Comparison of benchtop and handheld NIR devices to determine fruit wine fermenting parameters

**Sumaporn Kasemsumran, Antika Boondaeng, Kraireuk Ngowsuwan, Sunee Jungherapanich, Bussaba Punyachon, Sirimada Mongkolwit, Kanyarat Nitee, Warapornt Apiwatanapiwat, Phornphimon Janchai, Pilanee Vaiathanomsat**

KAPI, Kasetsart University, Bangkok 10900, Thailand, E-mail: aapskp@ku.ac.th

**INTRODUCTION**

Unbalanced production and market conditions have resulted in farmers suffering from falling prices of pineapple and dragon fruit due to oversupply. This leads to an increase in low-grade and waste fruits. Accordingly, the production of fruit wine using these low-grade fruits is an interesting approach in terms of using alternative resources and adding value to them.

**OBJECTIVE**

Sixth parameters of alcohol, reducing sugar, total acidity, total soluble solid, total yeast cell, and volatile acidity are required to inspect these samples throughout the fermentation process to maintain the consistency of wine quality, causing the alternative NIR analysis to enjoy this application (Kasemsumran et al., 2022).

The objective of this study was to develop NIR models and compare predictions using a benchtop type with a liquid probe and a handheld device to predict values of the sixth parameter of mixed pineapple and dragon fruit wine during fermentation.

**METHODS**

1. **Yeast culture preparation**

   ![Yeast culture preparation](Fig. 1)

   *S. cerevisiae var. Burgundy on YPD agar*

   **incubated for 24 h**

2. **Preparation of mixed pineapple and red dragon fruit musts**

   ![Preparation of musts](Fig. 2)

3. **Wine fermentation & Evolution of sixth parameters during fermentation by reference methods and NIR model developments**

   ![Wine fermentation](Fig. 3)

   **Ethanol**

   **RS**

   **TSS**

   **TYC**

   **VA**

   **incubated for 10 days**

   **NIR measurements**

**RESULTS**

A liquid probe with a length of 14 cm and a slit of 1 mm (IN271P-02) was connected to an FT-NIR spectrometer (MPA II, Bruker Optik GmbH, Germany) to collect the spectral data between 11,536–3952 cm⁻¹ by immersion into samples (Fig. 2).

The competitive device was a handheld type (Transmissive DLP NIRscan Nano EVM, Texas Instruments, USA) using a quartz cell (pathlength 10 mm) for spectral collection of samples from 901–1700 nm (Fig. 3). The obtained spectra were shown in the METHODS 3. and the over abs. regions were cut off for calculation.

All parameters were monitored during fermentation processing and employed as the reference chemical data for NIR model development (Table 1).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Min</th>
<th>Mean</th>
<th>Max</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol (%)</td>
<td>0.457</td>
<td>6.733</td>
<td>10.221</td>
<td>2.946</td>
</tr>
<tr>
<td>Reducing sugar (g/L)</td>
<td>24.36</td>
<td>87.10</td>
<td>184.76</td>
<td>52.39</td>
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<tr>
<td>Total acidity (%)</td>
<td>0.169</td>
<td>0.248</td>
<td>0.297</td>
<td>0.036</td>
</tr>
<tr>
<td>Total soluble solid (Brix)</td>
<td>8.07</td>
<td>13.78</td>
<td>25.00</td>
<td>4.99</td>
</tr>
<tr>
<td>Total yeast cell (CFU/mL)</td>
<td>5.92×10⁶</td>
<td>1.31×10⁷</td>
<td>3.40×10⁷</td>
<td>9.58×10⁶</td>
</tr>
<tr>
<td>Volatile acidity (%)</td>
<td>0.0011</td>
<td>0.0017</td>
<td>0.0024</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

The results demonstrated the performance NIR method as an alternative way for simultaneous monitoring of the chemical in the fermentation process. Moreover, using of low-grade fruits in winemaking was possible to get the new product with value-adding.

**CONCLUSIONS**

The results demonstrated the performance NIR method as an alternative way for simultaneous monitoring of the chemical in the fermentation process. Moreover, using of low-grade fruits in winemaking was possible to get the new product with value-adding.

**REFERENCE**