeared maximum in product prepared without carbonation and minimum in control sample. Total sugar was slightly increased throughout the storage.

#### T.S.S. :

Maximum T.S.S. was recorded in the carbonated sample (15.19<sup>o</sup> B) and followed by non-carbonated, sterilized and pasteurized product, while, minimum T.S.S. (15.11<sup>o</sup> B) was appeared in control group product. At the storage T.S.S. increased and recorded maximum at 90 days storage in all treatments.

#### Conclusion :

On the basis of analyzed data, it was concluded that the lime juice prepared by using the 140 PPM potassium metabisulphite with carbonation at 80 PSI pressure, it was found superior in respect of retention of all quality attributes like colour, taste, texture and flavour and was acceptable upto 90 days of storage and followed by non-carbonated sample with treatment KMS 140 PPM. The lime juice which contains highest ascorbic acid imparts the longest storability and better sensory qualities. The decreasing trend appeared upto to 75<sup>th</sup> day of storage and there after it decreased towards the end of storage.

#### Recommendation :

For the maximum acceptability and storability of lime juice, addition of 140 PPM potassium metabisulphite carbonation at 80 PSI pressure is recommended.

#### REFERENCES

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