Alcoholic fermentation (Item No.: P7171600)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 7-10
Topic: Organische Chemie
Subtopic: Sauerstoffhaltige organische Verbindungen
Experiment: Alkoholische Gärung

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Easy	10 Minutes	10 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

organic compounds, alcohols, alcoholic fermentation

Task and equipment

Information for teachers

Learning objectives

- Alcohol is produced from sugar containing liquids by fermentation with yeast.
- The sugar is split by the yeast fungus to alcohol and carbon dioxide.

Notes on setup and procedure

Preparation
Various fruit juices (e.g. cherry juice or grape juice) can be used, but they must be free of additives and should not be sulphurized. Sulphurized juices must be heated prior to fermentation. Any type of commercially available yeast is suitable for the experiment, but a pure culture of wine yeast available in drugstores is recommended.

Remarks on the students experiments
The Erlenmeyer flasks should not be exposed to sunlight and not be stored at temperatures above 20 °C. Storage on a radiator, for example, is not recommended.
Glass cupboards are particularly suitable, as they allow the periodic observation of the progress of the fermentation.


Hazards

- Calcium hydroxide solution is caustic. Wear protective glasses!
- To make glass/rubber connections, wet the glass with glycerol so that it can be easily inserted into the rubber stopper!

Notes

The enzymatic yeast fermentation takes place according to the following equation:

$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$

The actual course is, however, far more complicated and occurs in several separate steps with ATP involvement. In addition to

ethanol, large amounts of lactic acid, other carboxylic acids and higher alcohols, are formed. Pure sugar solution is less well fermented, because of the high sugar concentration and the lack of mineral substances.
The fermentation rate can be increased by adding a spoonful of flour or nutrient salt.

Remarks on the method

The experiment is very suitable for work-sharing. Various fruit juices can be used. A parallel test with sugar solution should always be carried out, to demonstrate that sugar is the substance which ferments.

Waste disposal

Label the two Erlenmeyer flasks and store them closed somewhere safe. No special regulations have to be regarded for the disposal of the resulting solutions.

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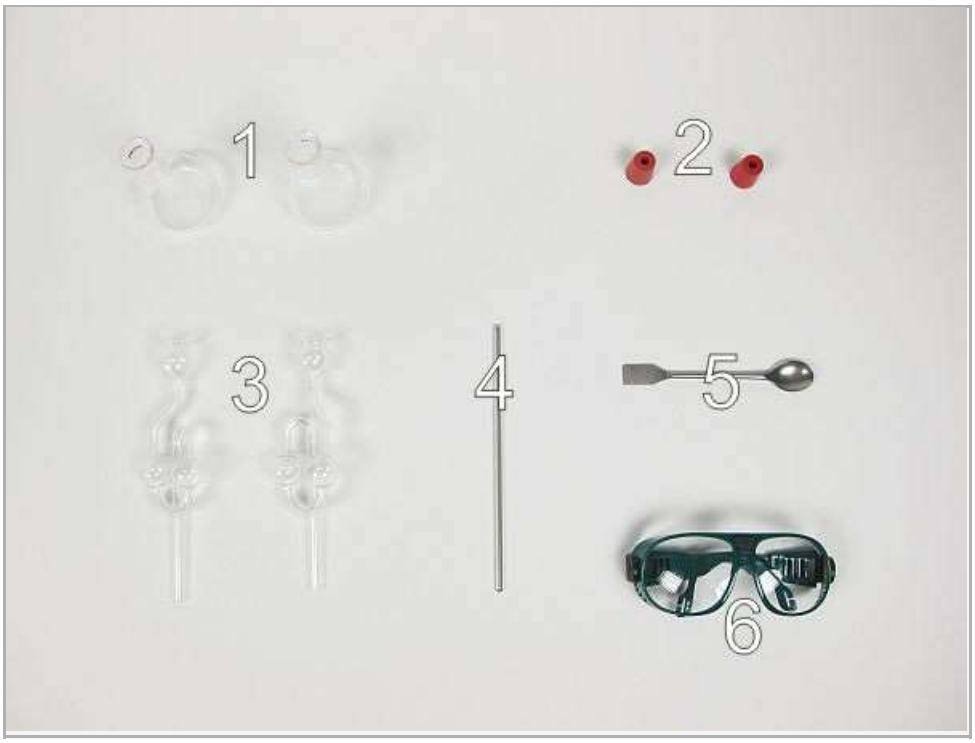
Task and equipment

Task

How are alcoholic beverages produced?

Produce an alcoholic liquid from a solution containing sugar.

Equipment



Position No.	Material	Order No.	Quantity
1	Erlenmeyer flask 100 ml, narrow neck, PN 19	36418-00	2
2	Rubber stopper, d = 22/17 mm, 1 hole	39255-01	2
3	Safety tube,-fermentation tube-	36935-00	2
4	Glass rod, boro 3.3, l=200mm, d=6mm	40485-04	1
5	Spoon, special steel	33398-00	1
6	Protecting glasses, clear glass	39316-00	1
	Calcium hydroxide solution 1000ml	31458-70	1
	D(+)-glucose 1000 g	30237-70	1
	Glycerol, 250 ml	30084-25	1
Additional material			
	Fruit juice (free of additives)		
	Yeast (wine yeast)		
	Water		

Set-up and procedure

Set-up

Hazards

- Calcium hydroxide solution (limewater) is caustic. Wear protective glasses!
- To make glass/rubber connections, wet the glass with glycerol so that it can be easily inserted into the rubber stopper!


Procedure

Carefully twist the fermentation tube to ease it through the rubber stopper (Fig. 1) without using force (wet it sufficiently with glycerol).

Fig. 1

Fill an Erlenmeyer flask about half full with fruit juice (Fig. 2), add 1 spoonful of glucose (Fig. 3) and stir until all of the sugar has dissolved (Fig. 4). Now add 2 g of finely crumbled solid yeast or half a bottle of wine yeast (Fig. 5).


Fig. 2

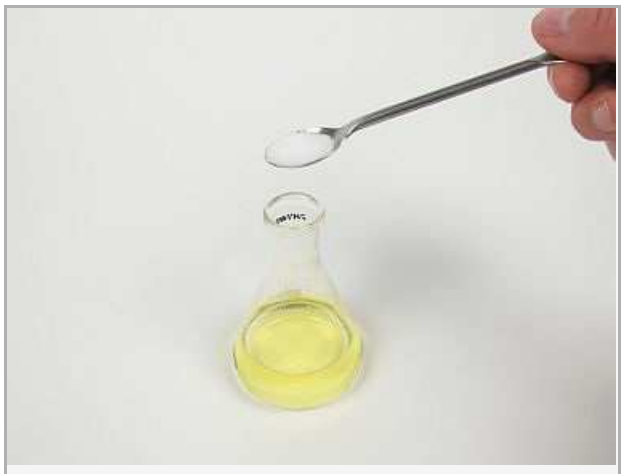


Fig. 3


Fig. 4


Fig. 5

Half-fill the second Erlenmeyer flask with water (Fig. 6), add 3 spoonfuls of glucose (Fig. 7) and stir until the sugar has completely dissolved (Fig. 8).


Fig. 6


Fig. 7


Fig. 8

Close the Erlenmeyer flasks with the rubber stoppers. Pour sufficient limewater in the fermentation tubes to fill them about half full (Fig. 9).
Store the flasks for one week in a warm place, checking the progress of the reaction at regular intervals.


Fig. 9

Report: Alcoholic fermentation

Result - Observations 1

Note the observations you make during the fermentation.

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Result - Observations 2

Compare the starting products and end products.

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Evaluation - Question 1

Draw conclusions from your observations.

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Evaluation - Question 2

Formulate in words an equation for the reaction which has taken place.

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Evaluation - Question 3

Which conclusion can be drawn from the different progress in the Erlenmeyer flasks?

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