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Sensory profiling of ripe fruit peel based wines: A comparative study

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ABSTRACT

Fruit processing produces a significant amount of agrowaste, with peels that are rich in nutrients and antioxidants making up the majority of the biomass that is thrown away. The organoleptic profile and sensory acceptability of mature fruit peel based wines made from four peel cultivars - banana, mango, sapota, and pineapple were assessed in this study. Commercial baker's yeast and probiotic *Saccharomyces cerevisiae* var. *boulardii* were used to standardise sixteen experimental fermentation treatments (T_1 - T_{16}) across two peel-to-water dilution ratios (1:1 and 1:2). Using the American Wine Society's 20 point scorecard, a panel of 20 judges evaluated sensory attributes such as appearance, aroma/bouquet, taste/texture, aftertaste, and overall acceptability. The sensory qualities were greatly impacted by dilution: increased water addition (1:2) considerably improved clarity ratings by reducing pectic haze and suspended colloids in all treatments. At a 1:1 dilution ratio, banana peel wines (T_1 , T_9) and pineapple peel wines (T_7 , T_{15}) attained ideal sensory qualities. On the other hand, sapota peel wines (T_6 , T_{14}) and mango peel wines (T_4 , T_{12}) worked best at a 1:2 dilution, which reduced the harsh resinous aromas, bitterness, and mouth drying astringency. Kendall's coefficient of concordance was used for statistical examination and the results showed that panelists were significantly in agreement ($p < 0.05$). Mango peel wine (T_4 : 15.89; T_{12} : 15.99) and sapota peel wine at 1:2 dilution (T_6 : 15.94; T_{14} : 15.78) received scores in the excellent sensory range (15-17 points) across all treatments. Additionally, *S. boulardii* showed organoleptic features similar to baker's yeast and fermentation efficacy, demonstrating its potential to produce functional wines while valorising agroindustrial fruit peel byproducts.

Keywords: Fruit peel based wines, Sensory profiling, *Saccharomyces cerevisiae* var. *boulardii*, Valorisation, Organoleptic properties

Introduction

In the agricultural food sector, food waste represents a prominent global challenge, as it ranks among the most produced residues worldwide, resulting in an estimated 1.3 billion tons of edible parts lost and disposed of globally each year (Gustavsson *et al.*, 2011). The fruit processing sector produces a large amount of waste, usually between 25-30 percentage of the total weight of the product, depending on the fruit's shape and the processing technique (Kumar *et al.*, 2020) [1]. Owing to their significant biodegradability and fermentability, these fruit wastes can pose a substantial environmental burden, leading to severe pollution problems such as the greenhouse effect, global warming, water and soil contamination, and risks to human health if not adequately managed. According to the circular economy concept, these fruit wastes could be valorised into commercially useful products as sustainable and renewable resources (Leong *et al.*, 2022) [2].

Among the various forms of fruit waste, peels constitute approximately 15-60 per cent and are typically discarded (Rifna *et al.*, 2021). In the case of banana, the peel alone constitutes 40 percentage of the edible fruit weight, resulting in an estimated 114 million metric tons of annual waste (Putra *et al.*, 2022) [3]. Industrial mango processing similarly generates over 20 million tons of residue each year in the form of peels and kernels (Sharma, 2026) [4], while in some canning industries, pineapple non edible fractions might surpass 50 percentage of the raw fruit mass. Individual contributions from fruits like sapota are lower, with the peel accounting for 15-20 percentage of the residual (Abraham *et al.*, 2023) [5]. However, these fruit peels contain significantly higher concentrations of antioxidants and minerals than in the fruit pulp serving as a natural source of antioxidants high in dietary fibre, carbohydrate, and pectin (Habiba *et al.*, 2025) [6].

Wine is defined as the product of total or partial alcoholic fermentation of fresh grape or any other fruit crush with appropriate proportion of sugar and yeast (Dahal *et al.*, 2015) [7]. It contains numerous antioxidants like resveratrol, anthocyanins and catechins that act as free radical scavengers to protect against oxidative stress and tissue inflammation. Bioactive compounds such as catechins and epicatechins aids to reverse skin damage caused by UV exposure (Snopek *et al.*, 2018) [8]. Consumption of moderate amount of red wine

helps to reduce risk of neurological disorders such as alzheimer's and parkinson's diseases and also, it's been related to shown reduced risk for developing lung, pancreas and brain cancers (Lucerón-Lucas-Torres *et al.*, 2023) [9]. The current study focus on standardising fruit peel based wines made from the four main tropical fruits: sapota, banana, mango, and pineapple. The fermentation performance and organoleptic properties of peel wines fermented with baker's yeast and the probiotic yeast *Saccharomyces boulardii* are thoroughly compared in this study. In order to evaluate the commercial potential of fruit peel upcycling in sustainable vinification, the dynamic stability of these sensory qualities is also thoroughly monitored over a six month maturation period.

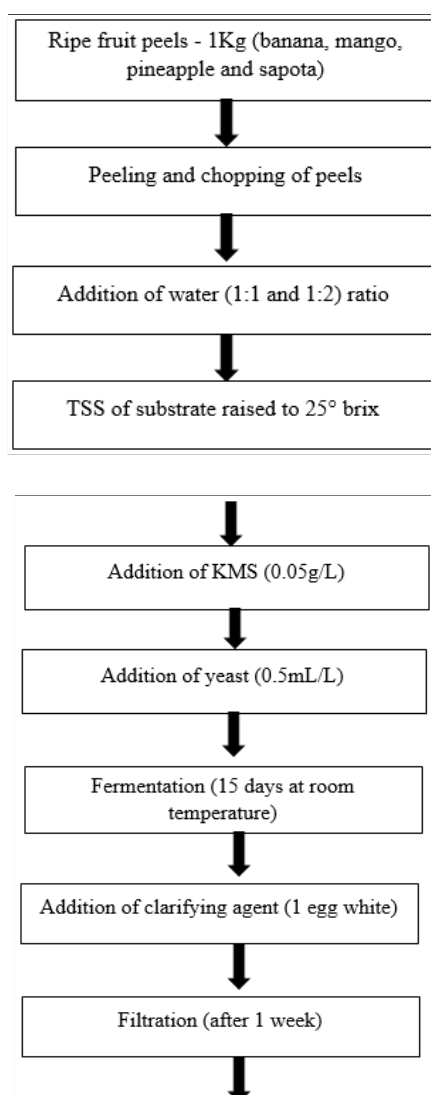
Materials and methods

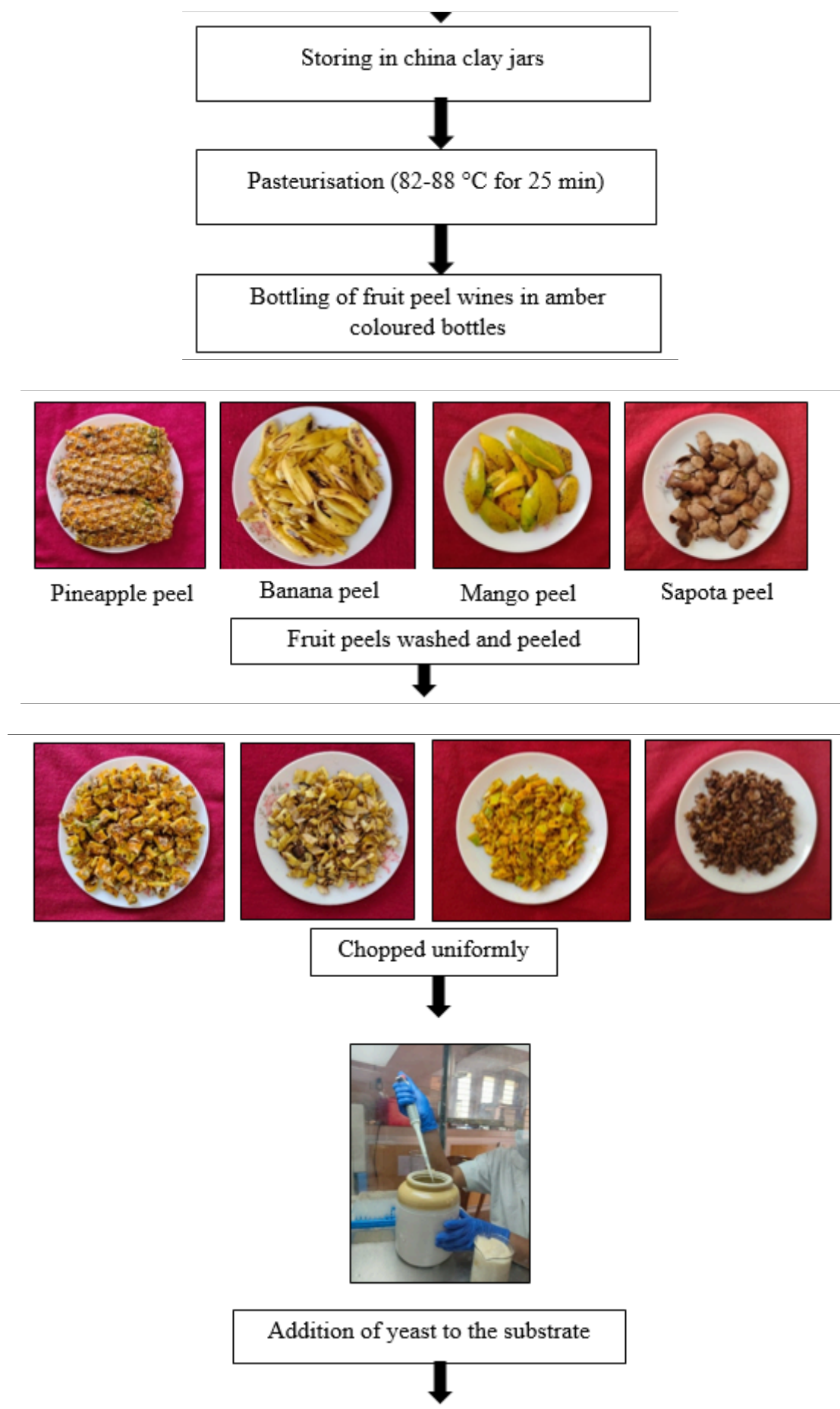
Fruit peels from banana (*Poovan variety*), mango (*Neelam variety*), sapota, and pineapple cultivars were collected from local fruit processing units and markets in the Thrissur district. Baker's yeast and *S.*

boulardii was used for the preparation of the wines. Fig 1. shows the flow chart of preparation of fruit peel based wines.

Sugar was dissolved in lukewarm water at the rate of 10g per 100ml of water. *S. boulardii* Unique 28 was then added at 5g per 100 ml of the sugar solution. The culture was kept as such for 30 minutes for vigorous frothing. The population was enumerated by serial dilution plating on Sabouraud's Dextrose Agar media contained in petri plates. The petriplates were incubated at room temperature for 4 to 5 days. The colonies were counted and expressed as CFU/mL of the sample. The baker's yeast was procured from local market and the starter culture was prepared by following the same preparation procedure of *S. boulardii* yeast culture.

Preparation of fruit peel based wines





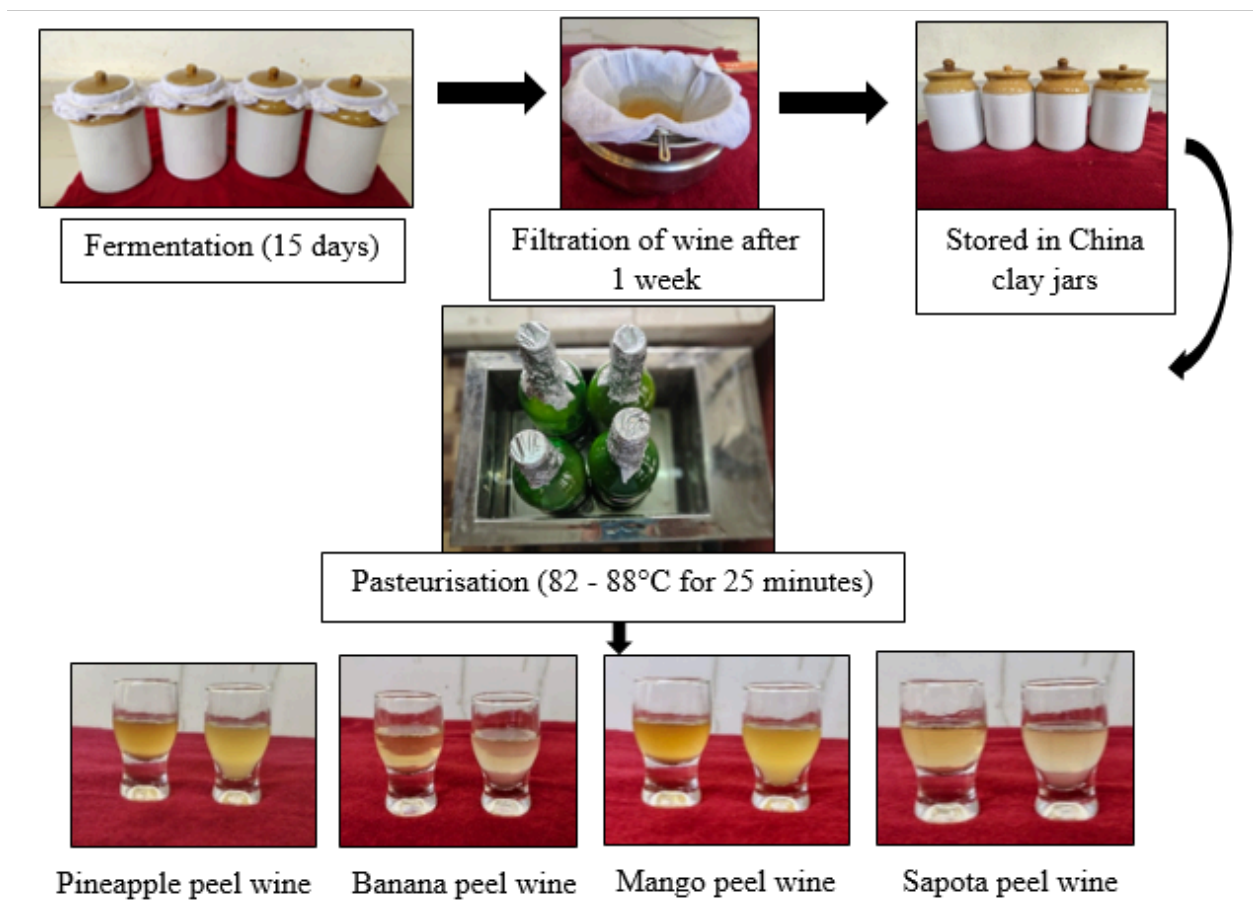


Figure 1. Flow chart of preparation of fruit peel based wines

Results

The production of fruit peel based wine was standardised using *Saccharomyces boulardii* and baker's yeast served as the control. All wines were prepared by following the modified procedure suggested by Sarthak (2019) [10]. The inoculum concentration for the preparation of wine was standardised and fixed as 0.5 per cent for all the treatments for baker's yeast and *S. boulardii*. The preparation of fruit peel based wines include treatments T₁-T₁₆ (Table 1). Among these,

treatments T₁-T₈ were carried out by using baker's yeast and T₉-T₁₆ were carried out by using *Saccharomyces cerevisiae* var. *boulardii*. A panel of twenty judges evaluated the organoleptic qualities of the wine using American Wine Society score card assessing attributes such as appearance, aroma/bouquet, taste/texture, aftertaste, and overall acceptability. The mean scores for the organoleptic parameters of each treatment were statistically analysed using Kendall's coefficient of concordance. The Table 2 and Table 3 represents the organoleptic scores of fruit peel based wines with baker's yeast and *S. boulardii*.

Table 1. Composition of ingredients in the preparation of fruit peel based wines

Treatments	Composition of ingredients
T ₁	Banana peels 1Kg + 1L of water (1:1) + Baker's yeast
T ₂	Banana peels 1Kg + 2L of water (1:2) + Baker's yeast
T ₃	Mango peels 1Kg + 1L of water (1:1) + Baker's yeast
T ₄	Mango peels 1Kg + 2L of water (1:2) + Baker's yeast
T ₅	Sapota peels 1Kg + 1L of water (1:1) + Baker's yeast
T ₆	Sapota peels 1Kg + 2L of water (1:2) + Baker's yeast
T ₇	Pineapple peels 1Kg + 1L of water (1:1) + Baker's yeast
T ₈	Pineapple peels 1Kg + 2L of water (1:2) + Baker's yeast
T ₉	Banana peels 1Kg + 1L of water (1:1) + <i>S. boulardii</i>
T ₁₀	Banana peels 1Kg + 2L of water (1:2) + <i>S. boulardii</i>
T ₁₁	Mango peels 1Kg + 1L of water (1:1) + <i>S. boulardii</i>
T ₁₂	Mango peels 1Kg + 2L of water (1:2) + <i>S. boulardii</i>
T ₁₃	Sapota peels 1Kg + 1L of water (1:1) + <i>S. boulardii</i>
T ₁₄	Sapota peels 1Kg + 2L of water (1:2) + <i>S. boulardii</i>
T ₁₅	Pineapple peels 1Kg + 1L of water (1:1) + <i>S. boulardii</i>
T ₁₆	Pineapple peels 1Kg + 2L of water (1:2) + <i>S. boulardii</i>

Treatments T₁-T₈ involved in the preparation of fruit peel based wine by using baker's yeast (Table 1). Organoleptic mean scores are de-

picted in the Table 2. While examining the mean scores, it was observed that banana peel wine T₂ (2.40) with 1:2 dilution achieved

highest score for appearance, followed by mango peel T_4 (2.30), pineapple peel T_8 (2.30) and sapota peel wines T_6 (2.10) in the same dilution. For aroma/bouquet, banana peel wine T_1 (5.15), pineapple peel T_7 (4.80) achieved higher score in the 1:1 dilution, whereas in sapota peel wine T_6 (5.05) and mango peel wine T_4 (4.86) with 1:2 dilution showed higher score. Regarding taste/texture pineapple peel wines T_7 (5.11) and banana peel wines T_1 (5.01) with 1:1 dilution exhibited higher scores, While, mango peel wine T_4 (4.95) and sapota peel wine T_6 (5.01) showed higher score at 1:2 dilution. Highest score for aftertaste was seen in sapota peel wine T_6 (2.05) and mango peel wine T_4 (1.98) in the 1:1 dilution, whereas banana peel wine T_1 (1.91) and pineapple peel wine T_7 (1.75) with 1:2 dilution achieved higher score. Finally, for overall acceptability pineapple peel wine T_7 (1.85) along with banana peel wine T_1 (1.80) with 1:1 exhibited highest score, meanwhile, mango peel wine T_4 (1.80) and sapota peel wine T_6 (1.73) achieved high score at 1:2 dilution. Across all the parameters sapota peel wine T_6 consistently achieved high scores at dilution 1:1. Banana peel wine T_1 (15.62) and pineapple peel wine T_7 (15.56) in the 1:1 dilution showed higher total scores, whereas mango peel wine T_4 (15.89) and sapota peel wine T_6 (15.94) showed higher total scores at 1:2 dilutions.

Treatments T_9 - T_{16} involved in the preparation of fruit peel based wines by using *S. boulardii* (Table 1). Organoleptic mean scores are depicted in Table 3. Based on the organoleptic scores, banana peel wine T_{10} (2.40), mango peel wine T_{12} (2.40) sapota peel wine T_{14} (2.40) and pineapple peel wine T_{16} (1.91) showed good score for appearance at 1:2 dilution. For aroma/bouquet banana peel wine T_9 (5.00) and pineapple peel wine T_{15} (4.95) showed high scores at dilu-

tion 1:1, furthermore, mango peel T_{12} (4.68) and sapota peel wine T_{14} (4.73) showed higher score at 1:2 dilution. For taste/texture banana peel T_9 (4.95) and pineapple peel wine T_{15} (5.05) exhibited higher scores at 1:1 dilution meanwhile, mango peel wine T_{12} (5.05) and sapota peel wine T_{14} (4.90) achieved higher score at 1:2 dilutions. Regarding aftertaste and overall acceptability banana peel wine T_9 (2.01 and 1.85), pineapple peel wine T_{15} (1.98 and 1.85) achieved higher scores at 1:1 dilution. Meanwhile, mango peel wine T_{12} (2.01 and 1.85), sapota peel wine T_{14} (1.95 and 1.80) exhibited higher scores at 1:2. Overall, banana peel wine T_9 (15.64), pineapple peel wine T_{15} (15.28) achieved higher total scores at 1:1 dilution. Whereas, mango peel wine T_{12} (15.99) and sapota peel wine T_{14} (15.78) showed higher total scores at 1:2 dilutions.

The sensory qualities of the fruit peel wines are influenced by the nature of the fruit peels as well as the dilution factor used in them. Across all fruit peel wines with baker's yeast sapota peel wine (T_6) consistently showed overall good scores for organoleptic, meanwhile mango peel wine (T_{12}) in *S. boulardii* achieved high total scores as compared to the rest of the treatment. Organoleptic evaluation across 16 treatments was statistically evaluated using Kendall's coefficient of concordance (W). Statistical analysis revealed that there is a significant degree of agreement between treatments ($p < 0.05$). According to the rating scale of American Wine Society scorecard, the total scores ranging from 15-17 is considered as excellent. Therefore, all the fruit peel based wines with baker's yeast and *S. boulardii* that exhibited higher scores for organoleptic profiles can be considered as excellent and comparable.

Table 2. Effect of peel:water ratio on organoleptic quality of fruit peel based wines using baker's yeast

Fruit peel wines	Treatments	Ratio of peel : water	Appearance (3)	Aroma/bouquet (6)	Taste/texture (6)	Aftertaste (3)	Overall acceptability (2)	Total score (20)
Banana peel wine	T_1	1:1	1.75 (1.25)	5.15 (1.84)	5.01 (1.80)	1.91 (1.68)	1.80 (1.72)	15.62
	T_2	1:2	2.40 (1.75)	4.45 (1.16)	4.10 (1.20)	1.55 (1.33)	1.37 (1.28)	13.87
Kendall's W test			0.500**	0.623**	0.450**	0.179**	0.282**	
Mango peel wine	T_3	1:1	1.55 (1.85)	4.30 (1.78)	4.15 (1.78)	1.00 (1.84)	1.15 (1.83)	12.15
	T_4	1:2	2.30 (1.15)	4.86 (1.23)	4.95 (1.23)	1.98 (1.16)	1.80 (1.18)	15.89
Kendall's W test			0.700**	0.403**	0.403**	0.683**	0.563**	
Sapota peel wine	T_5	1:1	1.60 (1.28)	4.75 (1.38)	4.01 (1.18)	1.10 (1.13)	1.28 (1.28)	12.74
	T_6	1:2	2.10 (1.73)	5.05 (1.63)	5.01 (1.83)	2.05 (1.88)	1.73 (1.73)	15.94
Kendall's W test			0.213**	0.107**	0.563**	0.663**	0.368**	
Pineapple peel wine	T_7	1:1	2.05 (1.38)	4.80 (1.63)	5.11 (1.82)	1.75 (1.84)	1.85 (1.85)	15.56
	T_8	1:2	2.30 (1.63)	4.46 (1.37)	4.05 (1.18)	1.01 (1.16)	1.15 (1.15)	12.97
Kendall's W test			0.139**	0.112**	0.463**	0.652**	0.612**	

T_1 - Banana peel wine (1:1), T_2 - Banana peel wine (1:2), T_3 - Mango peel wine (1:1) T_4 - Mango peel wine (1:2), T_5 - Sapota peel wine

(1:1), T_6 - Sapota peel wine (1:2), T_7 - Pineapple peel wine (1:1), T_8 - Pineapple peel wine (1:2)

Table 3. Effect of peel:water ratio on organoleptic quality of fruit peel based wines using *S. boulardii*

Fruit peel wines	Treatments	Ratio of peel: water	Appearance (3)	Aroma/bouquet (6)	Taste/texture (6)	Aftertaste (3)	Overall acceptability (2)	Total score (20)
Banana peel wine	T ₉	1:1	1.83 (1.23)	5.00 (1.90)	4.95 (1.27)	2.01 (1.68)	1.85 (1.68)	15.64
	T ₁₀	1:2	2.40 (1.73)	4.20 (1.10)	4.05 (1.73)	1.55 (1.32)	1.50 (1.33)	13.70
Kendall's W test			0.312**	0.711**	0.344**	0.175**	0.223**	
Mango peel wine	T ₁₁	1:1	2.05 (1.33)	4.10 (1.22)	4.10 (1.15)	1.00 (1.12)	1.00 (1.12)	12.25
	T ₁₂	1:2	2.40 (1.68)	4.68 (1.78)	5.05 (1.85)	2.01 (1.88)	1.85 (1.85)	15.99
Kendall's W test			0.272**	0.482**	0.612**	0.767**	0.700**	
Sapota peel wine	T ₁₃	1:1	1.60 (1.20)	4.23 (1.34)	4.10 (1.23)	1.10 (1.18)	1.20 (1.20)	12.23
	T ₁₄	1:2	2.40 (1.80)	4.73 (1.66)	4.90 (1.78)	1.95 (1.83)	1.80 (1.80)	15.78
Kendall's W test			0.450**	0.140**	0.465**	0.563**	0.450**	
Pineapple peel wine	T ₁₅	1:1	1.45 (1.33)	4.95 (1.88)	5.05 (1.82)	1.98 (1.72)	1.85 (1.85)	15.28
	T ₁₆	1:2	1.91 (1.68)	4.05 (1.12)	4.01 (1.18)	1.45 (1.28)	1.15 (1.15)	12.57
Kendall's W test			0.212**	0.767**	0.463**	0.282**	0.700**	

T₉ - Banana peel wine (1:1), T₁₀ - Banana peel wine (1:2), T₁₁ - Mango peel wine (1:1), T₁₂ - Mango peel wine (1:2), T₁₃ - Sapota peel wine (1:1), T₁₄ - Sapota peel wine (1:2), T₁₅ - Pineapple peel wine (1:1), T₁₆ - Pineapple peel wine (1:2)

Discussion

The optimisation of fermentation conditions for fruit peel based wines exhibited distinct characteristics between raw materials, dilution ratios, fruit peel cultivar and fermentation performance of baker's yeast and *S. boulardii*. The substrate dilution and microbial strain specificity are the two primary points that determines the final wine quality, yield and sensory acceptance.

Banana peel wine (T₁, T₉), mango peel wines (T₄, T₁₂) and sapota peel wine (T₆, T₁₄), pineapple peel wine (T₇, T₁₅) achieved higher scores for appearance at 1:2 dilutions as compared to 1:1 dilution. Increased water addition improved particle sedimentation and decreased colloidal haze brought on by the leaching of insoluble dietary fibre and pectin. *Dhanalakshmi et al. (2024)* [11] incorporated pineapple peel wines with different proportions of sugar substitutes and observed that over all harmony (1.4/2.0) with total score of 7.4/10 was achieved by wines made with table sugar. Similarly, *Joshi et al. (2012)* [12] reported that higher dilution levels (1:2) in jamun wine aids to alleviate thick pulp and improved appearance as well as clarity scores. Furthermore, *Ngoc et al. (2024)* [13] observed optimising dilution ratios in wine prevents pectic haze and aids to provide clearer wines.

The aroma/bouquet profile showed slight differences mainly based on the peel cultivar and substrate composition of wines. Banana peel wines (T₁:5.15, T₉:5.00), and pineapple peel wines (T₇:4.80, T₁₅:4.95) exhibited high scores at dilution 1:1. Banana and pineapple peel contains volatile aliphatic esters, especially isoamyl acetate, ethyl butyrate and butyl acetate. Higher dilutions tend to deplete these volatile compounds below sensory levels. *Chavan et al. (2021)* [14] observed that incorporating 10% of banana peel in banana wine preserved the colour aroma, bouquet and taste and texture of the wine, along with that it achieved top score of 17.57 over all from 20 point scale. This aligns with the present study where 1:1 dilution preserves the essential volatile compounds as compared to 1:2 dilution. Similarly, *Zhang*

et al. (2020) [15] reported that pineapple peel wine retained high concentrations of its qualities at lower dilution ratios. In contrary, sapota peel wine (T₆, T₁₄) and mango peel wines (T₄, T₁₂) achieved high scores for aroma at 1:2 dilution. The sapota peel contains high concentrations of tannins and polyphenols as compared to other peels, so 1:2 dilution aids in providing less astringency and mouthfeel. These findings aligns with *Panda et al. (2014)* [16], that adjusting peel to water ratios in sapota peel wine balanced the bitterness and palatability of the product. Similarly, *Deepa et al. (2023)* [17] discovered that undiluted sapota must produce an astringent beverage with an unpleasant lingering mouthfeel; this was addressed by optimising fining and water dilution.

Mango peels are rich source of monoterpenes, terpenes and sesquiterpenes. At dilution 1:1, these compounds are extracted at high concentration imparts pungent and harsh resinous notes in wine that overpower fruity bouquets. Thus 1:2 dilution aids to balance these volatile compound concentration by imparting pleasant, floral notes to wine. This observations are highlighted by *Pino et al. (2003)*, that reported higher dilution factors in mango peel helps to dissolve unpleasant pungent taste and attribute fruity/floral mango notes. *Varakumar et al. (2012)* [18] observed that, by using mango peel as a immobilisation carrier for *S. cerevisiae* improved the sensory quality of wine on a 9 point hedonic scale (appearance – 7.6 ± 0.54, aroma – 7.9 ± 0.73 and taste 7.7 ± 0.24). *Sadineni et al. (2012)* [19] reported that mango peel contains natural sugars and ester profile that aids tropical notes to wine while fermenting at moderate dilution ratios.

Regarding the taste/texture and aftertaste of fruit peel based wines, pineapple peel wine (T₇, T₁₅) and banana peel wines (T₁, T₉) exhibited higher palatability at 1:1 dilution, while mango (T₄, T₁₂) and sapota (T₆, T₁₄) achieved superior scores at 1:2 dilution. In mango and sapota peels, polyphenols, mangiferin and saponin can impart a astringent mouthfeel when diluted at 1:1 dilution. This can be tackled by balancing the dilution at 1:2. This similar findings was reported by *Pino et al. (2003)*. *Ajila et al. (2007)* [20] and *Berardini et al. (2005)* [21]. They demonstrated that both ripe and unripe peels concentrate high proportions of soluble polyphenols and hydrolysable tannins. Mangiferin and galloyl glycosides in mango peels, cross link with oral mucins when extracted at high quantities at 1:1 ratio, giving the posterior palate a bitterness and roughness. These can be reduced to

sub threshold amounts by dilution to a 1:2 ratio, which restores the feeling of fruitiness and sweet acid balance.

In contrary, pineapple and banana peel wines contain lower concentrations of condensed tannins and saponins, the primary volatile components (isoamyl acetate, butyl butyrate and ethyl hexanoate) expressed better at 1:1 dilution. Diluting at higher dilution depletes these volatile compounds and stability of the product. Someya *et al.* (2002) [22] observed similar results, that condensed tannin in banana is far below the threshold. Furthermore, soluble phenolics (dopamine and gallic catechin) in banana peels, do not cause mouth drying astringency or aggressive salivary protein precipitation. According to Sabat *et al.* (2024) [23] the aliphatic esters produce the distinctive fruity, floral fragrance that characterises consumer acceptability during the fermentation of pineapple waste. Excessive addition of water (1:2 dilution) causes premature volatilisation during vigorous fermentation degassing and lowers the dissolved ester concentration below olfactory recognition thresholds because, volatile esters have higher water air partition coefficients than polyphenols.

Banana peel and pineapple peel wines scored higher overall acceptability (T_1 :1.80- T_7 :1.85) at 1:1 dilution and achieved high total scores (T_1 :15.62, T_9 :15.64) and (T_7 : 15.56, T_{15} : 15.28). When the dilution factor was increased, the scores dropped. Selli *et al.* (2012) [24] and Sabat *et al.* (2024) [23] observed, banana and pineapple peels are naturally rich in volatile acetate and ethyl esters, low in tannins. Diluting at 1:2 thins out, mouthfeel leading to feel watery taste of the product. Boondaeng *et al.* (2022) [25] conducted study on pineapple wine where excessive dilution of juice-water ratios thins the body and mouthfeel and yields low sweetness (5.49/9) and poor over all acceptability of the product (5.58/9). This mirrors with the results in the study where the 1:1 dilution for T_7 and T_{15} was better compared to T_8 and T_{16} .

In contrast, mango and sapota peel wines exhibited highest acceptability (T_4 :1.73- T_6 :1.85) and highest total scores (T_4 : 15.33, T_{12} :15.99, T_6 : 15.94, T_{14} :15.78) at 1:2 dilution ratio. While diluting at 1:1 ratio, total scores decreased. This characteristics is mainly due to the leaching of excessive astringent polyphenols, mangiferin and saponin at 1:1. Dhanalakshmi *et al.* (2024) [11] observed that sapota peel wines made with jaggery scored (9.0/10) on a OIV (International Organisation of Vine and Wine) point scale for overall acceptability, where fermenting in a balanced dilution helps to soften the astringency and better mouthfeel. So, higher dilution balance out the taste, aroma and other qualities leading to good overall acceptability (Silva *et al.*, 2017) [26].

Across all treatments, sapota peel wines (T_6) for baker's yeast showed higher scores whereas mango peel wine (T_{14}) showed higher score for *S. boulardii* showed for organoleptic evaluation. A balanced mouthfeel, residual sweetness, minimal clarity turbidity, and non astringent finish (aftertaste scores) were the main factors contributing to the higher overall score in mango peel and sapota peel wines at 1:2 dilution.

A crucial findings from the total scoring of fruit peel wines was that, *S. boulardii* showed comparable and in several treatments slightly higher sensory scores, that demonstrates that new functional wines can be created without compromising organoleptic quality by synthesising *de novo* volatile higher alcohols and fruity esters while withstanding ethanol stress. *S. boulardii*'s sensory success aligns with the studies by Mulero-Cerezo *et al.* (2016) [27] and Patelski *et al.* (2025) [28], who reported that yeast has strong vinification properties and produces pleasant aromatic profiles similar to commercial enological baker's yeast strains without producing phenolic or acetic off flavours.

Conclusion

The study presents the viability of utilising discarded ripe fruit peels mainly banana, sapota, mango and pineapple as sustainable byproducts for the production of wine. The organoleptic qualities of the

wines are mainly dependent on the phytochemical composition and dilution factor. A 1:1 dilution ratio effectively proved optimal for banana and pineapple peels, which known to preserve the volatile aroma compounds, mouth feel and body of the wine. In contrast, 1:2 dilution ratio was essential for mango and sapota peels to inhibits its colloidal haze, soften excessive tannin and other component loads and to eliminate off tastes. Furthermore, sapota peel wines and mango peel wines fermented at 1:2 dilution outperformed other treatments in baker's yeast and in *S. boulardii*. The use of *S. boulardii* successfully achieved sensory scores equivalent to baker's yeast, with good aromatic bouquets and pleasant mouthfeel. Valorising ripe fruit peels through controlled fermentation offers an ecofriendly approach to mitigate waste.

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