Food and Nutrition Sciences, 2025, 16(11), 1611-1622
https://www.scirp.org/journal/fns
ISSN Online: 2157-9458
ISSN Print: 2157-944X

Vitamin C Degradation Kinetics and Evolution of Titratable Acidity of Nectars from Three *Mangifera Cultivars Indica* L. during Storage at 4˚C and 37˚C

Papa Guedel Faye[1,2,3*], Alioune Sow[4], Oumar Ibn Khatab Cisse[5], Khadim Niane[1], Samba Baldé[1], Omar Toure[1,2], Nicolas Cyrille Ayessou[1,2], Mady Cisse[1,2], Codou Mar Diop[1]

[1]Department of Chemical Engineering and Applied Biology, Water, Energy, Environment and Industrial Processes Laboratory (LE3PI), Polytechnic Higher School of Dakar, Cheikh Anta Diop University, Dakar, Senegal
[2]Center for Studies on Food Safety and Functional Molecules (CESAM), Dakar, Senegal
[3]Faculty of Agronomic Sciences and Food Technologies, Cheikh Ahmadou Bamba Khadim University (UCAK), Touba, Senegal
[4]Faculty of Agronomic Sciences, Aquaculture and Agri-Food Technologies, Gaston Berger University, Saint-Louis, Senegal
[5]National Higher School of Agriculture, Iba Der THIAM University, Thies, Senegal
Email: *papaguedel.faye@esp.sn

How to cite this paper: Faye, P.G., Sow, A., Cisse, O.I.K., Niane, K., Baldé, S., Toure, O., Ayessou, N.C., Cisse, M. and Diop, C.M. (2025) Vitamin C Degradation Kinetics and Evolution of Titratable Acidity of Nectars from Three Mangifera Cultivars Indica L. during Storage at 4˚C and 37˚C. *Food and Nutrition Sciences*, **16**, 1611-1622.
https://doi.org/10.4236/fns.2025.1611094

Received: September 25, 2025
Accepted: October 28, 2025
Published: October 31, 2025

Abstract

Ascorbic acid is a water-soluble molecule essential to the human organism. This vitamin is particularly sensitive to oxidation, due to various factors such as temperature. Furthermore, the titratable acidity not only influences the stability of vitamin C, but also the organoleptic quality of food. Tropical fruits such as mango (Kent variety, papaya, "Dieg Bou Diar" (DBD)) are very popular in the formulation of nectars, due to their nutritional wealth. The objective of this study is to assess the evolution of the vitamin C concentration and the titular acidity in three fruit nectars (papaya, kent, DBD) during storage at 4˚C and 37˚C over 14 days. The content of ascorbic acid was determined by iodometry, a titrimmetric method based on the oxidation of vitamin C by iodine. The titratable acidity was measured by titration. The results reveal a significant decrease in the content of ascorbic acid, more marked at 37˚C, with a maximum loss of 46.4% in the papaya nectar, against 19.5% at 4˚C. The Kent variety has shown the fastest degradation at both temperatures, while the DBD nectar presented better global stability, in particular with stabilization of vitamin C after the ninth day at 4˚C. The papaya nectar has excellent stability at 4˚C, but undergoes marked acidification from the seventh day at 37˚C. Kent nectar, more sensitive to thermal variations, sees its acidity double at 4˚C and increase even more to 37˚C. As for the DBD nectar, it is particularly reactive to temperature, its acidity is multiplied by 2.17˚C to 4˚C and by 3.35˚C to 37˚C, revealing high sensitivity to heat. Thesis works confirm the sensitivity of vitamin C to heat and physico-chemical characteristics of fruit matrices. They highlight the importance of refrigerated storage and varietal choice to preserve the nutritional and technological quality of nectars.

Keywords

Vitamin C, Mango, Nectar, Acidity, Storage, Degradation, Heat

1. Introduction

The mango tree (*Mangifera indica* L.) is a species belonging to the *Anacardiaceae* family, which includes nearly 600 species in 70 genera [1]-[3]. This tree is widely cultivated in tropical and subtropical areas, as well as in certain temperate regions of the Mediterranean basin. Its introduction to Africa and Brazil dates back to the 16th century [4]-[7]. It was not until the 19th century that its presence was attested in West Africa, notably in Senegal, Gambia, Guinea, Ivory Coast, Mali and Burkina Faso [8]. Mango is particularly valued for its high antioxidant content, including ascorbic acid, carotenoids such as β-carotene (provitamin A), as well as various phenolic compounds [9]-[12]. These bioactive substances give it many therapeutic properties, particularly in the prevention and treatment of cancer, cardiovascular and neurodegenerative diseases, diabetes, oxidative stress, inflammation and hypercholesterolemia, thanks to their powerful antioxidant power [13]-[18]. The most common varieties in Senegal are Kent, Keitt, Amélie and Julie. Its regular consumption could be an effective means of combating vitamin A deficiency [19] [20]. Because of its organoleptic quality and nutritional importance, mango is very popular among the population. However, the high-water content of mango (84.4 ± 1.7) makes this product very perishable [21]. This therefore poses a real conservation problem. Faced with the narrowness of national and sub-regional markets, the lack of fresh fruit storage infrastructure, and the increase in added value, mango must necessarily undergo processing in order to minimize post-harvest losses. These significant losses of mango after harvest can be mainly explained by the difficulty of preserving fresh mango due to its biochemical composition and the lack of post-harvest fruit stabilization technologies.

In Senegal, despite abundant production of tropical fruits, post-harvest losses and deterioration in the quality of processed products hamper their competitiveness. Several authors have highlighted the degradation of vitamin C in fruit products stored at room or high temperature [22]-[24]. However, few studies have simultaneously compared the impact of two typical contrasting storage temperatures (4˚C and 37˚C) on nectars from local African or adopted varieties, such as papaya, Kent and DBD. Three varieties, selected for their representativeness and local availability (Kent, Keitt and Amélie), will be used to produce the nectars using a standardized method, guaranteeing a homogeneous initial composition in terms of pulp, sugar and pH. The samples obtained will be packaged in airtight containers and then stored at two different temperatures to simulate domestic refrigeration conditions, and 37˚C to reproduce a warm environment comparable to the tropical climate. Samples will be taken at regular intervals to monitor the evolution of the physicochemical parameters.

2. Materials and Methods

This section describes the different experimental steps implemented to evaluate the kinetics of vitamin C degradation and the evolution of the titratable acidity of nectars from three Senegalese mango cultivars (*Mangifera indica* L.).

2.1. Material

Plant Material

Mangifera cultivars *indica* L. (Kent, Papaye and Dieg BouDiar (DBD)) from Senegalese orchards were selected because of their local agro-economic importance and their distinctive physico-chemical characteristics. Papaye is a cultivar of *Mangifera indica L.*

The fruits were harvested at commercial maturity in the Dakar region, then rigorously sorted on the basis of criteria of morphological uniformity, health integrity and absence of visible defects (**Figures 1-3**).

Figure 1. Papaya mango.

Figure 2. Kent mango.

Figure 3. DBD mango.

2.2. Methods

2.2.1. Methods of Making Nectar

From 5000 ± 0.01 g of fresh mangoes per cultivar, the fruits were manually sorted to eliminate defective specimens, then washed in potable water and disinfected in a 100-ppm sodium hypochlorite solution for 5 minutes. After peeling and pitting, the pulp obtained represented a mass of 3088 ± 0.01 g, a yield of 61.80%. This pulp was then mechanically homogenized using a blender, then sieved through a 2 mm stainless steel sieve, obtaining 2870 ± 0.01 g of filtered pulp (57.40%). Dilution with sterile distilled water was carried out at a pulp/water ratio of 60/40 to obtain a nectar at 15˚ Brix, for a total mass of 4783 ± 0.01 g. The mixture underwent pasteurization at 90˚C for 30 minutes, followed by rapid cooling, before being aseptically packaged in sterile 250 mL glass bottles. The samples were stored at two temperatures:

- 4˚C to simulate refrigerated household storage,
- 37˚C to simulate accelerated tropical conditions.

The storage period was set at 14 days, with analyses carried out on days D1, D3, D5, D7, D9, D11, D13 and D14.

2.2.2. Vitamin C Dosage

The ascorbic acid content was determined by iodometry, a titrimetric method based on the oxidation of vitamin C by iodine [22]. The results are expressed in $g \cdot L^{-1}$

2.2.3. Measurement of Titratable Acidity

Titratable acidity was measured by titration with 0.1 N NaOH solution in the presence of phenolphthalein as an indicator. Results are expressed as g citric acid. L^{-1} nectar, according to AOAC 942.15. [25].

2.2.4. Data Processing

Statistical treatments were performed using one-way analysis of variance (**ANOVA**), implemented in R software (***version*** **3.2.4** ***Revised*****, 2018-03-16,** ***R*****-70336**). Analyses were repeated three times per sample. The mean values (X) obtained for each sample were annotated with superscript letters ($X^{(i)}$, where i = a, b, c, …), in accordance with the multiple comparison method. Samples sharing the same letter do not show a significant difference at the 5% probability level ($p > 0.05$).

3. Results and Discussion

The results presented evaluate the influence of storage conditions on the evolution of titratable acidity and the stability of vitamin C in nectars from the three mango cultivars studied.

3.1. Evolution of the Titratable Acidity of the Different Batches of Nectars during Storage at 4˚C for Fourteen Days (Figure 4)

Papaya nectar has a quasi-stable acidity during storage. The increase is small

(+0.199 g·AC·L^{-1} between D1 and D14), which demonstrates very good stability at low temperature. Kent shows a marked increase in acidity, especially between D2 (+ 0.704 g·AC·L^{-1}), then a progressive stabilization. Its acidity goes from 0.896 ± 0.010 g·AC·L^{-1} at 1.952 ± 0.009 g·AC·L^{-1} (+1.056 g·AC·L^{-1}), the largest increase of the three. DBD shows a moderate increase, from 0.736 ± 0.008 g·AC·L^{-1} to 1.600 ± 0.010 g·AC·L^{-1} (+0.864 g·AC·L^{-1}). The growth rate is more linear and constant than that of Kent.

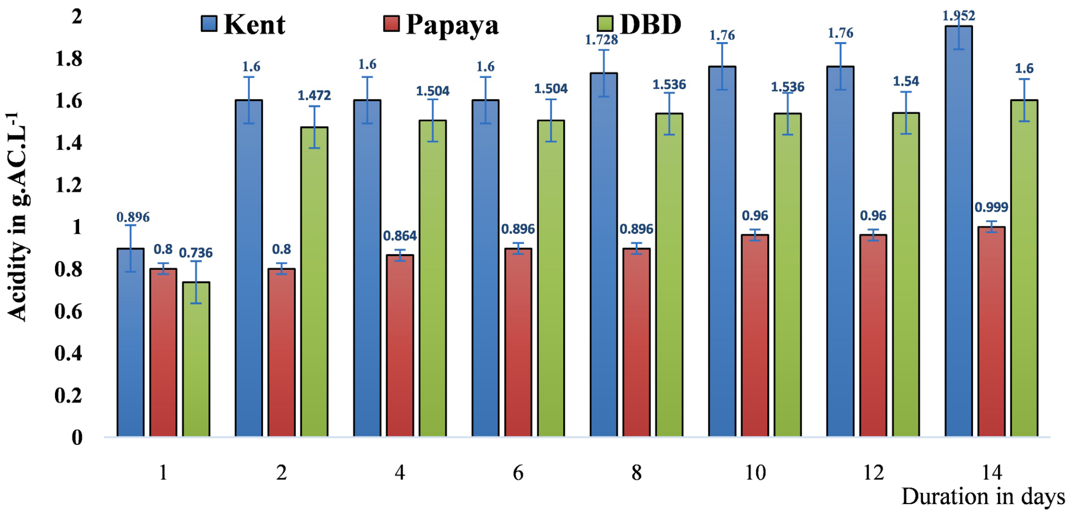

Figure 4. Evolution of titrable acidity during storage at 4˚C.

The stability of titratable acidity observed in mango nectar, particularly for the Papaya cultivar at 4˚C, can be attributed to the reduction of enzymatic and microbial activity at low temperatures. Indeed, cold slows down the biochemical reactions responsible for the degradation of organic compounds, which limits the accumulation of secondary organic acids. This observation is consistent with the work of Ayele and Bayleyegn (2017), who showed that storage at low temperatures (10˚C) significantly slowed down the ripening process and biochemical changes in mangoes, including the decrease in pH and the increase in titratable acidity after returning to room temperature [26]. Similarly, Kantanet *et al.* (2021) reported that storing mangoes at 5˚C or 8˚C extended their post-harvest shelf life while maintaining stable physicochemical characteristics, including titratable acidity, for more than 30 days [27]. These authors point out that temperatures above 10˚C lead to faster quality degradation, which corroborates the more marked increase in acidity observed in Kent and DBD cultivars at ambient or elevated temperatures. Thus, the results of your study confirm that storage at 4˚C is an effective strategy for preserving the acid stability of mango nectars, especially for varieties naturally less susceptible to biochemical alterations.

3.2. Evolution of the Titratable Acidity of the Different Batches of Nectars during Storage at 37˚C for Fourteen Years (Figure 5)

The evolution of the titratable acidity of nectars from the Papaya, Kent and DBD varieties, stored at 37˚C for 14 days, highlights a progressive acidification kinetics, characteristic of plant products subjected to high thermal conditions. This increase could result mainly from the intensification of enzymatic reactions of carbohydrate degradation and the production of organic acids. Among the samples studied, the DBD variety shows the most marked variation, suggesting a greater sensitivity to oxidation phenomena and a potentially more sustained enzymatic activity. These results are consistent with those of Faye *et al.* (2022), who observed a significant increase in titratable acidity in *Mangifera* nectars *indica* L [28]. subjected to heat treatment, attributing it to the conversion of sugars into acidic compounds during storage. Their study also highlights that fruits with high initial acidity tend to better preserve their vitamin C content, while developing faster acidification. Furthermore, the work of Diop *et al.* (CIRAD, UCAD) on baobab pulp confirms that stabilization treatments, such as pasteurization or microfiltration, can slow down this acid evolution [29]. Lounaci *et al.* (2018) highlighted a significant acceleration of the acidification of nectars stored at room temperature, corroborating the decisive influence of temperature in the dynamics of biochemical transformation of fruit matrices [30].

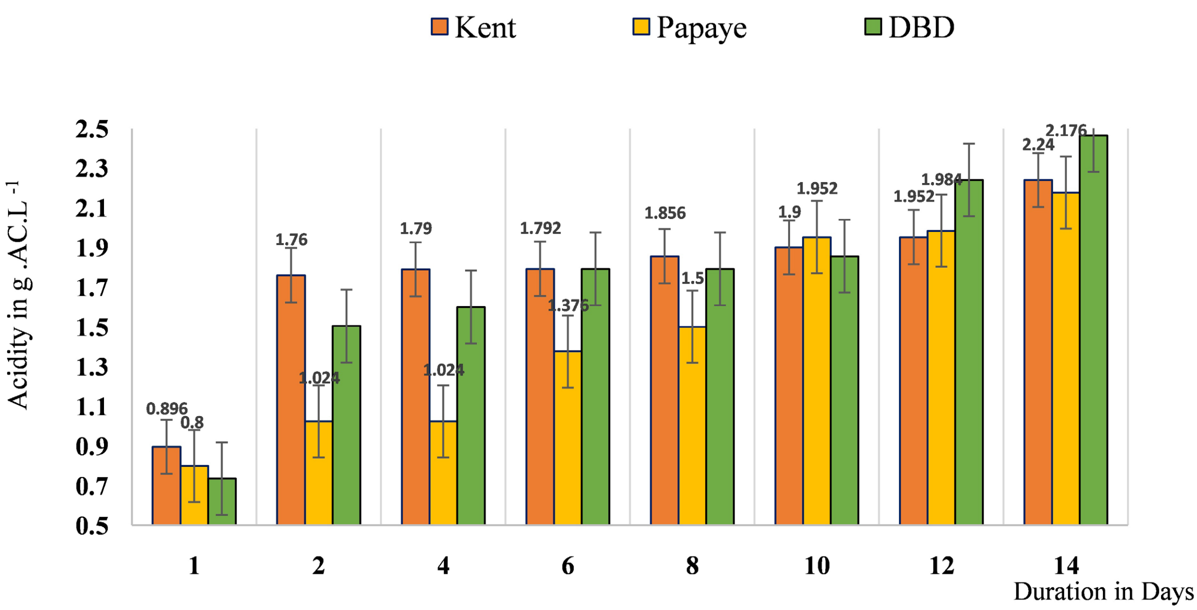

Figure 5. Evolution of the titratable acidity of nectars as a function of the days of storage at 37˚C.

Table 1. Evolution of the titratable acidity of nectars of the Papaya, Kent and DBD varieties stored at 4˚C and 37˚C for 14 days.

Temperature	Papaya (Δ acidity) g·AC·L^{-1} From 01 to 14 days	Kent (Δ acidity) g·AC·L^{-1} From 01 to 14 days	DBD (Δ acidity) g·AC·L^{-1} From 01 to 14 days
4˚C	(0.800^{b} ± 0.013) → (0.999^{d} ± 0.016) (+0.199)	(0.896^{a} ± 0.010) → (1.952^{e} ± 0.009) (+1,056)	(0.736^{c} ± 0.008) → (1.600^{f} ± 0.010) (+0.864)
37˚C	(0.800^{b} ± 0.013) → (2.176^{d} ± 0.010) (+1.376)	(0.896^{a} ± 0.010) → (2.240^{e} ± 0.010) (+1.344)	(0.736^{c} ± 0.008) → (2.464^{f} ± 0.005) (+1.728)

At 37˚C, enzymatic activity (e.g. pectinmethyl-esterase, invertase) and microbial proliferation are favored, which accelerates the production of organic acids (Table 1).

At 4˚C, these reactions are significantly slowed down, which explains the relative stability of the samples, particularly for the Papaya variety.

The DBD variety appears to be particularly sensitive to temperature, which could be linked to its initial composition (sugar content, pH, enzymes).

Comparison of titratable acidity data at 4˚C and 37˚C highlights the determining effect of temperature on the stability of nectars. Storage at 37˚C induces a rapid and significant increase in titratable acidity for the three nectar varieties (Papaya, Kent, DBD), reflecting an intensification of the reactions. Conversely, storage at 4˚C allows this acidification to be slowed down considerably, particularly for the Papaya variety, which shows remarkable stability. This observation confirms that storage temperature is a critical factor in acidification kinetics, as highlighted by Faye *et al.* (2022) and Lounaci & Ziad (2018) [27] [29]. Cold acts as an inhibitor of the biochemical processes responsible for the degradation of sugars into organic acids, thus prolonging the physicochemical stability of the products.

3.3. Evolution of Vitamin C Concentration during Storage at 4˚C (Figure 6)

The evolution of vitamin C concentration in the three nectars (Papaya, Kent, DBD) stored at 4˚C over a period of 14 days (Figure 6) reveals slowed but persistent degradation kinetics, confirming that low temperature attenuates but does not neutralize the oxidation of ascorbic acid [22].

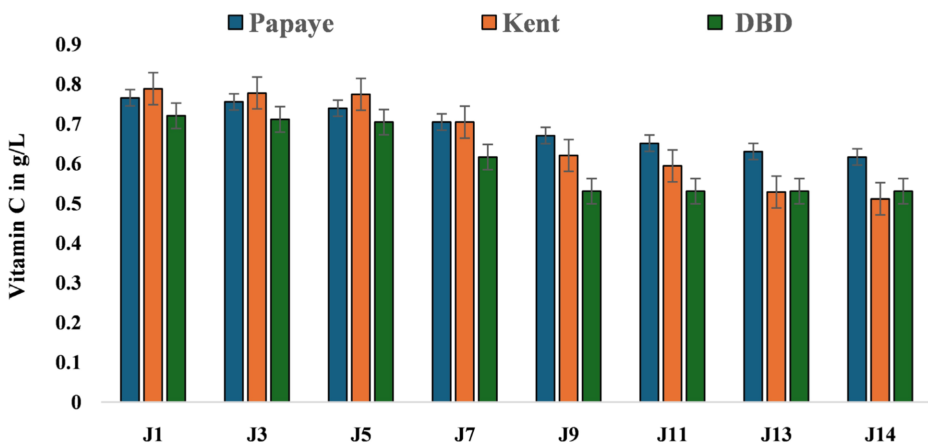

Figure 6. Evolution of vitamin C during storage at 4˚C/14 days.

The vitamin C concentration of papaya nectar increases from 0.765 ± 0.005 $g \cdot L^{-1}$ to 0.616 ± 0.002 $g \cdot L^{-1}$, a loss of 19.5%. The degradation is moderate and regular, especially between D5 and D9. This relative stability suggests that the papaya matrix, under these conditions, offers partial protection, possibly linked to a more acidic pH or a higher concentration of natural antioxidants [24]. With a loss of

35.1% (from 0.788 ± 0.005 g·L^{-1} to 0.511± 0.002 g·L^{-1}), Kent nectar shows the highest degradation. A clear break is observed from D7. This behavior could be explained by a lower acidity, a greater permeability to oxygen, or the presence of catalytic ions (Cu^{2+}, Fe^{3+}) facilitating oxidation [24]. The vitamin C concentration of DBD nectar decreased from 0.720 ± 0.002 g·L^{-1} to 0.530 ± 0.002 g·L^{-1}, a loss of 26.4%. There was a sharp initial decrease until D9, followed by an apparent stabilization. This could reflect the partial depletion of oxidizing substrates or an improvement in long-term chemical stability [22]. Ascorbic acid, although more stable at low temperatures, remains vulnerable to dissolved oxygen, light, and certain physicochemical characteristics of fruit matrices (pH, antioxidant content, presence of oxidizing enzymes).

3.4. Evolution of Vitamin C Concentration during Storage at 37˚C (Figure 7)

Analysis of the evolution of vitamin C content in three nectar formulations (Papaya, Kent and DBD varieties) stored at 37˚C (Figure 7) highlights notable degradation kinetics, with losses varying between 33 and 46% after 14 days of storage. These observations corroborate the well-documented vulnerability of ascorbic acid to environmental factors such as high temperature, the presence of dissolved oxygen and possibly light.

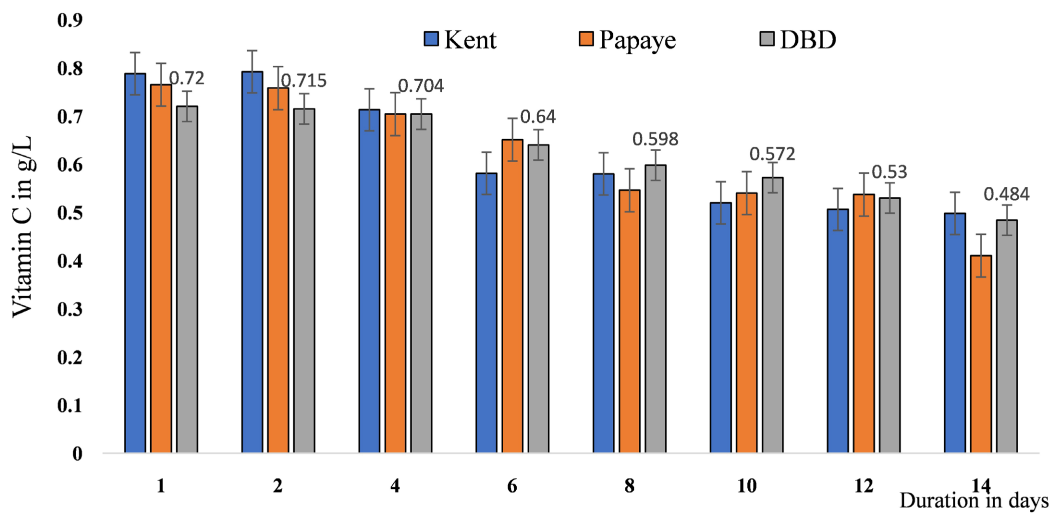

Figure 7. Evolution of vitamin C content during storage at 37˚C.

The results obtained are in line with the work of Gomez Ruiz (2016), who reported a degradation greater than 50% of vitamin C in aqueous medium in less than 10 days at 60˚C [22]. Although the experimental temperature in the present study is lower, the observed kinetics remain consistent with a first-order reaction, in which the degradation rate increases with temperature.

Furthermore, significant disparities were noted depending on the nectar variety. DBD nectar showed better preservation of vitamin C, suggesting the influence of intrinsic parameters such as pH, concentration of antioxidant compounds or enzymatic activity (ascorbate oxidase), as suggested by Beaucamp (2011) in his study on the catalytic role of metal ions in the oxidation of ascorbic acid [24]. Conversely, the Papaya variety showed the greatest decrease, which could result from physicochemical conditions favorable to accelerated oxidation. The results confirm the high thermo-sensitivity of vitamin C and highlight the importance of the fruit matrix and processing and storage conditions. They open up perspectives for the optimization of technological processes to preserve the nutritional value of tropical fruit products.

3.5. Comparison of VC Concentrations between 4˚C and 37˚C over 14 Days of Storage (Figure 8)

The evolution of vitamin C concentration in the three nectars (Papaya, Kent and DBD) shows a marked difference depending on the storage temperature (**Figure 8**).

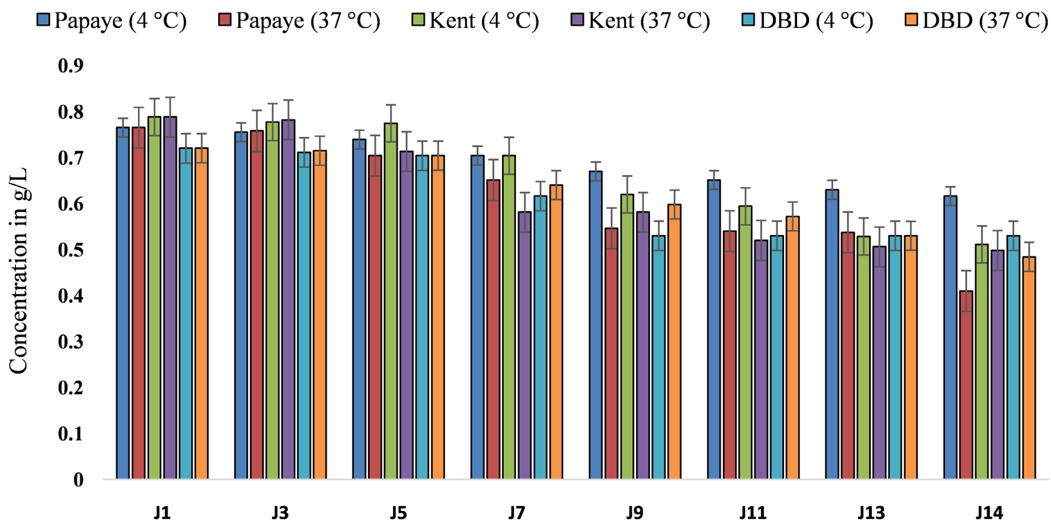

Figure 8. Comparison of VC concentrations between 4 and 37˚C over 14 days of storage.

Storage at 37˚C results in rapid and pronounced degradation of ascorbic acid, while storage at 4˚C significantly slows down these degradation kinetics. According to the results obtained, vitamin C decreases by up to 46% at 37˚C (papaya nectar) compared to 19.5% at 4˚C for the same variety. Similar losses were observed for Kent (35.1% at 4˚C vs. 37% at 37˚C), while DBD nectar appears more stable at 4˚C (26.4%), with an apparent stabilization of the concentration after D9, a phenomenon absent at 37˚C. These observations are in agreement with the work of Gomez Ruiz (2016), who showed that vitamin C degradation follows first-order kinetics and is highly temperature-dependent [22]. At 60˚C, losses exceeded 50% in less than 10 days. The significant drop at 37˚C, although at moderate temperature, confirms this exponential trend of degradation under thermal conditions. The work of Al Fata (2017) on fruit purees completes this analysis by showing that even at 4˚C, the oxidation of vitamin C continues slowly, especially in the presence of dissolved oxygen [23]. Thus, the degradation observed in our samples at 4˚C, although the degradation kinetics are attenuated, a significant alteration of the samples remains observable. DBD nectar shows increased stability at this temperature, with a concentration stabilized around 0.530 $g \cdot L^{-1}$ from the ninth day, which suggests a limitation of oxidative reactions, probably induced by the depletion of dissolved oxygen or the establishment of a chemical equilibrium. These results are in agreement with those reported by Ait Saadi (2024), who demonstrated that low temperature storage promotes the conservation of nectars, notably by maintaining the vitamin C content and pH stability [31]-[34].

4. Conclusion

The results obtained highlight the major impact of storage temperature on the stability of vitamin C and titratable acidity in tropical fruit nectars (Papaya, Kent, DBD). At 37˚C, vitamin C degradation is rapid, reaching up to 46.4% in papaya nectar, compared to a reduced loss of 19.5% at 4˚C. DBD nectar showed the best overall stability, especially at low temperatures. Titratable acidity, on the other hand, undergoes a more marked increase at high temperatures, confirming the deleterious effect of heat on acid-base balances.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Watson, L. and Dallwitz, M.J. (1992) Onwards. The Families of Flowering Plants: Descriptions, Illustrations, Identification, and Information Retrieval. https://www-archiv.fdm.uni-hamburg.de/b-online/delta/angio/index.htm

[2] Lizada, C. (1993) Mango. In: Seymour, G.B., Taylor, J.E. and Tucker, G.A., Eds., *Biochemistry of Fruit Ripening*, Springer, 255-271. https://doi.org/10.1007/978-94-011-1584-1_8

[3] Tasneem, A. (2004) Postharvest Treatments to Reduce Chilling Injury Symptoms in Stored Mangoes. Master's Thesis, McGill University.

[4] Morton, J.F. (1987) Mango. In: Morton, J.F., Eds., *Fruits of Warm Climates*, Echo Point Books & Media, 221-239.

[5] Soumah, B.B. (1988) Mango Processing and Packaging Project in Boundiai, Ivory Coast. SIARC (Food Engineers Section/Hot Region), 80.

[6] Martine, F. (1993) Processing Tropical Fruits. Technology Update Collection. GRET Edition, Ministry of Cooperation, CTA, ACCT, 222.

[7] Thana raj, T.V. (2010) Understanding the Changes in Sri Lankan Mango Fruits during Postharvest Ripening. Master's Thesis, Cranfield University.

[8] Rey, J., Diallo, T.M., Vannière, H., Didier, C., Kéita, S. and Sangaré, M. (2004) La mangue en Afrique de l'Ouest francophone: Variétés et composition variétale des vergers. *Fruits*, **59**, 191-208. https://doi.org/10.1051/fruits:2004018

[9] De La Cruz, M.J. and Garcia, H.S. (2002) Mango: Post-Harvest Operations. AGSI/FAO, 70.

[10] Pott, I., Marx, M., Neidhart, S., Mühlbauer, W. and Carle, R. (2003) Quantitative Determination of β-Carotene Stereoisomers in Fresh, Dried, and Solar-Dried Mangoes (*Mangifera indica* L.). *Journal of Agricultural and Food Chemistry*, **51**, 4527-4531. https://doi.org/10.1021/jf034084h

[11] Liu, F., Fu, S., Bi, X., Chen, F., Liao, X., Hu, X., *et al.* (2013) Physico-Chemical and Antioxidant Properties of Four Mango (*Mangifera indica* L.) Cultivars in China. *Food Chemistry*, **138**, 396-405. https://doi.org/10.1016/j.foodchem.2012.09.111

[12] Rodríguez-Pleguezuelo, C.R., Durán Zuazo, V.H., Muriel Fernández, J.L. and Franco Tarifa, D. (2012) Physico-Chemical Quality Parameters of Mango (*Mangifera indica* L.) Fruits Grown in a Mediterranean Subtropical Climate (SE Spain). *Journal of Agricultural Science and Technology*, **14**, 365-374.

[13] Block, G., Patterson, B. and Subar, A. (1992) Fruit, Vegetables, and Cancer Prevention: A Review of the Epidemiological Evidence. *Nutrition and Cancer*, **18**, 1-29. https://doi.org/10.1080/01635589209514201

[14] Lampe, J.W. (1999) Health Effects of Vegetables and Fruit: Assessing Mechanisms of Action in Human Experimental Studies. *The American Journal of Clinical Nutrition*, **70**, 475S-490S. https://doi.org/10.1093/ajcn/70.3.475s

[15] Liu, R.H. (2003) Health Benefits of Fruit and Vegetables Are from Additive and Synergistic Combinations of Phytochemicals. *The American Journal of Clinical Nutrition*, **78**, 517S-520S. https://doi.org/10.1093/ajcn/78.3.517s

[16] Naidu, K.A. (2003) Vitamin C in Human Health and Disease Is Still a Mystery? An overview. *Nutrition Journal*, **2**, No. 7. https://doi.org/10.1186/1475-2891-2-7

[17] Robles-Sánchez, R.M., Rojas-Graü, M.A., Odriozola-Serrano, I., González-Aguilar, G.A. and Martín-Belloso, O. (2009) Effect of Minimal Processing on Bioactive Compounds and Antioxidant Activity of Fresh-Cut 'Kent' Mango (*Mangifera indica* L.). *Postharvest Biology and Technology*, **51**, 384-390. https://doi.org/10.1016/j.postharvbio.2008.09.003

[18] Ma, X., Wu, H., Liu, L., Yao, Q., Wang, S., Zhan, R., *et al.* (2011) Polyphenolic Compounds and Antioxidant Properties in Mango Fruits. *Scientia Horticulturae*, **129**, 102-107. https://doi.org/10.1016/j.scienta.2011.03.015

[19] Sibetcheu, D., Mbofung, C.M. and Njintang, Y.N. (1999) Study of Artisanal Mango Processing in Cameroon: Technological Aspects and Product Quality. Unpublished Document, University of Ngaoundéré.

[20] Bendech, M.A. (2002) Mango in West Africa: Current Situation and Development Prospects for the Sector. In: Rey, J.Y. and Konan, K., Eds., *Mango Export in West Africa*, CIRAD-FLHOR, 3-20.

[21] Sawadogo-Lingani, H. (1993) Technological Development of the Amélie Mango Variety from Burkina Faso: Control of Physicochemical Parameters for Better Stabilization of Transformation Products. Ph.D. Thesis, University of Ouagadougou.

[22] Gomez Ruiz, B. (2016) Degradation of Vitamin C Under Heat Treatment Conditions between 50˚C and 90˚C. Ph.D. Thesis, AgroParisTech. https://agris.fao.org/agrissearch/search.do?recordID=FR2017000147

[23] Al Fata, D. (2017) Artisanal and Industrial Processing of Mango in Burkina Faso. *International Journal of Biological and Chemical Sciences*, **11**, 845-857.

[24] Beaucamp, J. (2011) Study on the Mango Sector in West Africa [Technical Report]. CIRAD.

[25] AOAC International (2022) Official Method 942.15—Acidity (Titratable) of Fruit Products. In: Latimer, G.W., Ed., *Official Methods of Analysis of AOAC INTERNA-*

TIONAL (22*nd Edition*), Oxford Academic, p. 37.

[26] Nayra, F.A., Renildo, L.M., Cíntia, M.B., Myllena, T.M., William, L.C. and Carlos, A.V. (2018) Mechanical Harvest Methods Efficiency and Its Impacts on Quality of Narrow Row Cotton. *African Journal of Agricultural Research*, **13**, 2263-2268. https://doi.org/10.5897/ajar2016.12080

[27] Kantanet, T., Rattanathanalerk, M. and Wongmetha, O. (2021) Effect of Temperature and Storage Duration on Physicochemical Quality of Mango Fruits. *Journal of Food Science and Agricultural Technology*, **7**, 25-34.

[28] Faye, P.G., Diouf, M. and Ndiaye, A. (2022) Effect of Pasteurization Scale on Vitamin C Content and Color of Four Types of Fruit Nectar. *Afrique Science*, **21**, 133-145.

[29] Diop, A.G., Fall, A.D. and Ndiaye, M. (n.d.) Study of the Transformation of Baobab Pulp into Nectar. CIRAD & UCAD. https://www.inecoba.com/

[30] Lounaci, H. and Ziad, S. (2018) Test of Formulation of a Nectar Based on Fruits and Vegetables and Study of the Influence of Temperature during Storage. Master's Thesis, Mouloud Mammeri University of Tizi-Ouzou.

[31] Ait Saadi, A. (2024) Test of Formulation of a Nectar Based on Fruits and Vegetables and Study of the Influence of Temperature during Storage. Master's Thesis, Mouloud Mammeri University of Tizi-Ouzou. https://dspace.ummto.dz/handle/ummto/4142

[32] Kouassi, M. and Diop, S. (2025) Influence of Cold Storage on the Physicochemical Stability of Tropical Fruit Nectars. *African Journal of Food Science and Technology*, **16**, 45-54.

[33] Ngom, A. and Fall, M. (2024) Oxidative Degradation Kinetics of Vitamin C in Mango-Based Beverages under Refrigerated Conditions. *Proceedings of the* 12*th International Symposium on Food Preservation Technologies*, Dakar, July 2024, 112-118.

[34] Rodríguez, L. and Martínez, J. (2025) Temperature-Dependent Shelf-Life Modeling of Fruit Based Beverages: A Kinetic Approach. *Journal of Food Engineering*, **345**, Article ID: 110987.