# Exercise 6

# Sugar analysis in honey

## Example of calculations

# A. Direct analysis of the reducing sugars (glucose & fructose) in honey-Layne-Eynon method

## Process

1. Reduction of Fehling's solution (Fel. A + Fel. B) with standard invert sugar (glucose + fructose 1:1) solution

    - Determination of Fehlings solution "title"
      (i.e. the amount of invert sugar in grams required to reduce the amount of $Cu^{+2}$ contained in the titrated Fehling's solution)

2. Reduction of Fehling's solution with the honey solution (1 %w/v honey in water)

    - Determination of the reducing sugars in honey (glucose and fructose)

# A. Direct analysis of the reducing sugars (glucose & fructose) in honey-Layne-Eynon method

## Process

1. Test titrations
   result: e.g. a ml of standard or honey solution are consumed

2. Final titrations
   result: e.g. b ml of standard or honey solution are consumed

3. Calculations
   are done using the result of the final titrations (b ml)

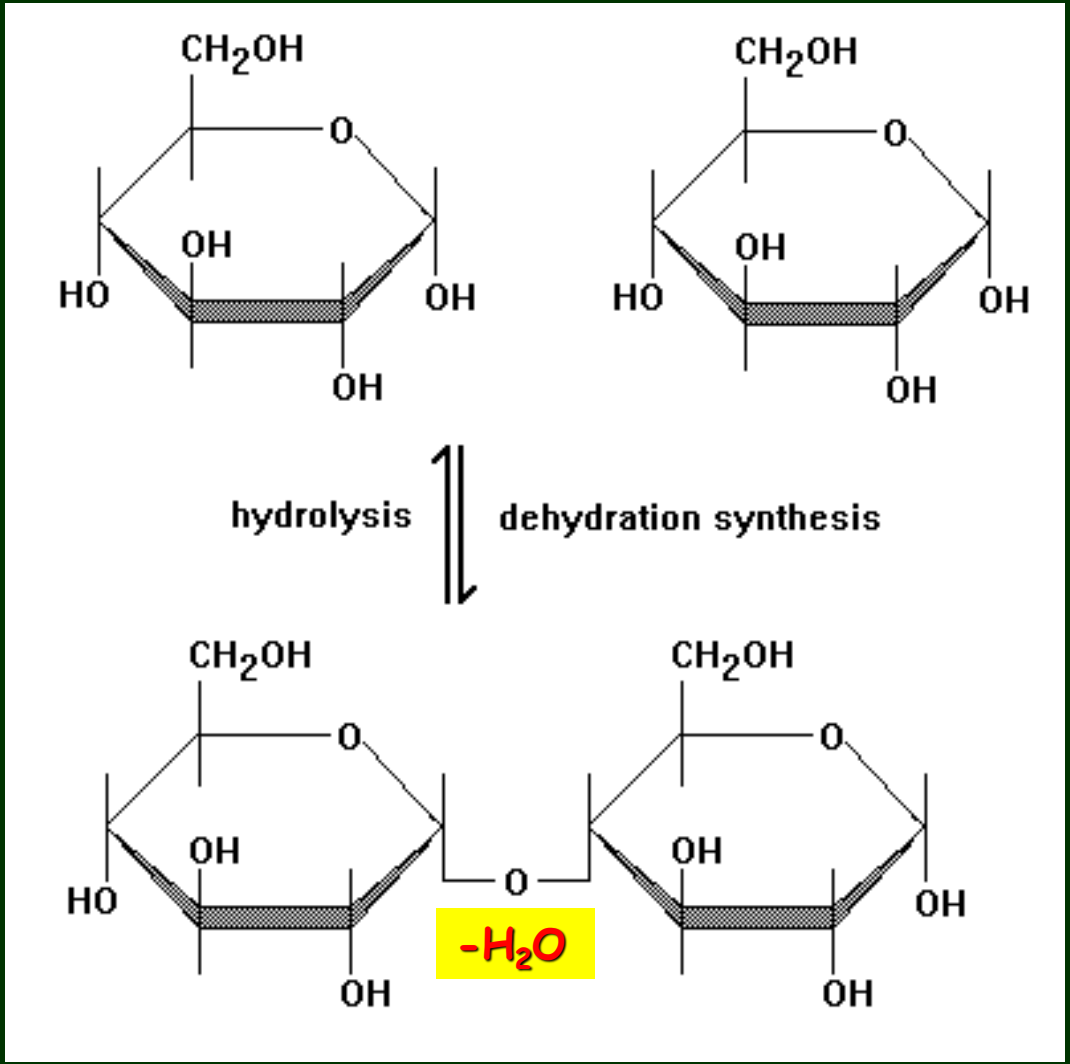
# B. Analysis of total sugars (glucose + fructose + sucrose) in honey-Layne-Eynon method

## Principle

- Hydrolysis of the sucrose (which is a non-reducing sugar) contained in the sample, at 60 °C, with HCl sol., to the reducing sugars glucose & fructose
- Determination of the total reducing sugars by the Layne-Eynon method as previously
- Calculation of sucrose by the equation:

(total reducing sugars - directly assayed reducing sugars) x 0,95

# B. Analysis of total sugars (glucose + fructose + sucrose) in honey-Layne-Eynon method




Glucose + fructose

sucrose

# B. Analysis of total sugars (glucose + fructose + sucrose) in honey-Layne-Eynon method

## Calculations example

- Standard solution of invert sugar: initial concentration 1% w/v invert sugar → diluted as: 50 ml in 200 ml with water → therefore the final concentration of the standard solution is 0,25 %w/v invert sugar
  - ❖ *for the Layne-Eynon method, 42 ml of this solution were consumed to reduce the Fehling's solution*
- Honey sample for direct analysis of reducing sugars (Honey 1): prepare a solution of 1% w/v honey in water
  - ❖ *for the Layne-Eynon method, 13 ml of this solution were consumed to reduce the Fehling's solution*
- Honey sample for analysis of total sugars (Honey 2): dilute 50 ml of Honey 1 to 100 ml and hydrolyze the contained sugar by HCl → the final concentration of this solution is 0,5 %w/v honey in water
  - ❖ *for the Layne-Eynon method, 24 ml of this solution were consumed to reduce the Fehling's solution*

# B. Analysis of total sugars (glucose + fructose + sucrose) in honey-Layne-Eynon method

## Calculations example

- Calculation of the Fehling's solution "title":

  ► 100 ml of standard solution contain 0,25 g of reducing sugars (invert sugar)

  the 42 ml that were consumed X g?? → X = (42 × 0,25) / 100 = 0,105 g reducing sugars (so, 0.105 g invert sugar is the "title" of the Fehling's solution!)

- Direct determination of reducing sugars in hioney:

  ► The 13 ml of Honey 1 (1%w/v) that were consumed to reduce the Fehling's solution must contain 0,105 g reducing sugars

  100 ml of Honey 1 sol. X?? → X = (100 × 1,105) / 13 = 0,808 g of reducing sugars

  ► But the 100 ml of Honey 1 solution contain 1 g of honey

  Therefore, 0,808 g of reducing sugars are contained in 1 g of honey

  so, in 100 g of honey X?? → X = (100 × 0.808) / 1 = 80,8 g of reducing sugar

  ► Therefore the honey contains 80,8 % w/w reducing sugars

# B. Analysis of total sugars (glucose + fructose + sucrose) in honey-Layne-Eynon method

## Calculations example

- Determination of sucrose in honey:
  - ► The 24 ml of Honey 2 solution (0,5%w/v honey in water) that were consumed, contain 0,105 g of invert sugar

    The 100 ml of Honey 2 sol. X?? → X = (100 × 1,105) / 24 = 0,438 g of total reducing sugars (since any contained sucrose was hydrolyzed to glucose +fructose)

  - ► But 100 ml of of Honey 2 solution contain 0,5 g of honey

    therefore, in 0,5 g of honey, 0,438 g of total reducing sugars are contained

    In 100 g of honey X?? → X = (100 × 0.438) / 0,5 = 87,5 g of total reducing sugars

► Therefore honey contains: (87,5-80,8) × 0,95 = 6,37 % w/w sucrose