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Getränkeanalytik

Determination of sugar according to Dr. Rebelein

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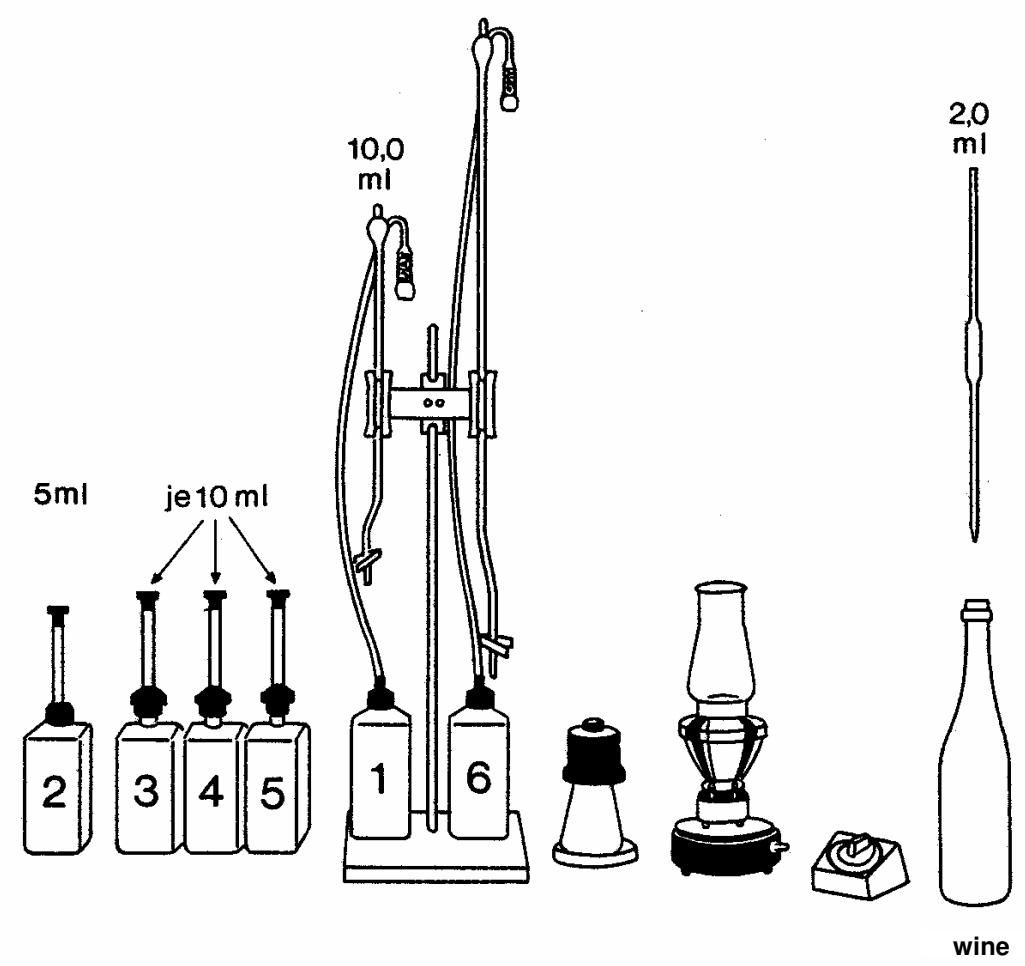

Method 1: Determination of Natural Inverted Sugar (without Inversion):

- Heat laboratory burner for approx. 5 minutes.
- Check burettes. The meniscus must be on a level with the top mark of the burettes. Remove drops from the burette jets, fill up dose cylinders.
- Fill 200 ml conical flask slowly with 10,0 ml of "Sugar 1", wipe remaining drop off the jet of the burette on the inside wall of the flask. (When pipetting initial solution mind correct pipetting technique.)
- Add 5 ml of "Sugar 2" (dose cylinder) and 5 - 8 pumice stones.
- Pipette 2,0 ml of the liquid to be analysed into conical flask (Blowing-out Pipette).
- Place the conical flask on the heated reflector burner and set the laboratory alarm clock to 2 ½ minutes.
- After this time put rubber cap on conical flask, place the flask into the Petri dish and cool it with running water.
- Once the liquid has cooled down to room temperature (after about 2 - 3 minutes) add 10 ml each of "Sugar 3", "Sugar 4", and "Sugar 5" (dose cylinder) in the listed order while shaking the flask gently.
- Titrate the now deep blue liquid with "Sugar 6" to "creamy yellow". (See "Comments on Titration".)
- Read content of sugar off titration burette. If necessary multiply this figure with the dilution factor.
- Fill up burettes to the starting mark for the next determination. Do not leave burettes completely or partly empty.

Pipetting technique:

Before pipetting rinse pipette with liquid to be pipetted!) Suck liquid approx. 2 cm above ring mark of the blowing-out-pipette, wipe pipette with cellulose cloth, lower the level to the mark. In doing so the tip of the pipette should be placed onto the wall of a glass beaker supplied specifically for this purpose, whereby the last drop should be wiped off. Put the sample without loss into the conical flask. Place the tip on the inside wall of the flask and drain pipette. Approx. 15 seconds after draining blow out the pipette and wipe remaining drops off the tip of the pipette on the inside wall of the flask.

Method 2: Determination of Natural Inverted Sugar and Saccharose (with Inversion):

- Put a few pumice stones, 10,0 ml of "Sugar 1", 2 ml of inversion solution, and 2,0 ml of the sample to be determined in 200 ml conical flask.
- Place flask on heated laboratory burner and set laboratory alarm clock to 2 minutes.
- After the 2 minutes let 5 ml of "Sugar 2" (dose cylinder) run into the centre of the boiling liquid without removing flask from the reflector burner.
- Set alarm clock to 2½ minute, during which time the liquid continues to boil.
- Thereafter cool flask under running water (place rubber cap on top of the flask!)
- Add 10 ml each of "Sugar 3", Sugar 4" and "Sugar 5" (dose cylinder) to the cooled liquid and titrate the mixture with "Sugar 6" to "creamy yellow".
- Read off burette the content of sugar after inversion in g/l (grams per litre). If necessary multiply this figure with the dilution factor.

Calculation of Saccharose:

(Sugar determination with inversion minus sugar determination without inversion multiplied by 0,95)

Example:

Sugar with inversion	26,0 g/l
Sugar without inversion	- 22,0 g/l
Saccharose	4,0 g/l x 0,95 **= 3,8 g/l**

Determination of the Total Sugar:

(Sugar determination without inversion plus saccharose)

Example:

Sugar without inversion	22,0 g/l
Saccarose	+ 3,8 g/l
Content of total sugar	**25,8 g/l**

Determination of the Sugar Free Extract:

(Total extract minus saccharose minus sugar determination without inversion plus 1)

Example:

Total extract	45,0 g/l
Saccharose	- 3,8 g/l
Sugar without inversion	- 22,0 g/l
	19,2 g/l
Factor	+ 1,0 g/l
sugar free extract	**20,2 g/l**

Choice of the correct method:

The natural inverted sugar of liquids free of saccharose is determined with variant 1 (determination without inversion). If a liquid contains inverted sugar as well as saccharose, the saccharose must be inverted before it can be determined as inverted sugar together with the natural inverted sugar. The inversion of the saccarose and the determination of the total inverted sugar is done according to variant 2 (determination with inversion).

Comments on Titration:

Before the titration the liquid has a deep blue colour. As soon as the liquid becomes brighter the titration should be slower down. Aim of titration is a mixed colour of white, grey, and beige. The technical term for this colour is "creamy yellow". It is hard to characterise but good and clear to recognise. When the titration comes near to the described mixed colour the burette reading is remembered and one lets fall another drop into the centre of the liquid surface and observes whether the area where the drop has fallen in becomes brighter. If this is not the case, the previous burette reading is the-final one. If, on the contrary, the colour is still brightening up the liquid is mixed by shaking, and the process is repeated until the colour remains constant.

Blank Titration for the Control of the Solutions:

Proceeds according to the instruction, but use 2,0 ml of distilled water as sample. A sugar content of 0 g/l should be obtained after titration with a tolerance not significantly exceeding ± 0,1g/l.

Notes Concerning the Determination of Sugar According to Dr. Rebelein:

The reducing sugar is oxidised with alkaline copper sulphate solution; the bivalent copper is reduced to cuprous oxide; the copper not used reacts with potassium iodide to iodine which is titrated back with sodium thio-sulphate. Due to the concentration and heating conditions adjusted to the theoretically disclosed reaction mechanism of the oxidation of sugar, oxidation proceeds according to stoichiometric aspects. It is independent of the heating duration and linear proportional of the sugar content.

Beverages with up to 28 g of sugar per litre are analysed undiluted (2,0 ml). Their sugar content is read off the burette in g/l.

Beverages with more than 28 g of sugar per litre are analysed diluted (2,0 ml of the dilution). Their sugar content is calculated by multiplication of the burette figure with the dilution factor. (Exception: alternative variant for the range of 0-56 g *of* sugar per litre).

Preparation of dilutions:

28 - 56 g/l sugar (dilution factor 2)
Pipette 25,0 ml of beverage into 50 ml measuring flask. Fill up to mark with distilled water, adjust exactly.

56 - 112 g/l sugar (dilution factor 4)
Pipette 25,0 ml of beverage into 100 ml measuring flask. Fill up to mark with distilled water, adjust exactly.

112 - 224 g/l sugar (dilution factor 8)
pipette 25,0 ml of beverage into 200 ml measuring flask. Fill up to mark with distilled water, adjust exactly.

224 - 560 g/l sugar (dilution factor 20)
pipette 10,0 ml of beverage into 200 ml measuring flask. Fill up to mark with distilled water, adjust exactly.

Example:

A diluted liquid has been analysed for sugar. The factor corresponding to the dilution is 4. The meniscus of the titration liquid reads 24,8. The analysed liquid contains:

24,8 x 4 = 99,2 g/l sugar

Alternative Variant for Examination Range 0 - 56 g of Sugar per Litre:

If instead of 2,0 ml only 1,0 ml of undiluted beverage is taken for analysis, the same result is obtained as with a dilution of the beverage with distilled water in the relation 1 : 1. The burette figure must be multiplied by 2. Through this variant a dilution free examination range of 0 - 56 g of sugar per litre is obtained. The working method is of interest when the sugar figures often are around 28 g of sugar per litre.

Determination of sugar according to Dr. Rebelein - parts list -

- ☐ 1 laboratory burner
- ☐ 1 laboratory alarm clock
- ☐ 1 Stand with staff 600 x 12 mm for burettes
- ☐ 1 holder for burettes 10 – 10 / 12
- ☐ 1 burette 10 ml TTS for „sugar 1“
- ☐ 1 burette „sugar according to Dr. Rebelein“ TTS for „sugar 6“
- ☐ 1 blowing out-pipette 1 ml
- ☐ 2 blowing out-pipettes 2 ml
- ☐ 2 blowing out-pipettes 10 ml
- ☐ 1 blowing out-pipette 25 ml
- ☐ 1 dose cylinder 5 ml for „sugar 2“
- ☐ 3 dose cylinder 10 ml for „sugar 3“, „sugar 4“ and „sugar 5“
- ☐ 2 conical-flasks 200 ml (Reaction flask)
- ☐ 1 rubber cap Size 4a as Hood
- ☐ 1 petri dish approx 95 mm Ø
  for putting into the reaction flask during the cooling with tap water
- ☐ 1 polyamide bottle 500 ml for distilled water
- ☐ 1 x pumice stones for analysis (Riedel-de-Haen)
- ☐ 1 spatula for pumice stones
- ☐ 1 measuring flask 50 ml for dilution
- ☐ 1 measuring flask 100 ml for dilution
- ☐ 1 measuring flask 200 ml for dilution
- ☐ 1 map with information-material

original allocation of equipment of reagents:	**Need per analysis:**
☐ sugar 1 500 ml in polyamide bottle	(10,0 ml / burette)
☐ sugar 2 500 ml in polyamide bottle	(5 ml / dose cylinder)
☐ sugar 3 500 ml in polyamide bottle	(10 ml / dose cylinder)
☐ sugar 4 500 ml in polyamide bottle	(10 ml / dose cylinder)
☐ sugar 5 500 ml in polyamide bottle	(10 ml / dose cylinder)
☐ sugar 6 500 ml in polyamide bottle	(variable / burette)

only on express order for determination of sugar with inversion:

☐ 500 ml inversion solution (2 n sulfuric acid) in polyamide bottle	(2 ml / dose cylinder)
☐ dose cylinder 2 ml	

recommendable accessories:

- ☐ draining rack for laboratory glass
- ☐ pipette stand from polypropylene