Optimization of mangosteen wine fermentation

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Abstract
Mangosteen is a tropical fruit, therefore it can be stored for a short time before over-ripens, so it is recommended to consume fresh. Nowadays mangosteen is get processed in different forms such as canned fruit, frozen, processed into juice, jam, syrup and candy. We come to a new approach, wine fermentation from mangosteen. Optimal results shows pectinase 0.15%, incubation 45 °C in 1.5 hour; yeast proliferation 24 hours, water addition 20%; yeast supplementation 9%; sugar addition 10%; dry matter 21%Bx; fermentation time 7 days.

Keywords: Mangosteen, yeast, wine, fermentation

1. Introduction
Mangosteen (Garcinia mangostana Linn) is a tropical fruit in Guttiferae family. Mangosteen is a dark purple to red-purple fruit. The edible fruit aril is white, soft, and juicy with a sweet, slightly acid taste and a pleasant aroma. The major bioactive compounds found in mangosteen are phenolic acid, prenylated xanthone derivatives, anthocyanins, and procyandins (Fu et al., 2007; Zadernowski et al., 2009; Chaivisuthangkura et al., 2009). Ten phenolic acids were identified in mangosteen fruit. Of these, protocatechuic acid was the major phenolic acid in the peel and rind, while p-hydroxybenzoic acid was the predominant phenolic acid in the aril (Zadernowski et al., 2007; Sangthawan, S. and Anprung, 2014). Several researchers recognized phenolics and anthocyanin for their antioxidant properties (Robards et al., 1999; Karalaya et al., 2001; Rossi et al., 2003; Davalos et al., 2005; Balasundram, 2006; Migdalia Arazo et al., 2011). Furthermore, it also contains vitamins and minerals, including vitamin A, vitamin C, thiamine, riboflavin, niacin, calcium, phosphorous and iron (Osman and Milan, 2006).

Most of mangosteen is consumed fresh or exported to foreign market. Extending shelf-life by using several processing methods such as juice processing, concentrating, drying and fermenting could add value for mangosteen and create a new market (Jay K Udani et al., 2009; Chaovanalikit et al., 2012). There is no any research mentioned to mangosteen fermentation so we come to a new approach in making wine from this fruits. In this research, we focus on the investigation of pectinase supplementation, water addition, yeast proliferation time, yeast ratio, sugar addition and fermentation time.

2. Material and Method
2.1 Material
Mangosteen fruits are purchased in Mekong river delta, Vietnam. Saccharomyces cerevisiae is supplied from Pasteur Institute, HCM City, Vietnam.

Fig 1: Mangosteen fruit
2.2 Research method

2.2.1 Determine pectinaza enzyme supplementation
We prepare 5 samples from mangosteen pulp; each sample 200 ml is supplemented with different pectinase ratio 0%, 0.10%, 0.15%, 0.20%, 0.25%. After addition, samples are incubated at 45 °C in 1.5 hour. Testing parameters include juice recovery, reduced sugar.

2.2.2 Determine water supplementation
We prepare 4 samples from mangosteen pulp; each sample 100 gram is supplemented with different water ratio: 15%, 20%, 25%, 30%. After extraction, we determine soluble dry matter and sensory score.

2.2.3 Determine proliferation time
Yeast *Saccharomyces cerevisiae* is preserved on agar medium. We investigate different proliferation times: 20, 24, 28, 32, 36, 40 hours.

2.2.4 Determine yeast ratio supplementation
We prepare the fermentation batch with 19gram of sugar/sample (each sample 200 ml), adjust juice acidity to pH=4, add different yeast ratios 5%, 7%, 9%, 11%. After fermentation, we analyse ethanol content, residual sugar to determine the best yeast ratio.

2.2.5 Determine sugar supplementation
We prepare 4 samples from mangosteen juice; each sample 200ml is adjusted pH to pH=4, add yeast and different sugar ratios 6%, 8%, 10%, 12%. After fermentation, we analyse ethanol content, residual sugar and sensory score to determine the best sugar ratio.

2.2.6 Determine fermentation time
We prepare 4 samples from mangosteen juice; each sample 200ml is fermented with different times: 5, 7, 9, 11 days. After fermentation, we analyse ethanol content, residual sugar and sensory score to determine the best sugar ratio.

2.3 Statistical analysis
All data are processed by Excel 2003.

3. Result & Discussion

3.1 Chemical composition in mangosteen pulp

<table>
<thead>
<tr>
<th>Composition</th>
<th>Moisture</th>
<th>Acidity</th>
<th>Saccharose</th>
<th>Glucose</th>
<th>Edible part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>86.12 %</td>
<td>0.26 %</td>
<td>135.25 g/l</td>
<td>134.58</td>
<td>46.73 %</td>
</tr>
</tbody>
</table>

From table 1, we see in mangosten the high content of glucose and saccharose which are suitable for wine fermentation.

3.2 Effect of pectinase supplementation

From figure 3 & 4, we see that 0.15% pectinase enzyme having the best extraction recovery.

3.3 Effect of water addition

From figure 5, we see that 15% water having the best soluble dry matter.

Fig 2: *Saccharomyces cerevisiae*

Fig 3: Extraction recovery by pectinase enzyme ratio

Fig 4: Reduced sugar extracted by pectinase ratio

Fig 5: Soluble dry matter in wine by water addition
Fig 6: Sensory score of wine by water ratio

From figure 6, we choose water ratio 20%.

3.4 Effect of yeast proliferation time

Fig 7: Effect of yeast proliferation time to yeast cell density
From figure 7, we realize the proliferation time is appropriate at 24 hours.

3.5 Effect of yeast ratio

Fig 8: Sensory score of wine by different yeast ratio

Fig 9: Effect of different yeast ratio to ethanol content in wine

Fig 10: Effect of different yeast ratio to residual sugar in wine
From figure 8 & 9, we choose yeast ratio 9% for further experiments.

3.6 Effect of sugar supplementation

Fig 10: Sensory score of wine by different sugar ratios
Fig 11: Ethanol content of wine by different sugar ratios

Fig 12: Residual sugar in wine by different sugar ratios

From figure 10, 11 and 12, we choose the sugar ratio 10% for wine fermentation.

3.7 Effect of fermentation time

Fig 13: Sensory score of wine by different fermentation times

Fig 14: Ethanol content in wine by different fermentation times

Fig 15: Residual sugar in wine by different fermentation times

From figure 13, 14 & 15, we define the fermentation time in 7 days to get the best mangosteen wine quality.

4. Conclusion

Due to its flavors and its bioactive compounds, mangosteen products including wine were investigated and introduced into markets. We have successfully examined optimal conditions for mangosteen pulp fermentation such as pectinase enzyme ratio, water addition, yeast proliferation time, yeast ratio, sugar supplementation, and fermentation time.

5. Reference

9. Osman MB, Milan AR. Mangosteen. *Garcinia*


