NATURAL POLYMERS 4
Plant (vegetable) GUMS

Dr. Ladislav Pospíšil

29716@mail.muni.cz

Time schedule

LECTURE	SUBJECT
1	Introduction to the subject – Structure & Terminology of nature polymers, literature
2	Derivatives of acids – natural resins, drying oils, shellac
3	Waxes
4	Plant (vegetable) gums, Polyterpene – natural rubber (extracting, processing and modification)
5	Polyphenol – lignin, humic acids
25.10. & 1. 11.	**Polysaccharides I – starch**
8.11. & 15. 11.	**Polysaccharides II – celullosis**
22. & 22. 11.	**Protein fibres I**
29. 11. & 6. 12.	**Protein fibres II**
13. & 20. 12.	**Casein, whey, protein of eggs**
20. 12.	**Identification of natural polymers**
	Laboratory methods of natural polymers' evaluation

A bit of TERMINOLOGY is NECESSARY

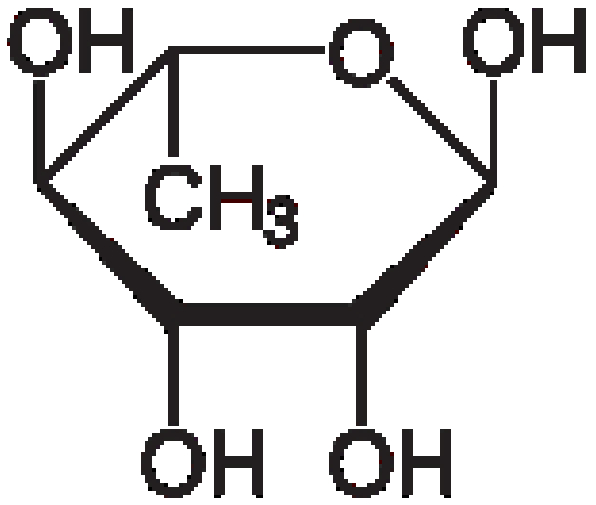
POLYTERPENES

Rubber – Vulcanization – Vulcanized Rubber (Hard Rubber)

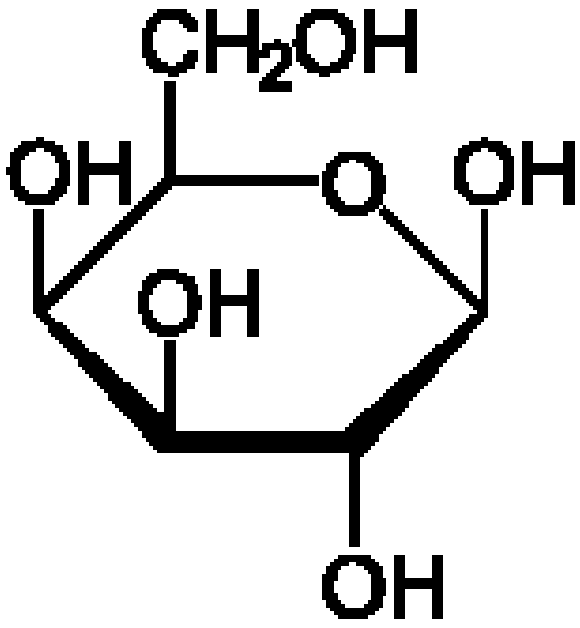
Plant (vegetable) GUMS = POLYSACCHARIDES = Mucilage (GUM)

Survey of the Plant (vegetable) GUMS

Monosaccharide	Arabic Gum	Traganth	Cherry gum	Plum gum	Peach gum
	% w/w				
Glucoronic acid	16	---	12	15	7
Galactonoric acid	---	43	---	---	---
Arabinose	19	3	55	34	43
Galactose	52	4	21	40	36
Rhamnose	14	---	Traces	---	Traces
Xylose	---	40	---	11	14
Manose	---	---	10	---	---
Fucose	---	10	---	---	---

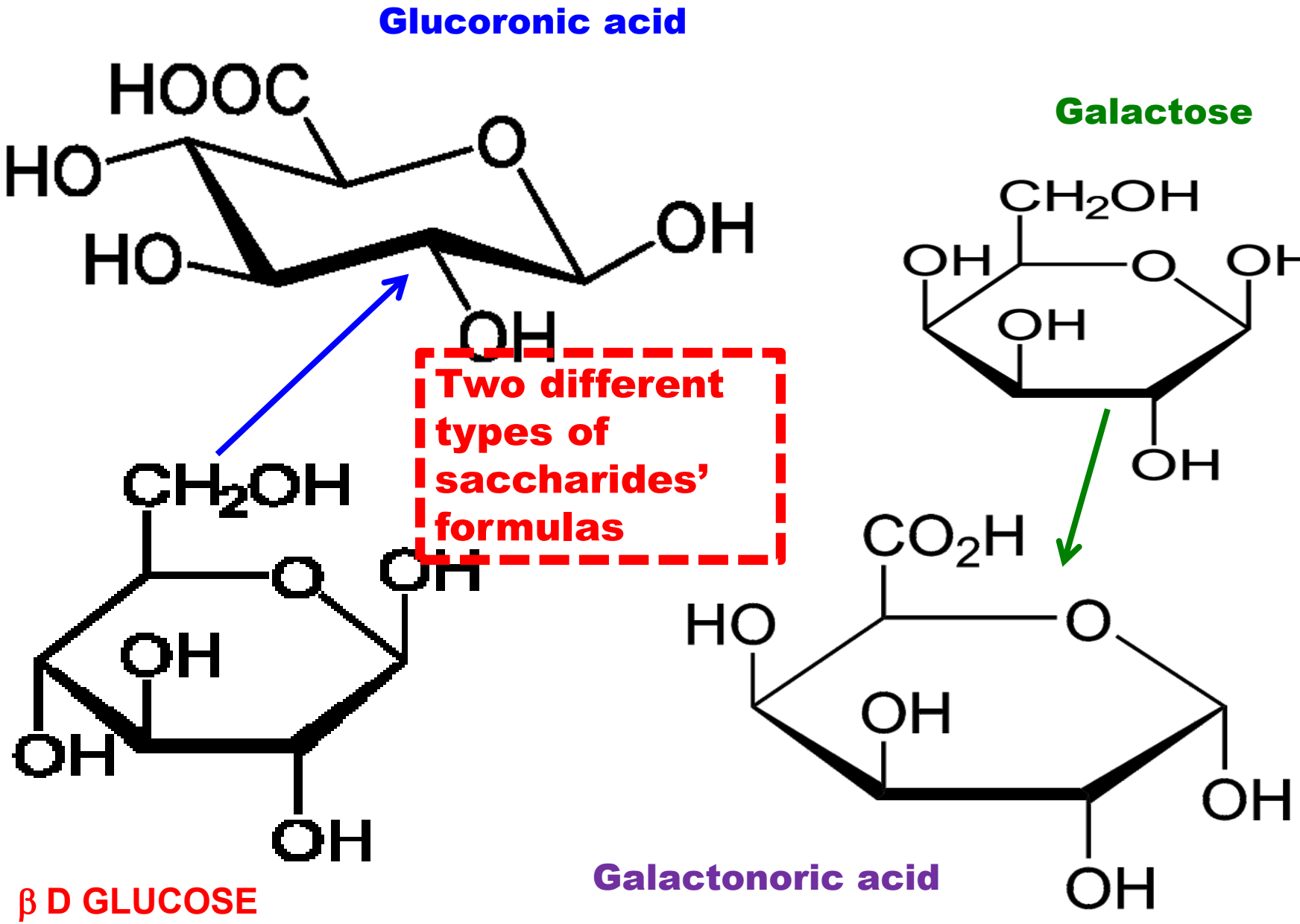


Rhamnose



Galaktose

prevailing form in the water – there can be also one HEXOSA and two PENTOSES


Glucoronic acid
HOOC
HO
HO
O
OH
OH
Two different types of saccharides' formulas
Galactose
CH2OH
OH
O
OH
OH
OH
CH2OH
O
OH
OH
OH
OH
β D GLUCOSE
CO2H
HO
O
OH
OH
OH
Galactonoric acid

Plant (vegetable) GUMS and so called „E“ Food Additives

Most of the Plant (vegetable) GUMS belongs to the „E“ Food Additives!

- The List of „E“ Food Additives is available on Internet, e.g. https://www.food.gov.uk/science/additives/enumberlist (Open!)
- They are used as (act so):
  - Thickener
  - Emulsifier
  - Stabilisers of the Rheological Properties
  - Bonding agent of the Pills and Tablets in Pharmacy

Plant (vegetable) GUMS = Mucilage (GUM) 1

- They are got by collecting of the dry Exudates from the Tree lesions fruit Trees
- Their Difference from RESINS is, that they are soluble in Water or at least are strongly swelling

The most common **Plant (vegetable) GUMS:**

- Arabic gum
- Tragant
- Fruit Trees Gums
  - Cherry,
  - Plum,
  - Peach.

Plant (vegetable) GUMS = Mucilage (GUM) 2

- They are frequently contaminated by Protein substances
- The acid part is oxidised saccharides (Glucoronic acid, Galacturic acid), often as salts Ca^{+2}, Mg^{+2}, Na^{+}
- The Acid hydrolysis >possibility of the Decomposition to Saccharides > approved by HPLC analysis
- The Solubility DEPENDS also on pH

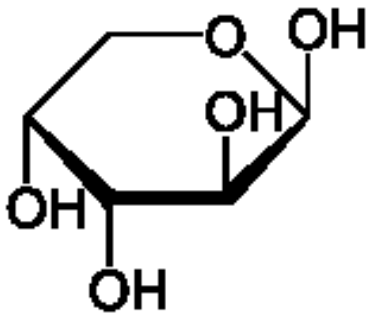
Arabic GUM (E 414) – the most frequent Plant (vegetable) GUMS

Acacia senegal

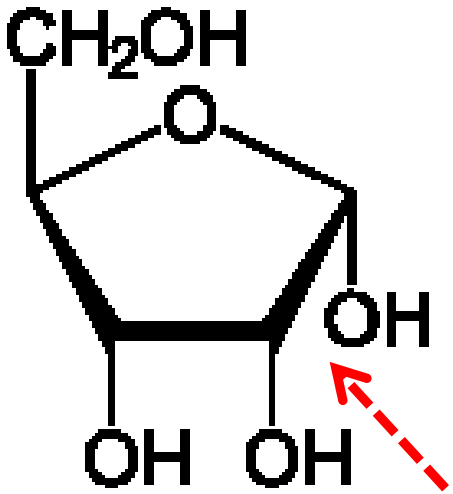
It looks like the RESIN!

Arabic GUM (E 414)

Gum arabic is a complex mixture of glycoproteins and polysaccharides. It is the original source of the sugars **arabinose** and **ribose**, both of which were first discovered and isolated from it, and are named after it.

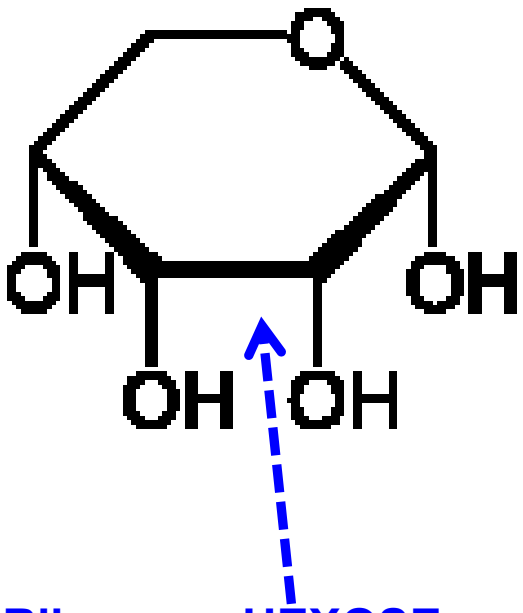


arabinose



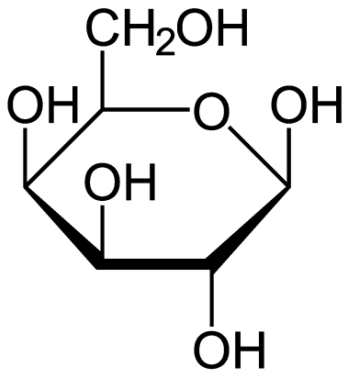
αD Ribose as PENTOSE

It exists also β D Ribose and Ribose as HEXOSE

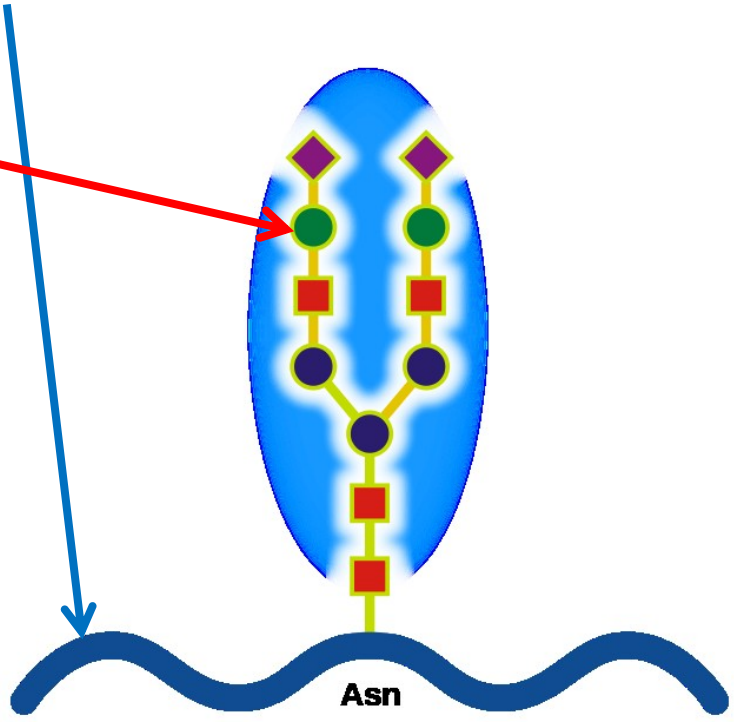


Arabic GUM (E 414)

- **CONTAINS:**
  - **Polysaccharides**
  - **Glycoproteins-** proteins with the bound Saccharides



Galaotóse – the main Component



Arabic GUM (E 414)

- **The Branched structure**
- **The Molecular weight is approx. 250 000 to 1 000 000 Da**
- **Solubility in Water up to40 % w/w**

NONFOOD USE

- **GLUE (paper, books' binding)**
- **Colour binding (aquarelle, tempera, pastel)**

Tempera

- **Emulsion water dilutable, e.g. EGG TEMPERA, OIL TEMPERA**
- **Arabic GUM acts here EMULSION STABILISER**

Tragacanth E413

- **Plant mucilages** having origin from some Asiatic plants sorts of the Plant called **Milk-vetch** (especially Astragalus gummifer, Astragalus adscendens a Astragalus microcephalus)
- It is used as a **EMULSION STABILISER, thickening agent** for Candy, Sauce a Salad dressing
- **Colour binding (aquarelle, tempera, pastel) or finishing substance in the textile industry**
- **It is hard to solute in water, it mostly swells only, it does not solute entirely and forms a gel only**
- **It is used for making the pastels**

Fruit Trees gums

- **Similar to Arabic gum and Tragacanth**
  - Cherry
  - Peach
  - Sour Cherry
  - Apricot
- **They mostly swells in Water only (demonstration)**
- **Insoluble in EtOH (demonstration)**
- **The darker Colour > limitation to dark pigments use**
- **Films are relatively (in comparison to Arabic gum) more elastic**

Artifical Mucilage (GUM)

Glue for paper on the DEXTRINE basis

Colour is like the genuine Mucilage

Connections are relatively brittle