PREPARATION OF WINE

This activity assesses
Unit 6339 Prepare or isolate consumer products and compare their properties to a commercial equivalent (Level 2)
version 2
Elements 1 Prepare or isolate consumer products
2 Compare the physical properties of a prepared sample with an equivalent commercial product

CONDITIONS Practical work (in groups of 2 or 3), individual written report.

INSTRUCTIONS

1 Preparation of wine

For this section you are required to produce a sample of wine. You are to work in groups of 2 or 3 students for the production process but all written work must be done individually.

You can make your wine from whatever fruit is available to your group.

You are to keep a logbook throughout the process detailing all steps taken.

You will be supplied with information regarding current small-scale wine-making techniques which you can use for guidance. The requirements are outlined below.

a Prepare a flow diagram to show all the steps taken to produce your wine. Your flow diagram must include details of
- all materials used including the variety of fruit or grapes
- reaction conditions, eg temperature, time,
- description of the steps in the wine-making process.

1.1

b Bottle and label your wine and submit one bottle to your teacher for assessment.

Note Make sure that the label you put on your bottle fulfills all of the legal requirements as regards the information that must be present.

In addition, hand in your log book outlining the steps taken throughout the production and analysis stage.

1.2
2 Analysis of wine

For this section you are required to measure and compare one selected physical property of your wine with an equivalent commercial wine product.

You can choose to compare the level of sulfur dioxide, the total acidity or the percentage of alcohol in your wine.

a  Determination of sulfur dioxide level in wine
b  Determination of total acidity in wine
c  Determination of the alcohol content of wine

Note  Experiments a, b and c involve titrations and you must ensure that you repeat the experiment until you have 3 concordant results. The titration methods and standardised solutions required will be supplied.

Write up your experiment as a full laboratory report.  

In your conclusion make sure that you compare any similarities and differences between the results you have obtained for your wine with the known value for the commercial equivalent.
### Assessment Schedule - Preparation of wine

Unit 6339 version 2  *Prepare or isolate consumer products and compare their properties to a commercial equivalent (Level 2)*

<table>
<thead>
<tr>
<th>Task</th>
<th>Element</th>
<th>Evidence</th>
<th>Judgement</th>
</tr>
</thead>
</table>
| 1    | 1.1     | Student presents a flow diagram of a valid method for producing wine, eg throughout the process wash all equipment with 2% sodium metabisulfite. Fruit = Chardonnay grapes  
- remove stalks, crush grapes, add 50ppm metabisulfite (20mL), leave 24 hrs  
- strain, add 50 ppm (10 mL) metabisulfite, leave to settle for 24 hrs in cold place  
- test specific gravity and if necessary add sugar to bring SG to 1.085 g/mL  
- transfer to brewing bottle and add wine yeast, put under airlock  
- when fermentation is complete test SG and if 1.000 g/mL rack and add 20mL metabisulfite to stop process, leave 4 - 6 weeks to settle  
- rack again, leave 2 - 3 weeks  
- rack and bottle. | Must include the name of their fruit and the sterilising agent used. Flowchart includes steps of crushing, fermentation, racking and bottling. |
| 1    | 1.2     | Labelled bottle of wine is produced and presented.  
Logbook is completed showing dates and details. | Label contains  
- name and address of company  
- date of production  
- % alcohol  
- country of origin.  
Logbook shows all dates and relevant information for the preparation process. |
### Evidence (The answers or performance expected from the students)

#### Task 2

#### Element 2.1

Either SO₂, total acidity or % alcohol experiment completed and presented.

Experiment written up in the standard way with Aim, Method, Results and Conclusion.

**eg Results:** SO₂ Level

Total SO₂: Our Wine

<table>
<thead>
<tr>
<th>Titration No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial volume (mL)</td>
<td>17.1</td>
<td>10.1</td>
<td>17.2</td>
<td>30.3</td>
</tr>
<tr>
<td>Final volume (mL)</td>
<td>24.5</td>
<td>17.0</td>
<td>24.1</td>
<td>37.3</td>
</tr>
<tr>
<td>Volume used (mL)</td>
<td>7.4</td>
<td>6.9</td>
<td>6.9</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Calculation:

\[ \% \text{ SO}_2 = 6.93 \times 16 = 109.3 \text{ mg L}^{-1} \]

**eg Results:** Total acidity

<table>
<thead>
<tr>
<th>Titration No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial volume (mL)</td>
<td>6.1</td>
<td>12.8</td>
<td>19.1</td>
<td>25.5</td>
</tr>
<tr>
<td>Final volume (mL)</td>
<td>12.8</td>
<td>19.1</td>
<td>25.5</td>
<td>31.8</td>
</tr>
<tr>
<td>Volume used (mL)</td>
<td>6.7</td>
<td>6.3</td>
<td>6.4</td>
<td>6.3</td>
</tr>
</tbody>
</table>

Calculation:

\[ \% \text{ Tartaric acid} = 0.75 \times 6.33 = 4.75 \text{ g L}^{-1} \]

#### Element 2.2

Property of their own wine and the commercial wine is compared.

**Eg Conclusion:**

Our wine sample has a lot less SO₂ in it compared to the commercial wine. This could lead to our wine not keeping as long as the commercial wine.

This may be caused by us not using sufficient sodium metabisulfite during the wine-making process.

### Judgement (A statement that defines the standard to be achieved)

One experiment completed with 3 concordant results for their wine.

Results clearly set out.

Calculations completed accurately using experimental data.

Commercial values to compare with are

- \% SO₂ = 50 - 300 mg L⁻¹
- % Tartaric acid = 6 - 9 g L⁻¹
- % alcohol = as shown on bottle

Results for their wine are compared with those of the commercial equivalent and commented on sensibly.
Preparation of wine

Below are described some very brief steps for the production of wine on a small-scale. There are many good reference books available that will elaborate on the methods.

*Keep all equipment clean and sterilised with 2% sodium metabisulfite solution

White grape wine

1. Remove stalks and crush grapes; add 20mL metabisulfite (use stronger concentration of 50 ppm here).
2. Leave crushed grapes for 24 hours.
3. Strain juice, add 20 mL metabisulfite and leave in cold place to settle.
4. Siphon off clear juice into fermenter.
5. Take Specific Gravity (SG) reading; if necessary add dissolved sugar to bring SG up to 1.085 g mL\(^{-1}\).
6. Add yeast suspension.
7. Put under airlock.
8. When fermentation is complete (no bubbles) - rack. Test SG and if 1.000 g mL\(^{-1}\) fermentation is complete add metabisulfite to stop everything. If SG is higher then add yeast to complete fermentation.
9. Leave about 4 - 6 weeks to settle and then rack again.
10. Leave 2 - 3 weeks then rack again into bottles.

Red grape wine

1. Remove stalks and crush grapes, add water to make up to 20L.
2. Add 20 mL metabisulfite solution, 4 tsp pectolase and leave 24 hrs.
3. Add yeast and dissolved sugar to bring SG to 1.085 g mL\(^{-1}\), put under airlock.
4. Ferment on the skins for 5 days. Stir twice daily.
5. Strain, put back under airlock.
6. When fermentation is complete (no bubbles) rack. Add metabisulfite to stop everything.
7. Leave about 10 weeks and rack again.
8. Rack again when mature and bottle.
Determination of sulfur dioxide in wine

The use of sulfur dioxide as an antiseptic and an antioxidant in wines started in the earliest days of winemaking. When dissolved in water, SO2 exists as a mixture of sulfurous acid (H2SO3), bisulfite ions (HSO3-), sulfite ions (SO32-) and free sulfur dioxide gas (SO2). The bisulfite ions react with acetaldehyde in the wine to form the acetaldehyde bisulfite complex. In this form, the SO2 is said to be bound. The unbound gas is known as the free SO2. Bound SO2 has less antiseptic properties than free SO2. It is necessary to know the quantity of SO2 in wines in order not to exceed the allowable limits and also to monitor its quantity during the aging process. In the determination of total SO2, the acetaldehyde bisulfite complex is first hydrolysed by means of sodium hydroxide. The solution is then acidified and titrated directly with iodine solution.

Total SO2 content

Aim: To determine the total SO2 in wine.

Method

1. Pipette 20.0 mL of wine into a 250 mL conical flask and add 25 mL of mol L⁻¹ NaOH. Stopper the flask, mix well and leave for 10 minutes.
2. Add 5 mL of starch solution.
3. Add 10 mL 25% H2SO4, mix.
4. Add about 1 gram solid NaHCO₃ and immediately titrate this sample directly with 0.01 mol L⁻¹ Iodine solution until a blue colouration appears and persists for 30 seconds.
5. Record the titration results in the usual way.

Calculations

\[
\text{Total } \text{SO}_2 \ (\text{mgL}^{-1}) = \frac{\text{Titre value of } 0.01 \ \text{mol L}^{-1} \ I_2 \times 16}{...}
\]

Note: If you are using red wine, the end point may not be clearly visible; the use of a light behind the flask may help. Better still, dip a glass rod in the solution when the end-point is suspected to be near, and then place it on a drop of starch solution on a porcelain plate. The end-point is reached when the drop turns blue.

(A total SO2 concentration of 200 mgL⁻¹ of wine is usually sufficient although up to 350 mgL⁻¹ is allowed in Canada.)
Determination of total acidity

The titratable acidity of wine is a measure of the total amount of H$_3$O$^+$ ions in solution. In this method the calculation is expressed as if all the acids in the sample are present as tartaric acid.

Aim: To determine the total acidity in a sample of wine.

Method

1. Degas 100mL of wine using a Buchner flask and vacuum pump. Use this degassed wine for titrations.
2. Place 100mL of distilled water in a conical flask and add 5 drops of phenolphthalein indicator to the flask. Mix.
3. Add 0.1 mol L$^{-1}$ NaOH until the colour of the solution turns a pink which persists for 30 seconds. It is not necessary to record this amount of NaOH.
4. Pipette 10.0 mL of wine into the flask (the pink colour will change back to colourless).
5. Titrate with 0.1 mol L$^{-1}$ NaOH until the colour of the solution changes back to a pale pink colour that persists for 30 seconds.
6. Record the titration results in the usual way.

Calculation

\[
\text{Titratable acidity} = 0.75 \times \text{titre volume (mL)} \times 0.1 \text{ mol L}^{-1} \text{ NaOH} \\
\quad (\text{g L}^{-1} \text{ tartaric acid})
\]

Titration analysis of the alcohol content of wine.

For a method for this refer to Sample Activity 31 for Unit 6341 Pg 6.157 in the NZQA Assessment Guide – Chemistry.

Please note the following modification to instruction 2.

2. Place a 20 mL aliquot of the diluted wine in a conical flask and add 20 mL of 0.04 mol L$^{-1}$ potassium dichromate. Slowly add about 20 mL of 2 mol L$^{-1}$ sulfuric acid solution to each flask.

Note Under these conditions the ethanol is oxidised to ethanal - not ethanoic acid so the calculations need to be modified accordingly.

eg $3C_2H_5OH + Cr_2O_7^{2-} + 8H^+ \rightarrow 3CH_3CHO + 2Cr^{3+} + 7H_2O$