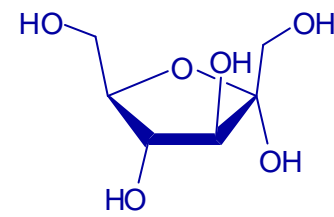# Analysis of Sugars

# Definition
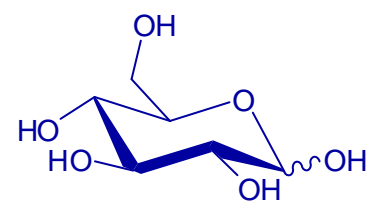
- Nutritional labelling of food products requires listing of *sugars* content.

- *Sugars* means all mono-saccharides and di-saccharides present in food*.
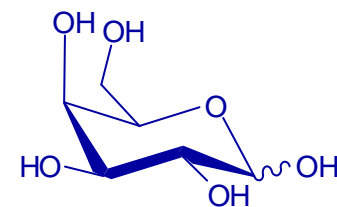
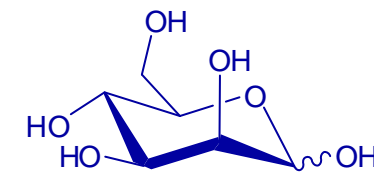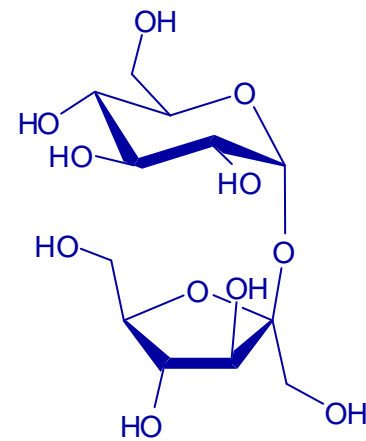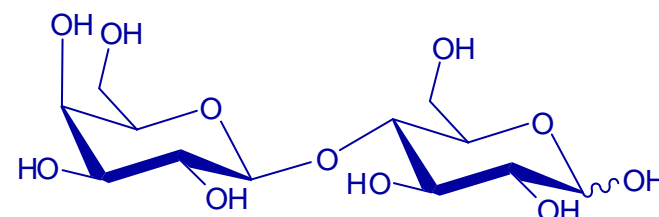*Codex Guidelines on Nutrition Labelling, *CAC/GL 2-1985*
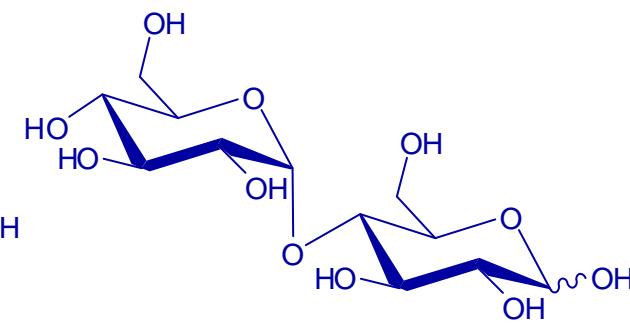
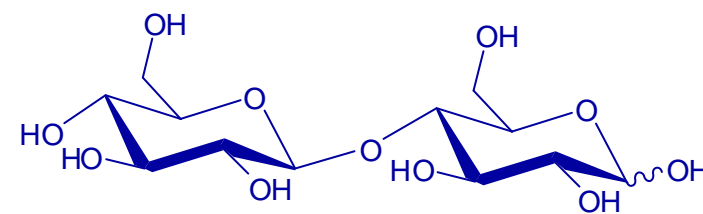# Mono- and di-saccharides

Fructose  Glucose  Galactose  Mannose  etc

Sucrose  Lactose  Maltose

Cellobiose  etc

# Common mono- and di-saccharides
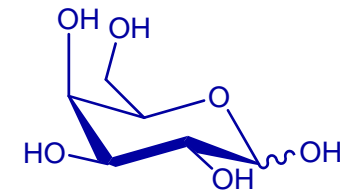
Fructose
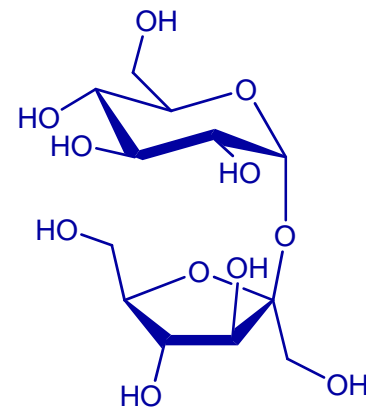
Glucose
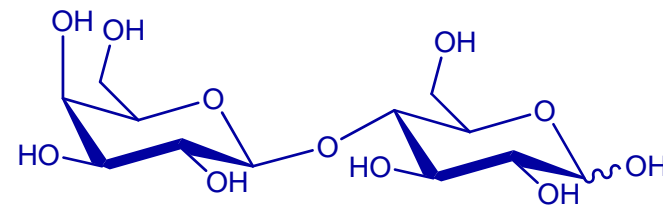
Galactose
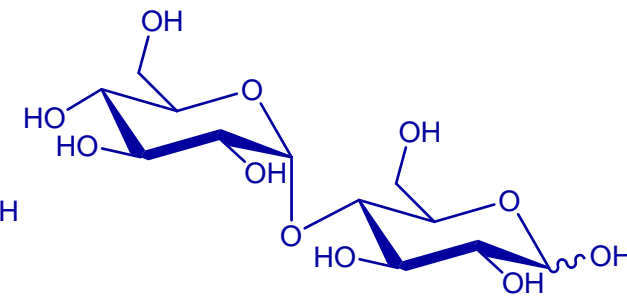
Sucrose

Lactose
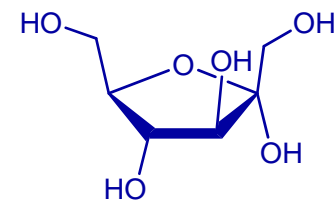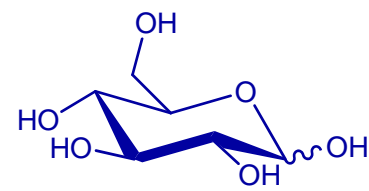
Maltose

# Common mono- and di-saccharides



Fructose  Glucose  Galactose

Sucrose  Lactose  Maltose
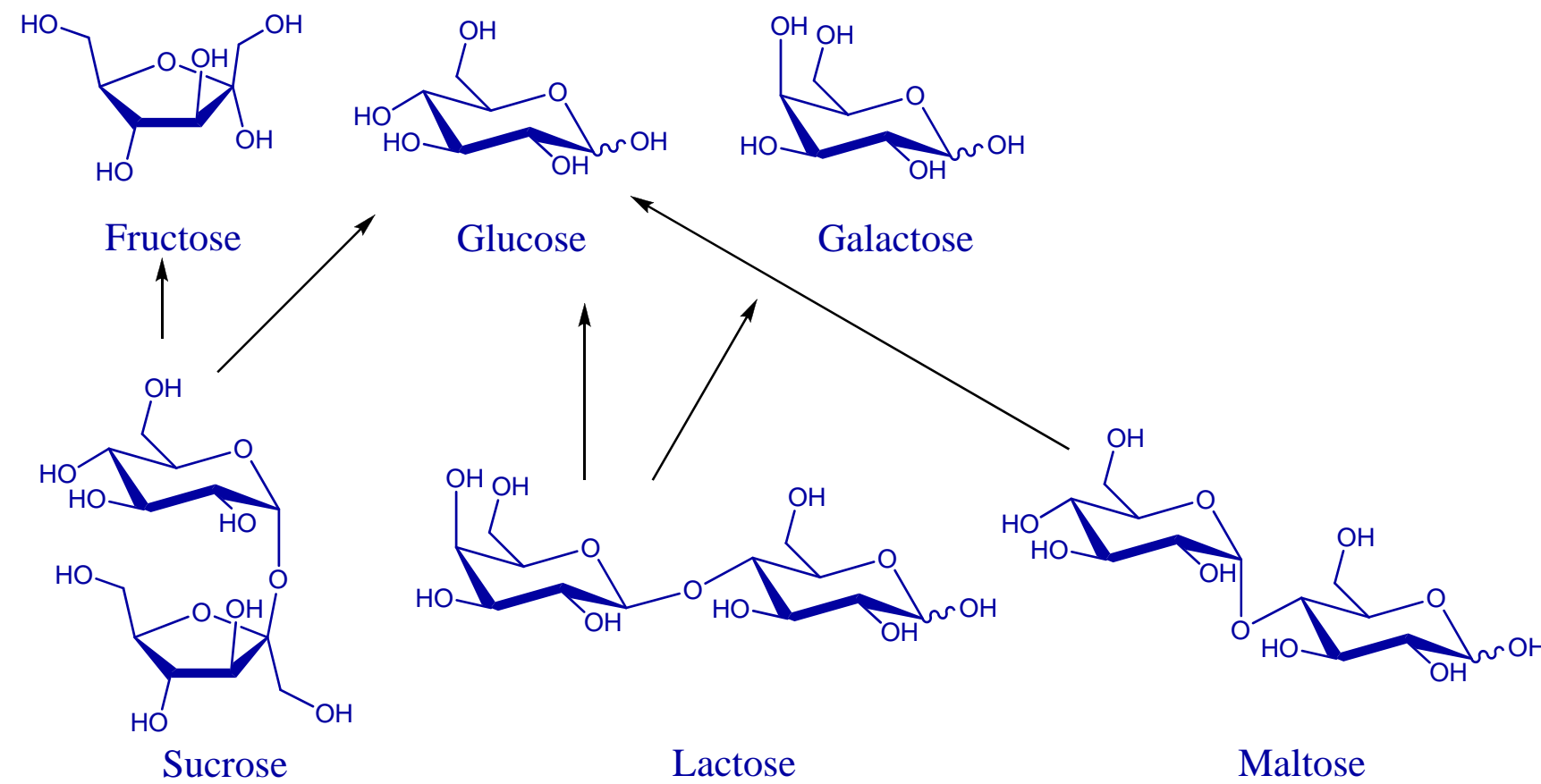
# Common sugars in foods

■ **Mono-saccharides:**

Fructose, glucose, galactose

■ **Di-saccharides:**

Lactose, maltose, sucrose

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# Properties of sugars

(LC Analysis)

Glycosylamine ← Primary amine

(LC Analysis)

OH

HO

HO

OH

O

OH

Trimethylsilyl chloride →

Methylsilyl ether
(GC Analysis)

$Ac_2O$

Acetate
(GC Analysis)
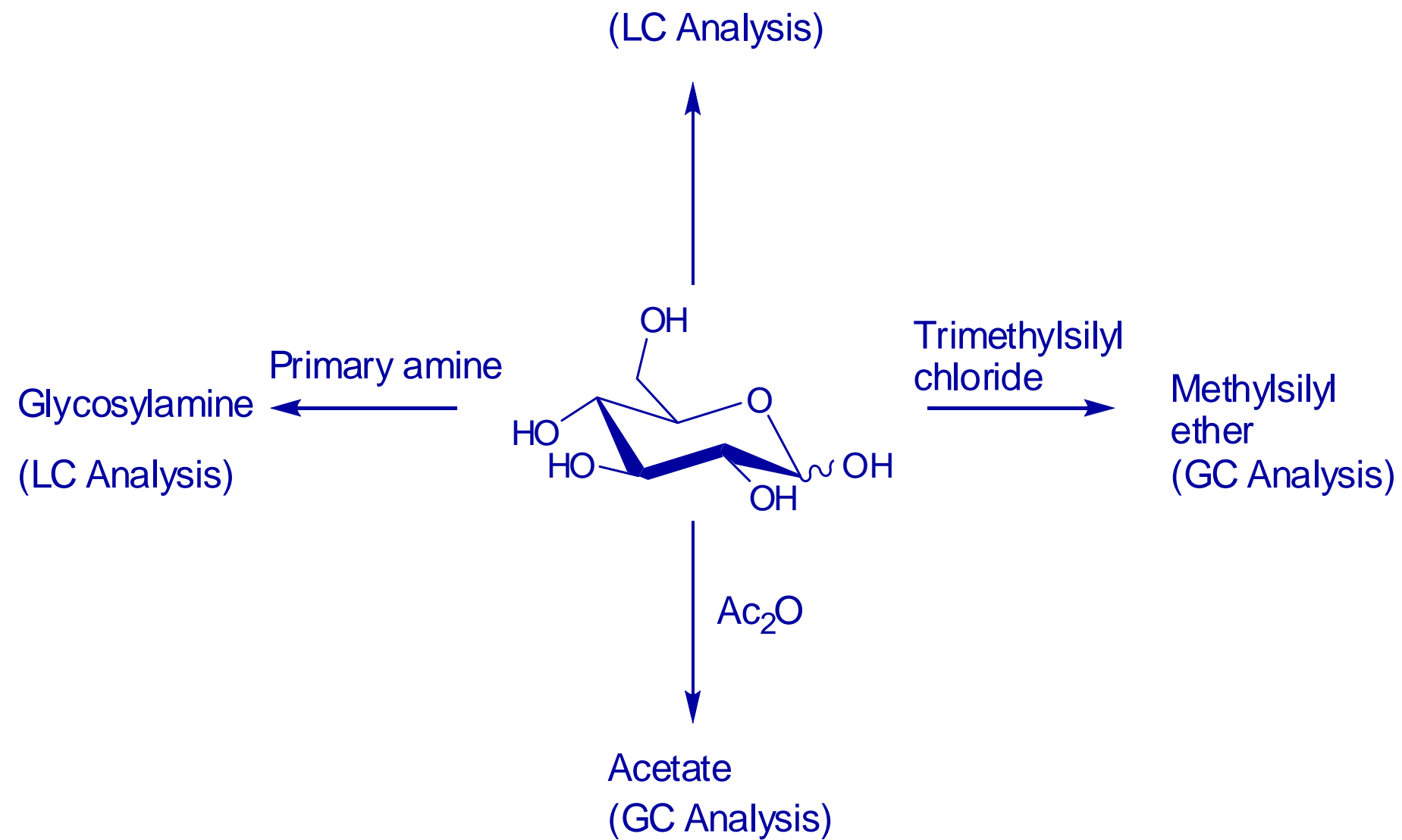
# Properties of sugars

- Water soluble.

- Low thermal stability.

- Do not have properties of fluorescence emission.

# Sugar Analysis

LC Methods with:

- Refractive Index Detector
- Evaporative Light Scattering Detector
- Pulsed Amperometric Detector

# Current AOAC LC Methods

| 977.20 | Honey | Fructose, glucose, sucrose |
|--------|-------|----------------------------|
| 980.13 | Milk chocolate | Fructose, glucose, lactose, maltose, sucrose |
| 982.14 | Presweetened cereals | Glucose, fructose, sucrose, maltose |
| 984.22 | Purity of lactose | Lactose |
| 996.04 | Cane & beet final molassess | Glucose, fructose, sucrose, lactose |
| 2000.17 | Raw cane sugar | Glucose, fructose |

# Current GB LC Method

GB-T 22221-2008

- 食品中果糖、葡萄糖、蔗糖、麦芽糖、乳糖的测定 高效液相色谱法

- Determination of fructose, glucose, sucrose, maltose, lactose in foods – high performance liquid chromatography

# Mono- and di-saccharides analysis
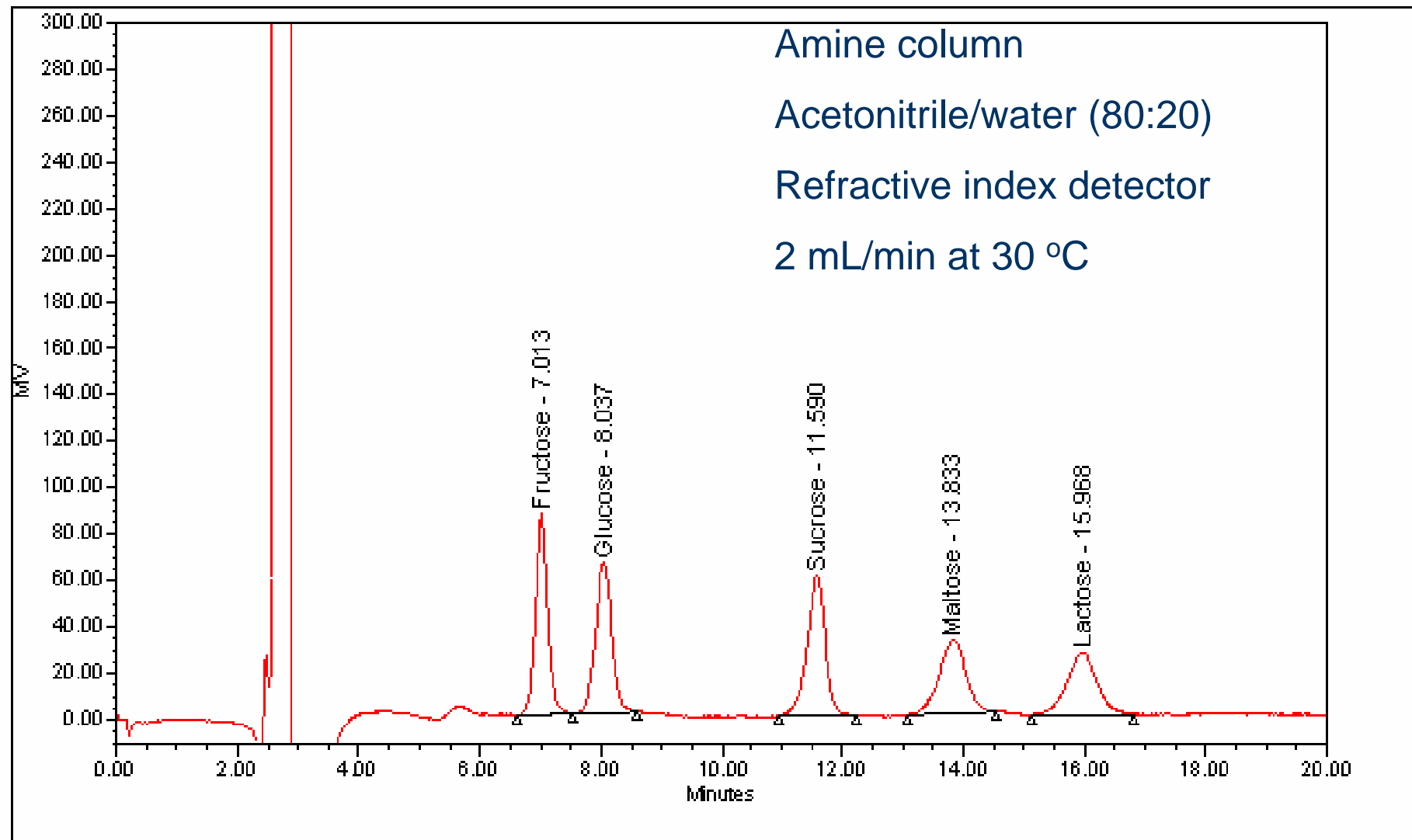
# Mono- and di-saccharides analysis
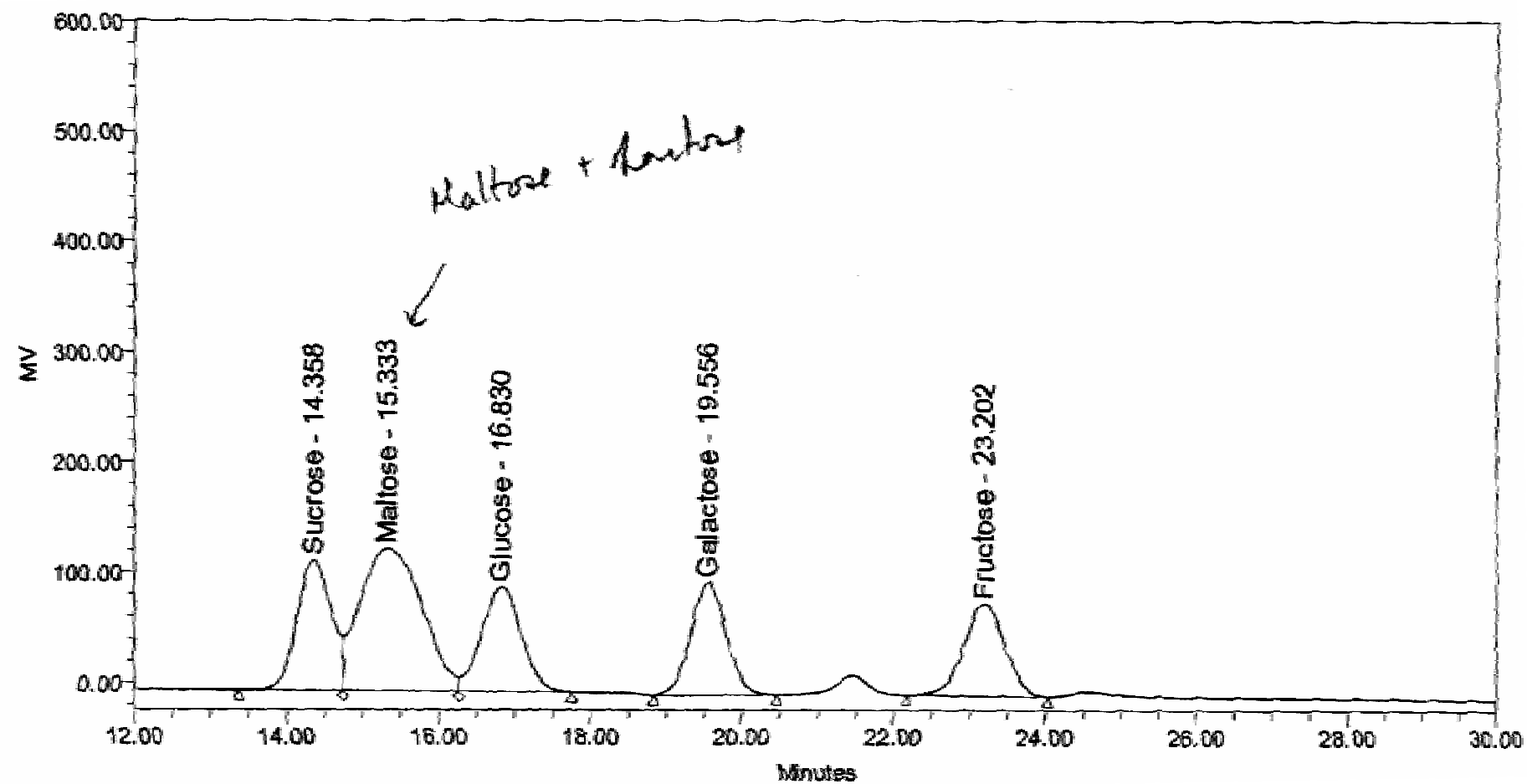
- Amine column may not be able to resolve all the peaks.

- Alternative column may be used, e.g., Shodex sugar column.

# Mono- and di-saccharides analysis
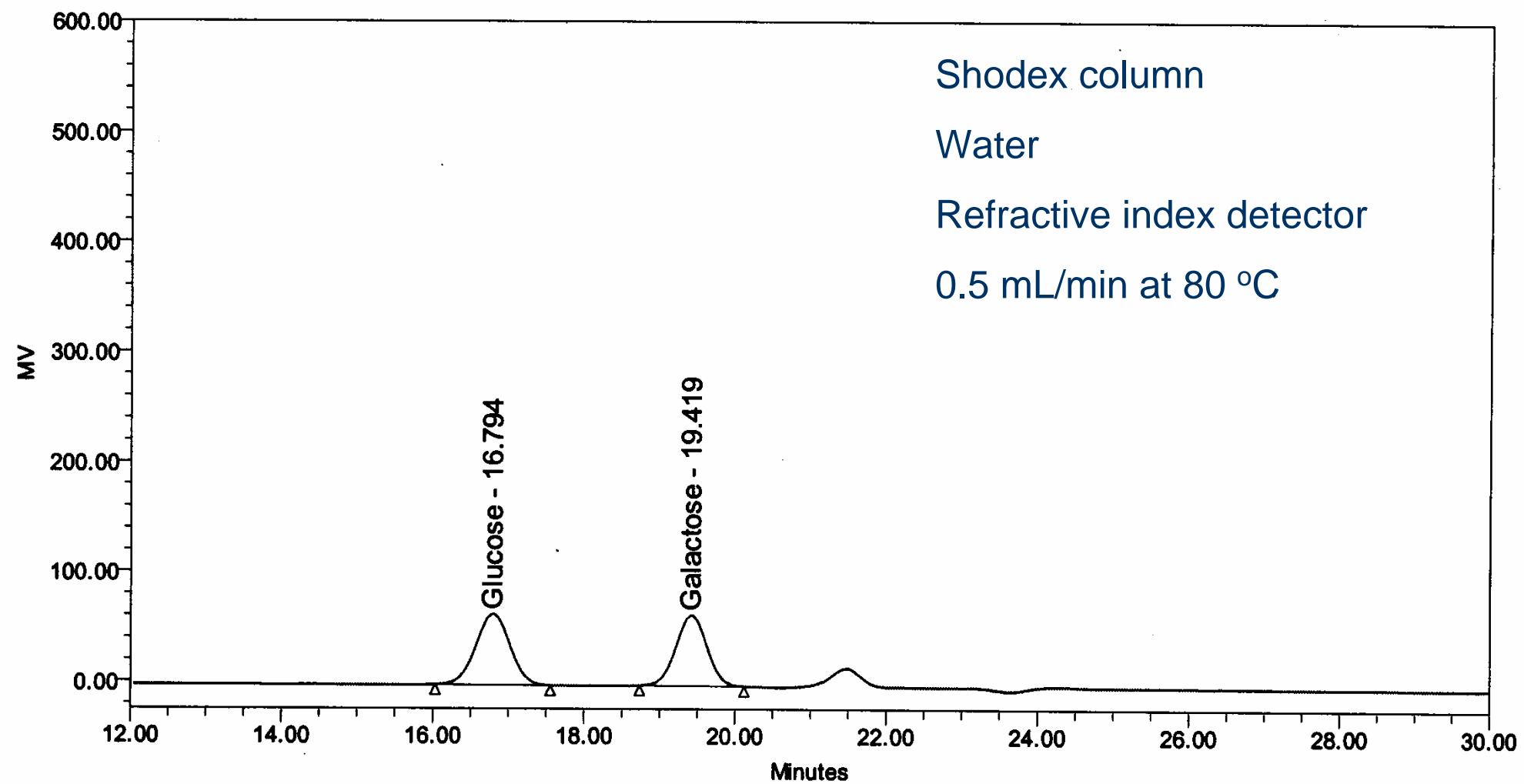
# Mono- and di-saccharides analysis

# Analysis of reducing sugars

AOAC methods:

| | |
|---|---|
| 920.183 | Sugars (Reducing) in Honey |
| 920.190 | Sugars (Reducing) in Maple Products |
| 945.66 | Total Reducing Sugars |
| etc. | |

# Analysis of reducing sugars

- Fehling solution is used in the methods

- It relies on chemical reaction between the sugars and the Fehling solution.
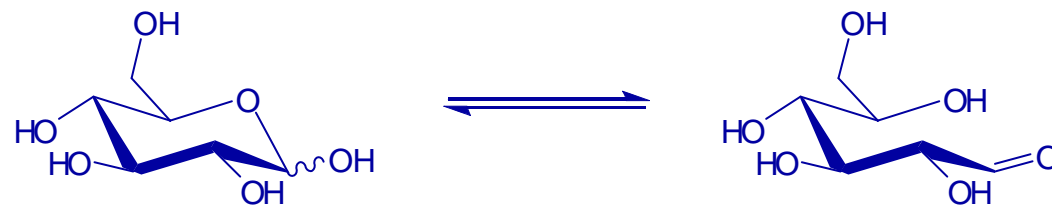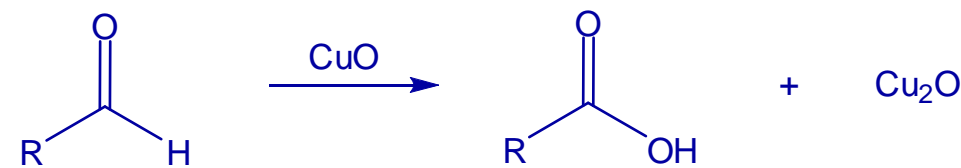
# Limitation of analyzing reducing sugar

■ The best-known and most significant
non-reducing sugar in foods is **sucrose**!
(The most important
low molecular weight
carbohydrate of animal diet).

**NOT appropriate for testing general food!!**

# Typical analysis

Sugars in sample → Preparation/ Clean up → LC
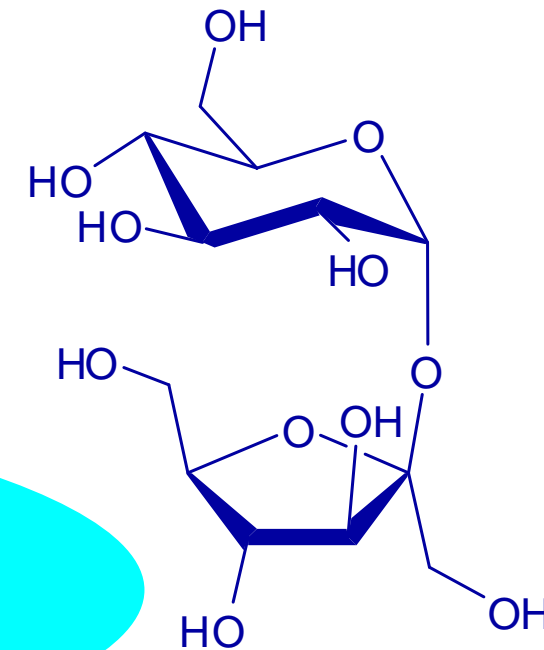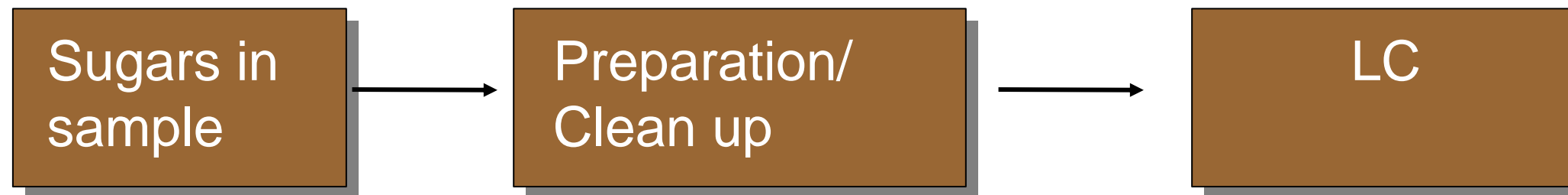
# Mono- and di-saccharides analysis

Extract the sugars from sample using a mixture of ethanol and water

# Mono- and di-saccharides analysis

Centrifuge the mixture after the extraction

# Mono- and di-saccharides analysis

Clean up the
extract by SPE

# Mono- and di-saccharides analysis

Clean up the
extract by SPE



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# Mono- and di-saccharides analysis

Analyse the extract using LC with refractive index detector



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# Proficiency test

FAPAS

LGC

AOAC

CRM

BCR

NIST

LGC

# Points to note

Sugar alcohols (polyols) are not "sugars"

Not all monosaccharides and disaccharides are reducing sugars.  Test method for reducing sugar may not be suitable for the analysis of sugars.

# Points to note

Definition of "0"
   Sugars ≤0.5 g/100 g

Limit of detection of total sugars should
be less than or equal to 0.5 g/100 g.

# Thank You