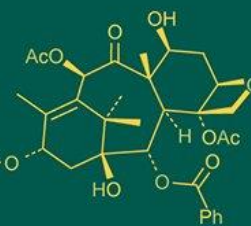
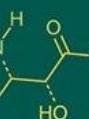
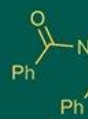


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(6): 217-223
www.biochemjournal.com
Received: 23-03-2026
Accepted: 26-04-2026

Madhu D Nevase
Ph.D. Scholar, Department of
Fruit Science, College of
Horticulture, Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth, Dapoli,
Maharashtra, India

CD Pawar
Ex-Professor, College of
Horticulture and Associate
Dean (L.A.E), Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth, Dapoli,
Maharashtra, India

KV Malshe
Agronomist, Regional Coconut
Research Station, Bhatye,
Ratnagiri, Maharashtra, India

MC Kasture
Head, Department of Soil
science and Agril. Chemistry,
College of Agriculture,
Dr. Balasaheb Sawant Konkan
Krishi Vidyapeeth, Dapoli,
Maharashtra, India

JJ Kadam
Professor (CAS), Department
of Plant Pathology, College of
Agriculture, Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth, Dapoli,
Maharashtra, India

MM Kulkarni
Associate Professor (CAS),
Department of Fruit Science,
College of Horticulture,
Dr. Balasaheb Sawant Konkan
Krishi Vidyapeeth, Dapoli,
Maharashtra, India

Corresponding Author:
Madhu D Nevase
Ph.D. Scholar, Department of
Fruit Science, College of
Horticulture, Dr. Balasaheb
Sawant Konkan Krishi
Vidyapeeth, Dapoli,
Maharashtra, India

Studies on chemical composition of must and fermentation characteristics of cashew apple (*Anacardium occidentale* L.) and lime (*Citrus aurantifolia*) blended wine

Madhu D Nevase, CD Pawar, KV Malshe, MC Kasture, JJ Kadam and MM Kulkarni

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i6Sc.8594>

Abstract

An investigation entitled “Studies on chemical composition of must and fermentation characteristics of (*Anacardium occidentale* L.) and lime (*Citrus aurantifolia*) blended wine” was conducted during 2023-24 at the Pomology Laboratory, Fruit Processing Unit, College of Horticulture, Dapoli and Fruit Beverage Research Centre, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri. The study aimed to evaluate the chemical composition of must and fermentation behaviour of cashew apple and lime blended wine. The experiment was laid out in a Factorial Completely Randomized Design (FCRD) with eighteen treatment combinations consisting of six juice blend levels and three T.S.S. levels. Cashew apple juice was blended with lime juice in different proportions and T.S.S. was adjusted to 16°, 20° and 24°Brix. The prepared must was inoculated with *Saccharomyces cerevisiae* var. bayanus and allowed to ferment at room temperature. Observations on T.S.S., pH, yeast count and wine recovery were recorded during fermentation. The results revealed that increasing lime juice proportion significantly decreased pH and increased titratable acidity of the must. Higher T.S.S. levels increased soluble solids content, whereas acidity decreased. During fermentation, T.S.S. and pH gradually declined in all treatment combinations and fermentation was completed within 15 days. Maximum reduction in T.S.S. was observed in treatment J₂T₁, while the lowest pH after fermentation was recorded in J₆T₂. Yeast population increased up to the 4th day and declined thereafter. Wine recovery ranged from 74 to 81 percent among treatments. The study concluded that blending cashew apple juice with lime juice and maintaining suitable T.S.S. levels improved fermentation characteristics and produced good quality blended wine.

Keywords: Cashew apple, lime, fermentation, T.S.S., blending

Introduction

Cashew (*Anacardium occidentale* L.) is one of the important plantation crops cultivated in the coastal regions of India, particularly in the Konkan region of Maharashtra. The crop is mainly grown for its kernels; however, the cashew apple possesses high nutritional and processing potential. Cashew cultivation plays an important role in the socio-economic development of farmers through employment and income generation (Gawankar *et al.*, 2018) [8]. Maharashtra is one of the leading cashew-producing states in India, particularly in the districts of Ratnagiri, Sindhudurg, Raigad and Palghar (Manerikar *et al.*, 2022) [11]. Recent reports indicated that Maharashtra produced nearly 1,99,700 tonnes of cashew during 2025, contributing significantly to national production, mainly from the Konkan belt (Anon., 2025) [2].

Cashew apple is rich in sugars, vitamins, minerals and antioxidant compounds and contains higher vitamin C content than many citrus fruits (Akinwale, 2000) [1]. Despite its nutritional importance, nearly 85-90 percent of cashew apples are wasted due to their highly perishable nature, short shelf life and astringent taste (Das and Arora, 2017) [5]. Therefore, utilization of cashew apple for preparation of value-added products such as wine has gained importance. Lime (*Citrus aurantifolia*) is an important citrus fruit known for its refreshing flavour, acidity and high vitamin C content. Lime juice contains citric acid, flavonoids and essential oils which contribute to its nutritional and medicinal value (Yadav, 2015) [19].

Blending cashew apple juice with lime juice helps in improving flavour, acidity and overall acceptability of fermented beverages. Lime juice also provides suitable pH conditions for fermentation and enhances the sensory quality of wine (Sobhana *et al.*, 2015) [17]. Hence, preparation of cashew apple and lime blended wine can be an effective approach for reducing post-harvest losses, improving value addition and developing nutritionally enriched fermented beverages.

Materials and Methods

The experiment entitled “Studies on wine from blended juice of cashew apple (*Anacardium occidentale* L.) and lime (*Citrus aurantifolia*)” was carried out in the year 2023-2024 at the Pomology Laboratory, Fruit Processing Unit of the College of Horticulture, Dapoli and the Fruit Beverage Research Centre of Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri. In this experiment, the must was prepared by blending cashew apple and lime natural juice as per treatments i.e., J₁ : 100 percent cashew apple juice, J₂ : 95 percent cashew apple juice + 5 percent lime juice, J₃ : 90 percent cashew apple juice + 10 percent lime juice, J₄ : 85 percent cashew apple juice + 15 percent lime juice, J₅ : 80 percent cashew apple juice + 20 percent lime juice, J₆ : 75 percent cashew apple juice + 25 percent lime juice and adjusting the T.S.S. to 16°Brix, 20°Brix and 24°Brix.

Fully matured, disease-free and healthy fruits of cashew apple were selected and washed with water and again rinsed with distilled water. Cashew apple juice extracted directly from helicoidal juice extractor machine. The procedure for juice extraction from cashew apples is shown in Fig. 1. For lime juice extraction ripe, healthy and disease free lime fruits were washed thoroughly with running tap water and rinsed with distilled water. Fruits were cut with the help of knife into half and seeds are separated. Juice was prepared by squeezing of lime fruits with hands. Juice was filtered with the help of sieve then kept overnight under cold storage (12±2 °C). The clear juice was used for preparation of wine (Fig. 2).

The must was prepared by blending the cashew apple and lime juice as per treatment details and 1 kg of blended juice was taken in 2 lit fermentation flasks. The T.S.S. of blended juice (J₁ to J₆) was adjusted to 16°B, 20°B and 24°B with the help of sugar. After adjustment of T.S.S., the pH of the juice was kept natural. The prepared must of each treatment combination was used for fermentation. The prepared must was inoculated with red wine yeast powder (*Saccharomyces cerevisiae* var. bayanus) at the rate of 0.3 g/kg of must in 10 times quantity of lukewarm water for activation of yeast cells. Must was inoculated with yeast culture @ 0.30 g kg⁻¹ and kept for fermentation at room temperature and fermentation was allowed to continue till the must showed constant T.S.S. The assembly was dismantled after end of fermentation. A double folded muslin cloth was used to filter the raw wine. The weight of the filtrate was measured after filtering and then bentonite was added @ 0.1 percent to extract. Bentonite was prepared by soaking it overnight in distilled water in 1:27 ratio. The wine was kept in cold storage at (12±2 °C) for 7 days. To extract the clear wine from settled debris, siphoning was done. The clear wine was put into clean bottles, sealed and kept at cold storage (12±2 °C) until it was used for chemical analysis and sensory evaluation (Fig. 3).

Total soluble solids (°Brix) were determined with the help of Hand refractometer (Erma Japan, 0 to 32°Brix) and value was corrected at 20 °C with the help of temperature correction chart (A.O.A.C., 1975) [3]. The pH of the wine was determined with the help of pH meter (Model Systronics μ pH system 361). The titratable acidity (%) were estimated as per the methods suggested by Ranganna (1997) [14].

Results and Discussion

1. Chemical composition of must prepared by blending cashew apple and lime natural juice

The data regarding chemical composition of must is presented in the Table 1. It is seen from data that, T.S.S., pH and titratable acidity of blended juice showed significant result with respect to juice levels, T.S.S. levels and their interactions, except T.S.S. of juice levels and interaction. T.S.S. was found to be increased with increase in T.S.S. levels from T₁ (15.99°B) to T₃ (23.97°B). This may be due to addition of sugar in increasing trend from T₁ to T₃ to adjust T.S.S. to 16°B, 20°B and 24°B. Solanke (2024) [18] reported similar finding of increase in T.S.S. with increase in T.S.S. levels in mango wine. However, results were non-significant with respect to juice levels and interaction of juice and T.S.S. levels.

In case of juice levels, pH was found to be decreased from J₁ (3.84) to J₆ (2.90). This decrease in pH may be the impact of increase in lime juice percentage from J₁ (0.0%) to J₆ (25%). Lowest pH was recorded by J₆ (2.90) was significantly superior over others. Nevase (2021) [12] reported similar finding of decrease in pH with increase in acidity in banana and kokum blended wine. The titratable acidity of blended must was increased from J₁ (0.21%) to J₆ (1.54%). Highest acidity was recorded by treatment J₆ (1.54%) was significantly superior over others. Similar findings were reported by Kamble (2024) [10] in cashew apple and aonla blended wine.

In case of T.S.S. levels, pH was found to be decreased from T₁ (3.46) to T₃ (3.31). This decrease in the pH may be due to increase in sugar from T₁ to T₃. Lowest pH was recorded by T₃ was significantly superior over others. Ghorband (2014) [9] reported similar finding in grape, guava and noni juice blended wine. The acidity was found to be decreased with increase in T.S.S. levels from T₁ (0.99%) to T₃ (0.78%). This decrease in acidity may be due to dilution of native acid due to addition of sugar in increasing trend to maintain T.S.S. to 16°B, 20°B and 24°B. Highest acidity recorded by treatment T₁ was significantly superior over others. Similar result found by Sadgir (2015) [15] while working on cashew apple and pineapple blended wine.

In case of interaction of juice and T.S.S. levels, lowest pH was recorded by interaction J₆T₃ (2.84) and it was at par with J₆T₂ (2.85). The highest acidity was recorded by interaction J₆T₁ (1.81%) and it was significantly superior over others. Lowest acidity was recorded by interaction J₁T₃ (0.20%).

2. Changes in T.S.S. during fermentation of cashew apple and lime blended must

The data related to changes in T.S.S. during fermentation of must are presented in Table 2. From the data it is seen that, during fermentation of cashew apple and lime blended must, T.S.S. was found to be decreased throughout the fermentation period. A rapid decrease in T.S.S. was

observed during initial three to five days of fermentation and later on, it decreased at slower rate till the end of fermentation (15th day). In general, the T.S.S. of must was found to be increased with increase in lime juice in blended must from J₁ (0.0%) to J₆ (25%). The maximum decrease in T.S.S. in the initial period of the fermentation may be due to faster conversion of sugars into alcohol. The yeast converts sugars into alcohol with the help of enzymes, pyruvic decarboxylase and alcohol dehydrogenase. The fermentation rate declines later due to increased quantity of alcohol exerting effect on fermentation process by hindering the activity of yeast. The results correspond with Deshpande *et al.* (2020) [6] in grape, guava and noni juice blended wine. In case of interaction, J₂T₁ recorded more reduction in T.S.S. i.e. (4.33 °B) at the end of fermentation.

3. Changes in pH during fermentation of cashew apple and lime blended must

The data related to the changes in pH during fermentation of cashew apple and lime blended wine is presented in Table 3 (2023-24). The pH of must prepared by blending cashew apple and lime natural juice were not adjusted. The table shows that the pH of the must decreased continuously as the fermentation process went on until it was finished. The reason behind decrease in pH of must may be the production of organic acids during fermentation. Because there is an inverse relation between acids and pH. In case of juice levels, pH shows decreasing trend with increase in lime juice content in must from J₁ to J₆ (0.0 to 25%). The lowest pH at the end of fermentation was recorded by interaction J₆T₂ (1.86). The results correspond with results of Sarkale (2012) [16] in kokum wine. pH of the different interactions recorded increasing trend with increase in T.S.S. levels. This increase in pH with increase in T.S.S. may be due to decrease in acidity due to addition of sugar in juice. Pawar (2009) [13] also reported similar results in sapota wine. The highest pH was recorded by J₁T₃ (3.26).

4. Changes in yeast count during fermentation of cashew apple and lime blended must

The data related to changes in yeast count during fermentation is shown in Table 4. It is seen from table that yeast count increased rapidly until the 4th day and after that yeast count subsequently declined until the end of fermentation. At 4th day of fermentation highest yeast count was indicated by interaction J₃T₃ (2383 x10⁴). Whereas interaction J₄T₃ (1045 x10⁴) recorded lowest yeast count. At the end of fermentation (13th day) highest yeast count was recorded by interaction J₆T₁ (99 x 10⁴). Whereas lowest yeast count was recorded by interaction J₅T₂ (59 x10⁴). Similar results have been recorded Chaudhary *et al.* (2014) [4] in grapes and jamun juice blended wine.

5. percent wine recovery (%) of cashew apple and lime blended wine

Wine recovery obtained from 1.0 kg cashew apple and lime must is presented in Table 5. From the pooled data it is seen that, in case of juice levels, wine recovery increased from J₁ to J₆. The significantly maximum recovery recorded by treatment J₆ (82.56%) may be due to clear lime juice contain in treatment increases from 0 to 25 percent. Lowest wine recovery was recorded by J₁ (74.73%) because 100 percent cashew apple juice is used which was less clear than lime juice. In case of T.S.S. levels, wine recovery increased with

increase in T.S.S. levels. Maximum wine recovery was recorded by treatment T₃ (80.38%), this may be due to T.S.S. of must adjusted to 24°B. In case of interaction significantly maximum wine recovery was recorded by interaction J₆T₃ (83.00%) and minimum by interaction J₁T₁ (74.19%). The results for percent wine recovery corresponds with results of Nevase (2021) [12] in banana and kokum blended wine.

Table 1: Chemical composition (T.S.S., pH and Titratable acidity) of must prepared by blending cashew apple and lime natural juice

Treatments/Treatment combinations	T.S.S. (°Brix)	pH	Acidity (%)
J ₁	20.02	3.84	0.21
J ₂	20.07	3.67	0.42
J ₃	19.98	3.53	0.69
J ₄	19.98	3.27	0.92
J ₅	19.94	3.06	1.39
J ₆	19.93	2.90	1.54
Average	19.99	3.38	0.86
S.E.m±	0.04	0.004	0.013
C.D. at 1%	NS	0.014	0.052
T ₁	15.99	3.46	0.99
T ₂	20.01	3.37	0.82
T ₃	23.97	3.31	0.78
Average	19.99	3.38	0.86
S.E.m±	0.026	0.003	0.010
C.D. at 1%	0.099	0.010	0.037
J ₁ T ₁	16.07	3.92	0.22
J ₁ T ₂	20.00	3.81	0.21
J ₁ T ₃	24.00	3.78	0.20
J ₂ T ₁	16.07	3.75	0.52
J ₂ T ₂	20.07	3.70	0.37
J ₂ T ₃	24.07	3.56	0.35
J ₃ T ₁	16.00	3.62	0.80
J ₃ T ₂	20.00	3.51	0.66
J ₃ T ₃	23.93	3.45	0.60
J ₄ T ₁	15.87	3.35	1.18
J ₄ T ₂	20.00	3.29	0.81
J ₄ T ₃	24.07	3.18	0.78
J ₅ T ₁	16.00	3.10	1.43
J ₅ T ₂	20.03	3.06	1.42
J ₅ T ₃	23.80	3.03	1.34
J ₆ T ₁	15.93	3.00	1.81
J ₆ T ₂	19.93	2.85	1.42
J ₆ T ₃	23.93	2.84	1.40
Average	19.99	3.38	0.86
S.E.m±	0.06	0.006	0.023
C.D. at 1%	NS	0.024	0.090

Table 2: Changes in T.S.S. (°Brix) during fermentation of cashew apple and lime blended must (2023-24)

Treatment combinations	T.S.S. (°Brix)								
	Initial	1 st day	3 rd day	5 th day	7 th day	9 th day	11 th day	13 th day	15 th day
J ₁ T ₁	16.07	13.63	5.80	5.60	4.94	4.93	4.93	-	-
J ₁ T ₂	20.00	18.03	8.60	6.40	6.07	6.07	6.07	-	-
J ₁ T ₃	24.00	21.93	12.20	9.60	6.87	6.87	6.87	-	-
Average 5.96									
J ₂ T ₁	16.07	13.70	5.80	5.46	5.20	4.33	4.33	4.33	-
J ₂ T ₂	20.03	17.20	8.20	6.66	6.46	4.33	4.33	5.67	-
J ₂ T ₃	24.03	22.23	12.20	9.60	8.36	4.33	4.33	6.87	-
Average 5.62									
J ₃ T ₁	16.00	13.73	5.60	5.60	5.40	4.67	4.67	4.67	-
J ₃ T ₂	19.98	16.26	8.40	7.60	6.80	6.03	6.03	6.03	-
J ₃ T ₃	23.93	21.70	12.20	9.40	8.86	6.40	6.40	6.40	-
Average 5.70									
J ₄ T ₁	15.87	14.56	5.80	5.60	5.25	4.53	4.53	4.53	-
J ₄ T ₂	20.00	16.96	8.80	7.60	6.96	6.96	5.53	5.53	5.53
J ₄ T ₃	24.07	22.66	12.60	10.20	8.72	6.13	6.13	6.13	-
Average 5.40									
J ₅ T ₁	16.00	14.26	5.80	5.40	4.40	4.40	4.40	-	-
J ₅ T ₂	20.03	18.03	9.20	7.40	5.00	5.00	5.00	-	-
J ₅ T ₃	23.80	21.23	12.60	9.80	5.87	5.87	5.87	-	-
Average 5.09									
J ₆ T ₁	15.93	14.60	6.40	6.20	6.20	4.00	4.00	4.00	-
J ₆ T ₂	19.93	18.16	9.20	7.33	7.13	5.13	5.13	5.13	-
J ₆ T ₃	23.93	22.26	12.8	9.80	9.13	5.93	5.93	5.93	-
Average 5.02									

Table 3: Changes in pH during fermentation of cashew apple and lime blended must (2023-24)

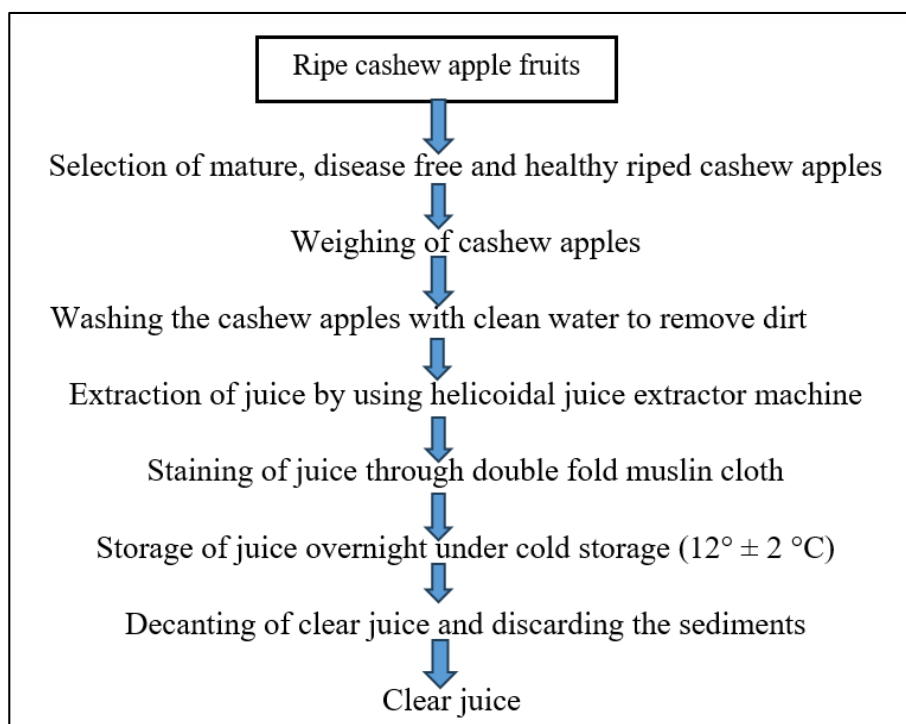
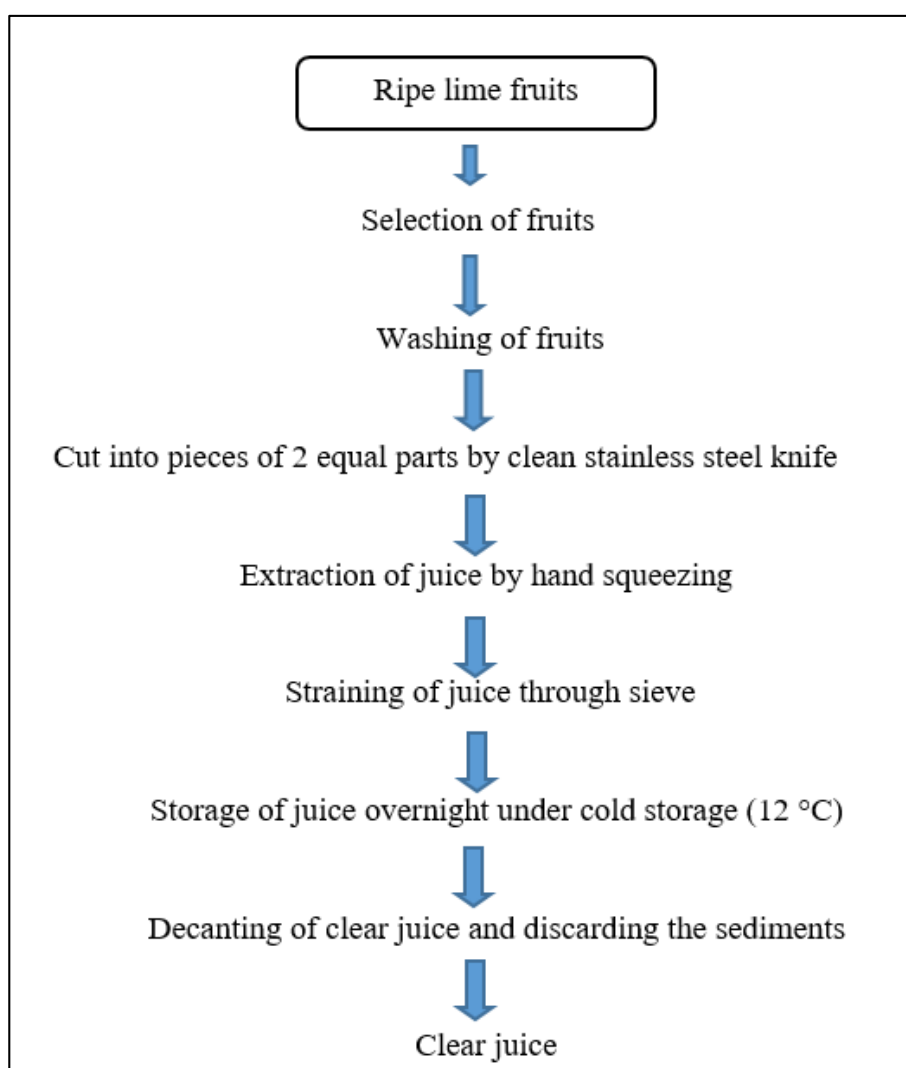
Treatment combinations	pH								
	Initial	1 st day	3 rd day	5 th day	7 th day	9 th day	11 th day	13 th day	15 th day
J ₁ T ₁	3.92	3.52	3.40	3.36	3.32	3.30	3.24	-	-
J ₁ T ₂	3.81	3.54	3.41	3.37	3.34	3.28	3.25	-	-
J ₁ T ₃	3.78	3.57	3.42	3.37	3.32	3.28	3.26	-	-
Average 3.25									
J ₂ T ₁	3.75	3.08	2.96	2.92	2.88	2.82	2.78	2.71	-
J ₂ T ₂	3.70	3.12	2.98	2.95	2.91	2.82	2.76	2.72	-
J ₂ T ₃	3.56	3.08	2.95	2.89	2.86	2.81	2.76	2.73	-
Average 2.72									
J ₃ T ₁	3.62	2.84	2.65	2.61	2.57	2.46	2.43	2.40	-
J ₃ T ₂	3.51	2.82	2.72	2.67	2.63	2.53	2.47	2.40	-
J ₃ T ₃	3.45	2.82	2.73	2.69	2.60	2.55	2.50	2.46	-
Average 2.35									
J ₄ T ₁	3.35	2.60	2.49	2.43	2.38	2.20	2.10	-	-
J ₄ T ₂	3.29	2.66	2.55	2.53	2.51	2.22	2.18	2.14	2.10
J ₄ T ₃	3.18	2.64	2.59	2.53	2.48	2.45	2.39	2.35	-
Average 2.18									
J ₅ T ₁	3.10	2.45	2.31	2.26	2.24	2.11	2.08	-	-
J ₅ T ₂	3.06	2.48	2.36	2.32	2.23	2.16	2.13	-	-
J ₅ T ₃	3.03	2.48	2.39	2.33	2.29	2.24	2.19	-	-
Average 2.13									
J ₆ T ₁	3.00	2.33	2.18	2.14	2.09	1.99	1.90	1.87	-
J ₆ T ₂	2.85	2.35	2.23	2.19	2.19	2.10	1.99	1.86	-
J ₆ T ₃	2.84	2.35	2.30	2.19	2.15	2.10	2.05	2.00	-
Average 1.91									

Table 4: Changes in yeast count during fermentation of cashew apple and lime blended must (2023-24)

Treatment combinations	Colony count in number × 10 ⁴					
	Initial	1 st day	4 th day	7 th day	10 th day	13 th day
J ₁ T ₁	0	112	1338	1466	765	-
J ₁ T ₂	0	128	1499	1200	745	-
J ₁ T ₃	0	90	2204	1449	457	-
J ₂ T ₁	0	73	1467	1643	653	-
J ₂ T ₂	0	111	1388	1337	256	-
J ₂ T ₃	0	98	1358	1114	546	-
J ₃ T ₁	0	111	1676	1071	674	-
J ₃ T ₂	0	118	1629	1233	653	-
J ₃ T ₃	0	114	2383	989	786	65
J ₄ T ₁	0	87	1971	1074	986	72
J ₄ T ₂	0	64	1714	1323	874	-
J ₄ T ₃	0	73	1045	1504	984	76
J ₅ T ₁	0	12	1346	1476	367	-
J ₅ T ₂	0	107	1815	1630	593	59
J ₅ T ₃	0	136	2076	1110	430	63
J ₆ T ₁	0	135	2169	1414	510	99
J ₆ T ₂	0	101	1315	1160	480	-
J ₆ T ₃	0	114	1933	1203	529	90

Table 5: Percent wine recovery of cashew apple and lime blended wine

Treatments/Treatment Combinations	Wine recovery (%)
J ₁	74.73
J ₂	78.44
J ₃	80.32
J ₄	80.98
J ₅	81.85
J ₆	82.56
Average	79.81
S.E.m±	0.11
C.D. at 1%	0.43
T ₁	79.16
T ₂	79.90
T ₃	80.38
Average	79.81
S.E.m±	0.08
C.D. at 1%	0.31
J ₁ T ₁	74.19
J ₁ T ₂	74.78
J ₁ T ₃	75.22
J ₂ T ₁	76.78
J ₂ T ₂	78.29
J ₂ T ₃	80.26
J ₃ T ₁	79.71
J ₃ T ₂	80.44
J ₃ T ₃	80.80
J ₄ T ₁	80.65
J ₄ T ₂	81.30
J ₄ T ₃	81.00
J ₅ T ₁	81.61
J ₅ T ₂	81.93
J ₅ T ₃	82.00
J ₆ T ₁	82.00
J ₆ T ₂	82.67
J ₆ T ₃	83.00
Average	79.81
S.E.m±	0.20
C.D. at 1%	0.75

**Fig 1:** Extraction of juice from cashew apple**Fig 2:** Extraction of juice from lime fruits

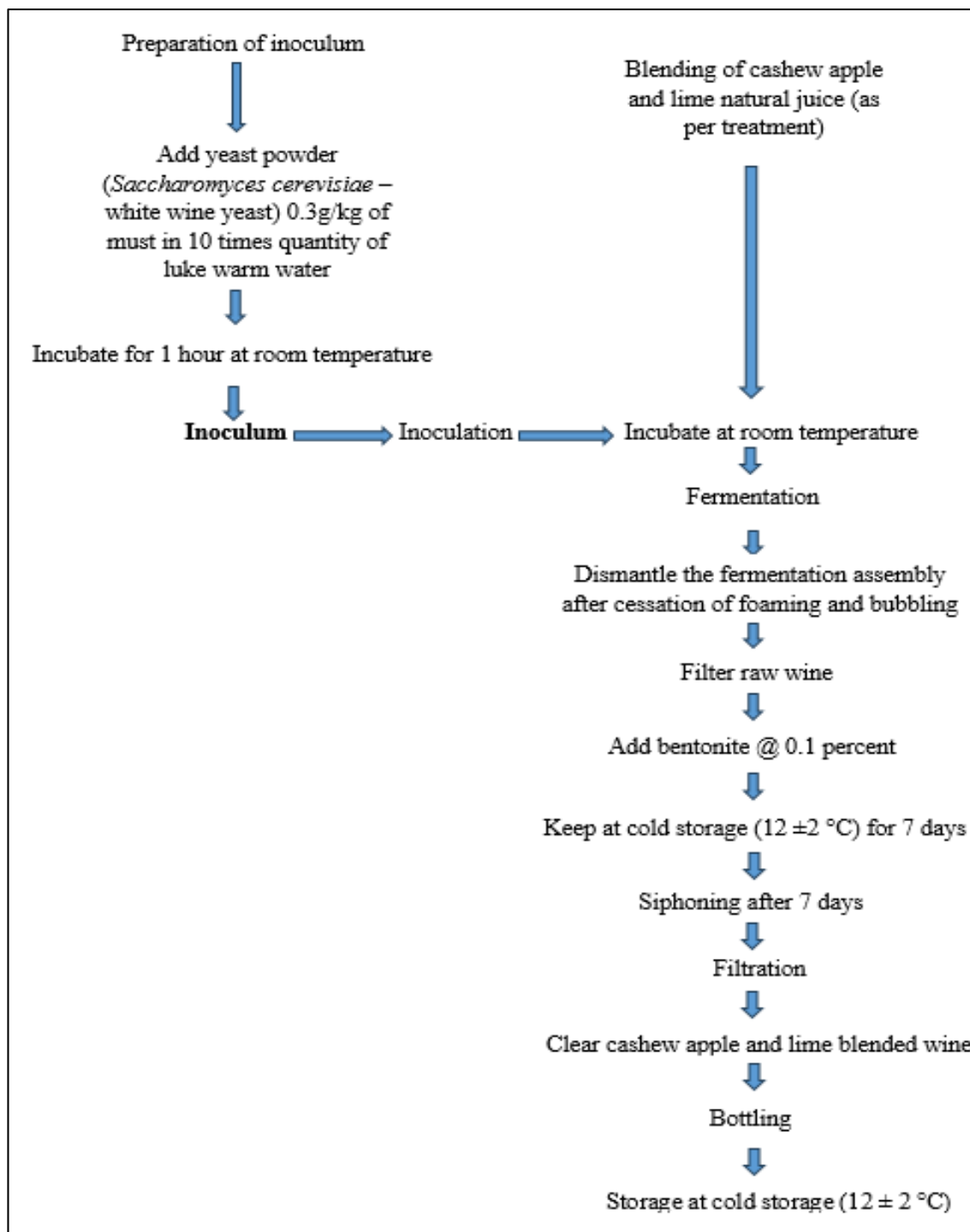


Fig 3: Preparation of cashew apple and lime blended wine

Conclusion

The present investigation demonstrated that during fermentation, treatment J₂T₁ (95% cashew apple juice + 5% lime juice with 16°Brix), which showed the lowest final T.S.S. value of 4.33°Brix at the end of fermentation. The lowest pH after fermentation was recorded in treatment J₆T₂ (75% cashew apple juice + 25% lime juice with 20°Brix), with a pH value of 1.86. The highest yeast count on the 4th day of fermentation was observed in treatment J₃T₃ (90% cashew apple juice + 10% lime juice with 24°Brix), recording 2383×10^4 colonies. At the end of fermentation, the maximum wine recovery was obtained in treatment J₆T₃ (75% cashew apple juice + 25% lime juice with 24°Brix), with wine recovery of 83.00 percent.

References

1. Akinwale TO. Cashew apple juice: its use in fortifying the nutritional quality of some tropical fruits. *Eur Food Res Technol.* 2000;211:205-207.
2. Anonymous. State insights: cashew producing states in India: area and production statistics. 2025.
3. AOAC. Official Method of Analysis. 12th ed. Washington (DC): Association of Official Analytical Chemists; 1975. p. 15-18.
4. Chaudhary C, Yadav BS, Grewal RB. Preparation of red wine by blending of grape (*Vitis vinifera*) and jamun (*Syzygium cumini*) juice before fermentation. *Int J Agric Food Sci Technol.* 2014;5(4):239-348.
5. Das I, Arora A. Post-harvest processing technology for cashew apple: a review. *J Food Eng.* 2017;194:87-98.

6. Deshpande HW, Katke SD, Kulkarni AS, Ghorband AS. Studies on process development and organoleptic evaluation of blended wine from grape, guava and noni juice. *Int J Curr Microbiol Appl Sci.* 2020;9(1):1288-1298.
7. Dewangan S, Ramteke V. Cashewnut and cashew apple: a potential drug and medicine. *Int J Plant Soil Sci.* 2022;34(22):1-8.
8. Gawankar MS, Salvi BR, Pawar CD, Khanvilkar MH, Salvi SP, Dalvi NV, *et al.* Technology development for cashew apple processing in Konkan region: a review. *J Adv Agric Res Technol.* 2018;2(1):40-47.
9. Ghorband AS. Studies on grape, guava and noni juice blended wine [MSc thesis]. Parbhani (Maharashtra): Vasantrao Naik Marathwada Agricultural University; 2014.
10. Kamble A. Studies on cashew apple (*Anacardium occidentale* L.) and aonla (*Embllica officinalis* Gaertn.) blended wine [MSc (Hort.) thesis]. Dapoli (Maharashtra): Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2024.
11. Manerikar S, Kshirsagar P, Thorat V, Torane SR. Trends in area, production and productivity of cashew in Konkan region of Maharashtra state: an economic analysis. *Int J Agric Sci.* 2022;18(1):180-185.
12. Nevase MD. Standardization of blended wine from diluted juice of banana and kokum [MSc (Hort.) thesis]. Dapoli (Maharashtra): Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2021.
13. Pawar CD. Standardization of wine making technology in sapota (*Manilkara achras* L.) [PhD (Hort.) thesis]. Dharwad (Karnataka): University of Agricultural Sciences; 2009.
14. Ranganna S. Handbook of Analysis and Quality Control for Fruits and Vegetable Products. 3rd ed. New Delhi: Tata McGraw Hill Publishing Company Ltd.; 1997.
15. Sadgir TB. Study on preparation of wine by blending of cashew apple and pineapple juices [MSc (Agri.) thesis]. Dapoli (Maharashtra): Konkan Krishi Vidyapeeth; 2015.
16. Sarkale AN, Pawar CD. Effect of different levels of TSS and pH on quality of kokum (*Garcinia indica*) must and its fermentation. *Int J Proc Post-Harvest Technol.* 2012;3(2):291-295.
17. Sobhana A, Mathew J, Ambili Appukutan A, Raghavan CM. Blending of cashew apple juice with fruit juices and spices for improving nutritional quality and palatability. *Acta Hortic.* 2015;1080:357-362.
18. Solanke A. Standardization of wine making technology from mature green and ripe Alphonso mango (*Mangifera indica* L.) fruits [PhD (Agri.) thesis]. Dapoli (Maharashtra): Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2024.
19. Yadav R. Nutritional and medicinal importance of lime fruits. *Asian J Hortic.* 2015;10(2):345-349.