

Laboratory Work 7

Title

Determination of alcohol strength (Alcohol by Volume, ABV) in beverages.

Objective of the Work

- To determine the alcohol content (ABV) of alcoholic beverages.
- To understand the principles and methods used for measuring ethanol concentration.
- To develop practical skills in analyzing beverage quality.

Theoretical Background

1. Alcohol by Volume (ABV)

ABV is the standard measure of how much ethanol is contained in a given volume of an alcoholic beverage. It is expressed as a percentage (%). ABV affects:

- Taste and sensory properties
- Alcohol strength and intoxication potential
- Legal labeling requirements

2. Methods of Determination

Common methods for determining ABV include:

- **Distillation and densimetry:** Distill alcohol from the beverage and measure its density.
- **Hydrometry:** Using an alcoholometer to measure density of the beverage.
- **Refractometry:** Measuring refractive index and correlating with ethanol content.
- **Gas Chromatography (GC):** Accurate laboratory method.

Hydrometry and distillation are the most common for routine laboratory analysis.

3. Hydrometer Method

- The alcoholometer measures the density of ethanol-water solution.
- Corrections are made for temperature (usually standardized at 20 °C).
- Density reading corresponds to ABV based on calibration tables.

4. Distillation Method

- Alcohol is separated from the beverage by distillation.
- Volume or mass of the distillate is measured and used to calculate ABV.

Equipment and Materials

- Alcoholic beverage sample

- Alcoholometer (hydrometer) with calibration table
- Hydrometer cylinder
- Thermometer
- Distillation apparatus (if using distillation method)
- Analytical balance
- Measuring cylinder
- Protective gloves and goggles

Experimental Procedure

A. Hydrometer Method

1. Pour the beverage into a hydrometer cylinder.
2. Allow the sample to reach 20 °C (or note the temperature for correction).
3. Gently lower the alcoholometer into the liquid.
4. Record the reading at the liquid surface.
5. Correct the reading for temperature using standard tables.
6. Report ABV in percent.

B. Distillation Method (Optional)

1. Set up the distillation apparatus.
2. Measure a known volume of beverage and distill to separate ethanol.
3. Collect the distillate in a graduated cylinder.
4. Measure the volume of ethanol and calculate ABV based on the initial beverage volume.

Calculations

- **Hydrometer method:** $\text{ABV (\%)} = \text{reading from alcoholometer (corrected for temperature)}$
- **Distillation method:** $\text{ABV (\%)} = (\text{volume of distillate} / \text{volume of sample}) \times 100$

Results Presentation

Sample	Temperature (°C)	Alcoholometer Reading	Corrected ABV (%)	Notes
Beverage A				
Beverage B				

Discussion

- Compare the measured ABV with labeled or standard values.
- Discuss potential sources of error (temperature variations, calibration accuracy, carbonation).
- Explain differences between hydrometer and distillation methods if both are used.

Conclusion

The laboratory work allowed determination of alcohol strength (ABV) in beverages. Accurate measurement of ABV is essential for quality control, labeling, and consumer safety.