

## REVIEWER'S REPORT

Manuscript No.: IJAR-53235

Date: 11-08-2025

**Title:** Biochemical and Microbiological changes in banana wine during storage

### Recommendation:

Accept as it is

Rating	Excel.	Good	Fair	Poor
Originality		√		
Techn. Quality		√		
Clarity		√		
Significance	√			

Reviewer Name: Dr. Manju M

**Date:** 11-08-2025

### Reviewer's Comment for Publication:

1. Amber bottles significantly improve wine stability by protecting against light and preserving quality.
2. The Alpan banana variety is the best choice for producing high-quality, commercially viable banana wine.
3. The first two months of storage are critical for fermentation, pH, acidity, alcohol, and microbial changes.
4. Wine parameters stabilize after four months, indicating this as a minimum aging period for optimal quality.
5. Microbial load decreases over time due to rising alcohol and low pH, confirming the wine's safety during storage.

## REVIEWER'S REPORT

### *Detailed Reviewer's Report*

#### **1. Objective of the Works**

This study aimed to evaluate the physicochemical, microbial, and sensory changes in banana wine during six months of storage. It assessed the impact of bottle type (amber vs plain) and banana variety on wine quality and stability. Key parameters such as pH, acidity, TSS, alcohol content, and microbial load were monitored. The goal was to determine the shelf life and commercial viability of banana wine under different storage conditions.

#### **2. pH Changes During Storage**

An overall increase in pH was noted across all treatments during the six-month storage period. This pH rise is attributed to the precipitation of organic acids into their salt forms, which reduces the concentration of free hydrogen ions.

- Amber bottles exhibited slightly less pH increase, implying better acid preservation through light protection.
- Final pH values ranged from 4.21 (W1, W2 – Khozikodu) to 3.72 (W7 – Alpan, amber bottle).

#### **3. Total Soluble Solids (TSS)**

TSS levels steadily decreased over time, consistent with ongoing sugar fermentation to alcohol, even post-primary fermentation.

- Wines in plain bottles showed a more rapid decline, possibly due to increased light and oxygen exposure, accelerating biochemical reactions.
- After 6 months:
  - W1 and W2 (Khozikodu) had the highest TSS (4.0 °Brix).
  - W8 (Alpan in plain bottles) had the lowest (3.65 °Brix).

#### **4. Titratable Acidity (TA)**

All samples exhibited a gradual decrease in titratable acidity, more pronounced in wines stored in plain bottles, likely due to oxidative acid degradation and precipitation.

- W5 (Alpan, amber) had the highest final acidity (0.54%).
- W2 (Khozikodu, plain) recorded the lowest (0.32%).

#### **5. Volatile Acidity**

Volatile acidity remained low and showed slight reductions over storage, indicating stabilization of fermentation by-products and possibly conversion of volatile acids to non-volatile compounds.

- Highest final values: W4 and W6 (0.40%)
- Lowest: W2 (0.32%)

#### **6. Alcohol Content**

A gradual increase in alcohol content was observed in all samples, reflecting continued but slow fermentation during storage.

- Wines stored in amber bottles had higher alcohol levels, possibly due to better yeast activity in reduced light exposure.
- Highest alcohol content: W7 (Alpan, amber) – 6.58%

## REVIEWER'S REPORT

- Lowest: W5 and W6 (~4.5%)

### 7. Microbial Stability

Microbial load declined significantly:

- Yeast counts ( $\sim 0.3 \times 10^3$  cfu/ml) were only detected in the first month.
- No fungi or bacteria were observed beyond the first month.

This reflects effective microbial inhibition due to rising alcohol content and low pH, supporting the natural preservation potential of banana wine.

### 8. Sensory Evaluation

Sensory analysis revealed significant differences in consumer acceptability.

- Highest scores: W7 and W8 (Alpan wines) – 6.74/9, especially praised for color and aftertaste.
- Lowest score: W6 (Palaykondan, plain bottle) – 5.0, possibly due to poor flavor retention.
- Amber bottle storage consistently correlated with better sensory scores.

### 9. Impact of Packaging (Amber vs Plain Bottles)

Amber-colored bottles provided superior protection, evident in:

- Slower pH increase
- Better retention of TSS and acidity
- Higher alcohol levels
- Enhanced microbial stability
- Improved sensory appeal

These findings reinforce the role of amber glass in protecting against photodegradation and oxidative changes.

### 10. Influence of Banana Variety

Banana variety significantly influenced wine quality:

- Alpan and Khozikodu varieties excelled in:
  - Alcohol yield
  - Acidity retention
  - Sensory characteristics
- Palaykondan and Karpurchakra Keli produced less stable or less preferred wines.

This underscores the importance of varietal selection in banana wine production.

### 11. Conclusion: Shelf-Stability and Commercial Viability

All banana wine samples remained microbiologically safe and chemically stable over six months under controlled storage.

- Changes in quality parameters stayed within acceptable limits.
- The combination of:
  - High alcohol content
  - Low pH
  - Amber bottle packaging

ensured wine stability and acceptability, demonstrating banana wine's commercial storage potential.

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## **REVIEWER'S REPORT**

### **12. Significance of the Work**

- Demonstrates that amber-colored bottles significantly improve the shelf stability and quality of banana wine by reducing light-induced degradation.
- Identifies Alpan and Khozikodu as superior banana varieties for wine production, guiding raw material selection for better sensory and chemical properties.
- Confirms that banana wine can remain microbiologically safe and chemically stable for at least six months, supporting its viability for commercial production and distribution.

### **13. Recommendations**

- Prefer amber glass bottles for packaging banana wine to maximize stability.
- Use Alpan or Khozikodu varieties for superior quality wines.
- Extend storage trials to 12 months for long-term shelf-life validation.