Polarimeter

Determination of Lactose Content of Milk by Polarimetry

The specific rotation , [α], of lactose in solution at equilibrium is +52.3° . The specific rotation is defined as the optical rotation of a solution containing 1 g/ml in a 100 mm polarimeter tube, it is affected by temperature (20°C reference temperature) and wavelength (usually the sodium D line , 589 nm) is used:

$$[\alpha]_D^{20} = \frac{\alpha}{c \cdot d}$$

where α is the measured optical rotation; d the light path in dm and c the concentration as g/ml.

One of the easiest methods of determining the lactose concentration in milk is through polarimetry. Normal milk contains 45—50 g lactose per liter. For the method to be successful, all optically active compounds except for the lactose (for instance the proteins) must be removed. The solution must be transparent enough for the polarized light to pass through readily. Setting the polarimeter to the correct angle for the optical rotation value is tricky and must be done carefully to avoid erroneous values.

Procedure

1. Sample Preparation
The milk sample must first be defatted and deproteinated. Use a volumetric pipette to transfer 50.0 ml of milk to a 125 ml Erlenmeyer flask. Add 7.5 ml of concentrated sulfuric acid to the milk. To this mixture add 7.5 ml of a mercury iodide/potassium iodide solution. Note the precipitation of milk proteins. Filter the solution to remove this precipitate. Rinse the Erlenmeyer and wash the protein solids with water to ensure that the dissolved lactose is transferred completely. Transfer the filtrate to a 100 ml volumetric flask and carefully dilute the solution to the mark. You may discard the solidified proteins.

2. Measurement

Fill a clean 100 mm long polarimeter tube with the diluted milk solution at 20°C. Place the filled sample tube in the polarimeter and record the measured value (angular degree).

3. Calculation

Use the following formula and solve for c to calculate the concentration of the diluted milk

$$[a] = \frac{a}{c \times l}$$

where c is concentration in grams per 100 ml, l is the path length in dm, [a] is the specific rotation, and a is your measured value.

Use the concentration from the above formula to calculate the number of grams of lactose present in the diluted milk (which is the same as grams in the undiluted milk).
In calculating the concentration of lactose, a correction should be used for the concentration of fat and protein in the precipitate.

Recommended polarimeter

==> Schmidt+Haensch Polarimeter Polartronic N / M series

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Optisch-elektronische Messinstrumente seit 1864