

CRUDE DRUGS CONTAINING CARBOHYDRATES AS ACTIVE CONSTITUENTS

1. MACROSCOPICAL TESTS

<i>Acaciae gummi</i>	<i>Maydis amyllum</i>
<i>Agar</i>	<i>Oryzae amyllum</i>
<i>Althaeae folium et radix</i>	<i>Solani amyllum</i>
<i>Farfarae folium</i>	<i>Tritici amyllum</i>
<i>Lichen islandicus</i>	<i>Graminis rhizoma</i>
<i>Lini semen</i>	<i>Malvae sylvestris flos</i>
<i>Psyllii semen</i>	<i>Taraxaci radix et folium</i>
<i>Tiliae flos</i>	<i>Mel</i>
<i>Gummi arabicum</i>	<i>Plantaginis ovatae semen</i>
<i>Tragacantha</i>	
<i>Trigonellae foenugraeci semen</i>	

2. MICROSCOPICAL TESTS

Powdered drugs: *Amyllum maydis*
Amyllum oryzae
Amyllum solani
Amyllum tritici

Cross section: *Althaeae radix et folium*
Lini semen

Powdered preparation: *Althaeae radix et folium*
Lini semen

3. CHEMICAL TESTS

3.1 Investigation of starches

3.1.1 Identification of starches

3.1.2. Tests for impurities

3.2 Mucilage

3.3 Mel qualification

4. QUANTITVE DETERMINATION

4.1 Swelling value

4.2 Enzymatic degradation of starch

1. MACROSCOPICAL TESTS

Amylum maydis - Maize starch

Zea mays L. Poaceae (Gramineae)

Ph.Hg. VIII., Ph. Eur.

Amylum solani - Potato starch

Solanum tuberosum L. Solanaceae

Ph.Hg. VIII., Ph.Eur.

Amylum tritici - Wheat starch

Triticum aestivum L. Poaceae (Gramineae)

Ph.Hg. VIII, Ph. Eur.

Amylum oryzae -Rice starch

Oriza sativa L. Poaceae (Gramineae)

Ph.Eur.

Starches are white to pale creamish or greyish-white powders or irregular masses which crepitate when crushed: odourless and almost tasteless.

Althaeae radix - Marshmallow Root

Althaea officinalis L. Malvaceae

Ph.Hg. VIII., Ph. Eur.

The root pieces are cylindrical, not ramified. They are 10 to 30 cm long, 1 to 2 cm thick, white or yellowish white in colour, with brown spots where root branches have been cut off. Bast fibers can be pulled off in fine threads from the root surface. When broken, the cortex is hardly dusting. The cortex breaks in filamentary. The cross section is white, except for the circular cambium, which is brownish yellow.

Althaeae folium - Marshmallow Leaf

Althaea officinalis L. Malvaceae

Ph.Hg. VIII. Ph.Eur.

The leaf has a short petiole, on both surfaces densely covered with velvety hairs, greyish green, silky. The lamina is ovate or cordate, with acuminate apex, obtuse base and irregularly crenated-dentate margin. The leaf is plicate between the veins, its pinnate venation strongly protrudes on the abaxial surface.

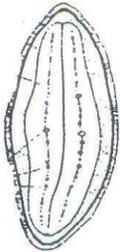


Lini semen - Linseed

Linum usitatissimum
L. Linaceae

Ph.Hg. VIII., Ph. Eur.

The linseed is 4 to 6 mm long, 2 to 3 mm wide, 1 to 1.5 mm thick, flat, ovate, light or dark brown, smooth, shin. Rounded on one end and acute on other. The hand magnifier shows a slightly uneven surface.



The seed-coat is rigid, fragile, when macerated in water, it becomes slippery due to swelling of the mucilaginous epidermal cells, White albumen, greenish white embryo, both oleaginous.

Odourless, taste, mild oily, mucilaginous

Malvae folium - Wild Mallow Leaf

Malva neglecta Wallr.
Malva silvestris L. Malvaceae

Ph.Hg. VIII.



Leaves are circular to kidney-shaped, toothed and shallowly 5-9 lobed.

Malvae sylvestris flos - Wild Mallow Flower

Malva sylvestris L. Malvaceae

Ph.Hg. VIII. Ph.Eur.

The drug consist of the pinkish violet flower. Radially zygomorphous hermaphrodite, pentamerous flower sitting in groups of 2 to 6 in the axil of the leaves. Double calyx. Nomerous stamina, columnar prominent filaments grown together to a 10 to 12 mm long, cylindrical reddish tube (monadelphous). Free, reniform uniseptate anthers. White pollen. The base of petals and the tube of filaments are grown together and fan off together after deflorescence. Flat disciform pistil, dinted above, with 9 to 10 lateral sulci according to the carpels. Filose styles, grown together at the base; stigmata reddish, filose.

Odourless taste, mucilaginous.

Graminis rhizoma - Couch-grass (Quack grass Roots)

Agropyron repens L. Poaceae (Gramineae)

Ph.Hg.VIII. Ph.Eur.

The drug consists of the numerous branched, wide-creeping, sweet-tasting rhizomes of the perennial grass.

Taraxaci radix - Dandelion Root

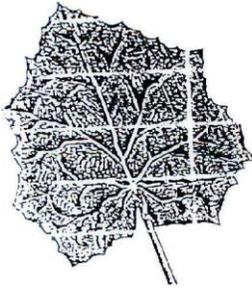
Taraxacum officinale Web. Asteraceae (Compositae)

Root and rhizome are 15 to 20 cm long and 1 to 2 cm thick. Reddish brown outside, greyish white inside. On the cross-section of the root softened in water numerous wide concentricai belts in the cortex are visible to the naked eye. Xylem is yellowish and hardly radial structure. The transversally annular rhizome has several heads. It continues in the main root, which is lengthwise wrinkled, striated and slightly ramified only. Even, not farinaceous fracture.

Farfarae folium - Coltsfoot Leaves

Tussilago farfara L.

Asteraceae (Compositae)



The drug consist of basal leaves, which are 8 -30 cm wide, almost circular in out line but polygonal, with up to 12 acute lobes. Whitish-tomerntose on boot, late only on the lower surface

Lichen islandicus - Iceland Moss

Cetraria islandica L. (Ach)

Parmeliaceae

The thallus is strap-like, deeply divided, shrubby and forms entagled mats, 1-15 cm high, only loosely attached to the substratum. The lobes are thin, either curled inwards almost into tubes of fiat, shilling chestnut-brown on the upper surf ace and lighter on the lower; the margins incised and ciliate.

Salep tuber - Orchid tuber

Orchis morio L.

Orchidaceae

The drug consist ofthe subglobular to ovoid tubers of the perennial herb.

Agar - Agar

Gelidium species

Ahnfeltia plicata (Huds.) Fries

Rhodophyta

Ph.Hg.VIII., Ph. Eur.

Greyish white or brownish yellow, translucent strips or bands, usually 0.1 to 0.3 mm thick, 3 to 4 cm broad. Odourless and tasteless mass of bands, which swells in water to form a jelly.

Acaciae gummi - Arabic gum

Acacia senegal Willd.

Mimosaceae

Ph.Hg.VIII., Ph. Eur.

The drug consists of the exsudation of the stem and branches of *Acacia senegal* indigenaus mainly in Cordovan, Sudan and in other parts of tropic Africa. Odourless; tasteless. Rarely colourless, mostly yellowish, the spherical pieces of acacia are pea- or hazelnut-sized. Being cracked, they are rarely transparent. Fracture conchoidal, when fresh, a glassy, sometimes iridescent surface can be seen. The power is white or yellowish white.

Tragacantha - Tragacanth gum

Astragalus species

Fabaceae

Ph.Hg.VIII., Ph. Eur.

Flat, greyish white horn-like, sometimes translucent and slightly yellowish plates, incurved in crest or crescent shape, about 5 mm wide and 1 to 3 mm thick. Semicircular, sinuous layers on their surface.

2. MICROSCOPICAL TESTS

Starches

Maize starch - **Amylum maydis**

Simple granules, approximately 5 to 30 μm in diameter, polyhedral to subspherical with a central hilum occurring as an irregular split or, more usually, as a cleft with three to five rays. Striations are not visible.

Potato starch - **Amylum solani**

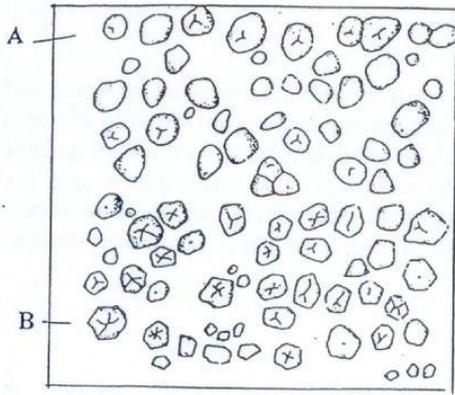
The granules are mostly simple with occasional compound granules having two or three components; they show great variation in size, the larger granules measuring up to approximately 100 μm in length. Individual granules are ovoid to subspherical and frequently show tuberosities; they have an eccentric point hilum which is situated near the narrower end in ovoid granules. Most of the granules show well-marked concentric striations.

Wheat starch - **Amylum tritici**

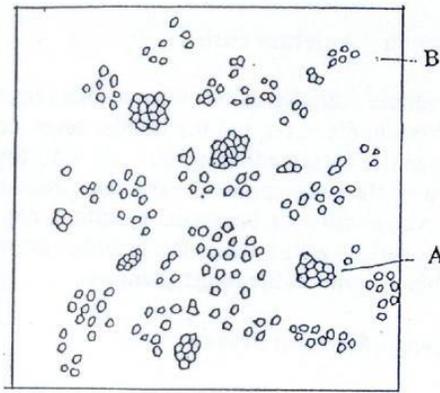
Mainly simple granules of two distinct size ranges; the larger granules measure approximately 25 to 45 μm in diameter and the smaller ones measure approximately 3 to 15 μm in diameter; a few granules intermediate in size are also found. A small number of compound granules with two or three components are also present. Individual granules are lenticular and they appear oval, circular or biconvex in outline, depending on their orientation. The central point hilum appears as a line when the granules are seen in edge view. Faint concentric striations are visible in some of the larger granules.

Rice starch - *Amylum oryzae*

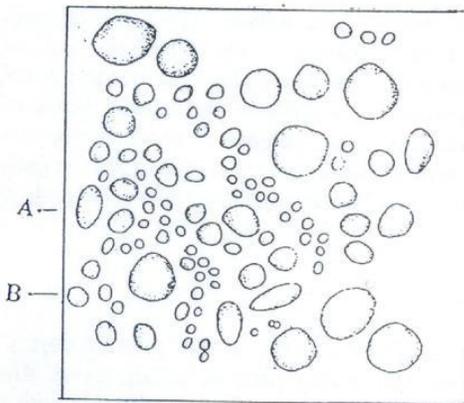
Simple granules or aggregations from compound granules; individual granules are approximately 2 to 10 μm in diameter, polyhedral or subspherical. A small central point hilum is visible in a few of the granules; there are no striations.



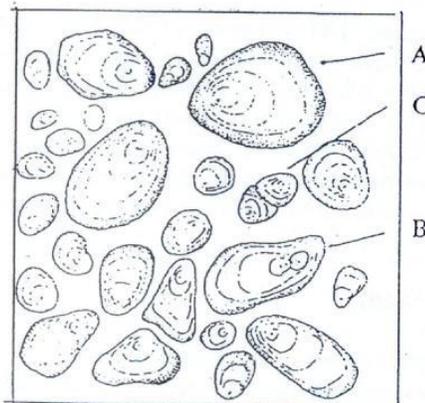
1. *Amylum maydis*



2. *Amylum oryzae*



3. *Amylum tritici*



4. *Amylum solani*

In polarised light starch grains appear bright on a black ground.



Althaeae folium

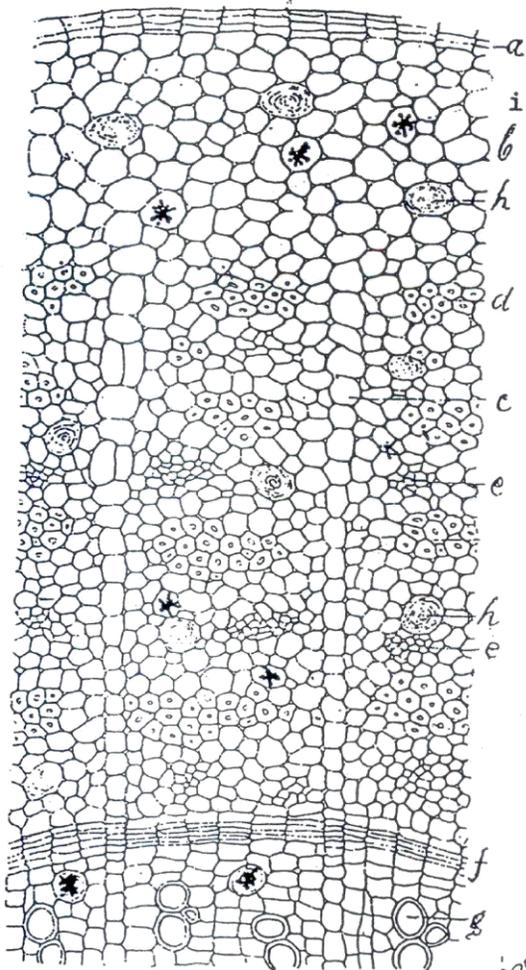
Cross-section. The structure of the leaf is dorsiventral. The basal part of every trichome branch has a sclereid-like thickened wall. The sticky glandular trichomes are composed of a short basal (stem) part and of a multicellular verticillate gland bead. Some of the epidermal cells are larger and contain mucilage. The columned parenchyma has sometimes two layers. There are larger mucilage cells as well as cells with club-shaped calcium oxalate rosette crystals. The vascular bundle is collateral.

Althaeae radix

Cross-section. External and internal can be differentiated. The dilatation zone with mucilage cells and club-shaped Ca-oxalate crystals is in the external cortex, whereas medullary rays of 1 to 2 cell width and hard and soft phloem parts alternating layers can be observed in the internal cortex. The soft phloem consists mainly of bast parenchyma, with sporadic cells containing mucilage or club-shaped calcium oxalate crystals and with somewhat compressed bundles of bast sieve tubes.

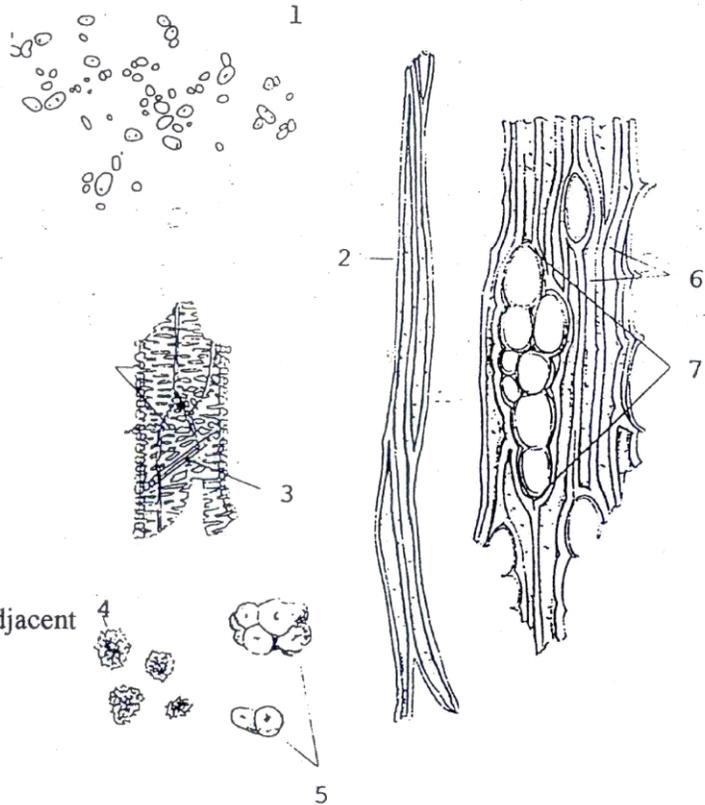
The xylem rays are mostly filled up with parenchymatous cells and sometimes with xylem fibres. The tracheae and tracheids are arranged in small groups, with a major vascular group to be found only in the root. Both in the cortex and in the xylem, club-shaped calcium oxalate crystals and lots of starch are to be found. There are many mucilage cells also in the cortical and xylem parenchyma.

Powder test. The drug powder is white. Under the microscope, parenchyma portions filled with starch and grains can be observed. The powder contains colourless, large-caverned fibres, singly or in bundles, as well as vessel fragments, club-shaped calcium oxalate crystals, colourless mucilage cells and small mucilage lumps. No suberine parts can be seen.



Althaea radix (cross section)

- a = periderm
- b = dilatation zone
- c = medullary rays
- d = bast fibres
- e = soft phloem
- f = cambium
- g = tracheae and tracheas in small groups
- h = mucilage containing cells
- i = cluster shaped calcium oxalate crystals



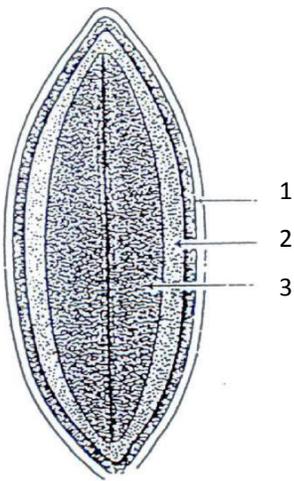
Althaea radix pulvis

1. starch granules
2. part of a group of fibres
3. scalariformly thickened vessels with adjacent xylem parenchyma
4. cluster crystals of $\text{Ca}(\text{COO})_2$
5. mucilage
6. xylem
7. medullary rays

Lini semen

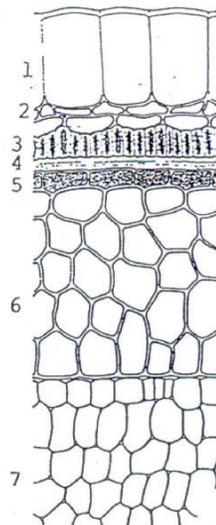
Cross-section Five layers of the seed coat can be observed. Cells of the epidermis radially elongated, the tangential walls of its cells are very thick, stratified and mucilaginous. The hypoderma consists of a so called annular layer of 2 to 3 rows of flat cells, with small intercellularies between them. Further inside, a layer of sclereids, with thick, lignified, simply pitted walls can be seen. Under the sclereids, there are several layers of tangentially elongated, flattened transversal cells. The innermost pigment layer of the seedcoat consists of a single row of square, reddish brown cells of pitted walls.

Under the pigment layer 3 to 7 cell rows endosperm are located containing granules and fixed oil drops. The embryo contains fixed oil and heterogeneous aleuron.



Linseed - longitudinal section

1. seed coats
2. endosperm
3. cotyledon



Linseed transverse section

1. mucilaginous epidermis
2. collenchyma
3. sclerenchyma
4. hyaline layers
5. pigment layer
6. endosperm
7. cotyledon

3. CHEMICAL INVESTIGATIONS

3.1 Investigations of starch

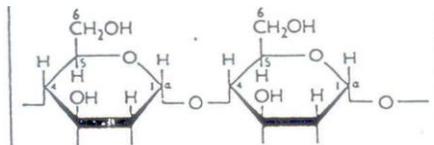
3.1.1. Identification of starches

Boil 1 g of starch with 50 ml of water: after cooling it becomes a translucent, odourless starch jelly.

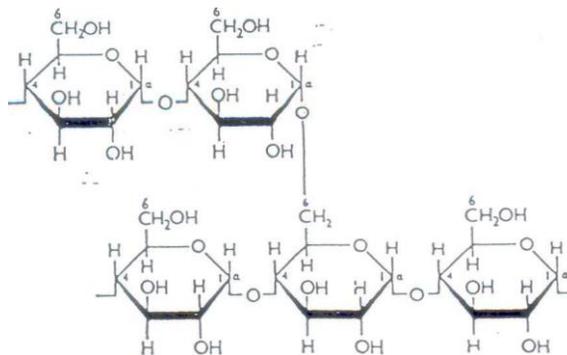
Shake 10 mg of drug with 5 ml of hot water. Add 1 drop of 0.01 N iodine solution to the liquid, it will turn blue.

The colour disappears from heating or if R-sodium hydroxide is added, but reappears at cooling, or if acidified by R-hydrochloric acid.

V



Amylose



Amylopectin

3.1.2 Test for impurities

Shake 1 g starch in 10 ml of cold water and filter. Add to the filtrate one drop of 0.1 N iodine solution. The filtrate may turn yellow or reddish, but must not turn blue.

3.2 Mucilage

Althaeae radix Tiliae flos

Make suspension from 2.5 g of crude drug with 50 ml water, left to extract for 20 minutes, let the drug subside and filter the supernatant on mull. Take out 10 ml from the filtrate and add 40 ml of ethyl alcohol to the mucilage solution during mixing it.

3.3 Adulteration of honey by artificial invert sugar

It can be examined by detecting hidroxy-methyl furfural, which gives a red colour with resorcinol in hydrochloric acid. It has to be noted that certain amount of hidroxy-methyl furfural may be formed in genuine honey by prolonged heating or lengthy storage

Mix carefully 5 g of honey with 10 ml of chloroform in a porcelan mortar. Filter the mixture and evaporate the chloroformic phase in a separate porcelan disk. To the residue add a few drops of freshly prepared resorcin solution (1 % resorcin in cc. HCl) The colour is pinkish or light orange for a short time, but alastingt red colour is a mark of hidroxy-methyl furfural.

4. QUANTITY DETERMINATIONS

4.1 Determination of Swelling Value - Ph.Eur: 2.8.4. SWELLING INDEX

The swelling index is the volume in millilitres occupied by 1 gram of a drug, including any adhering mucilage, after it has swollen in an aqueous liquid for 4 h.

Moisten the prescribed quantity of air-dry drug with 1 ml of ethanol in a 25 ml volumetric cylinder. Shake up the fluid thoroughly with 25 ml of water. Stir the mixture every 10 minutes for an hour and then maintain for 2 hours at room temperature. Read off the volume of the drug in ml together with any adhering mucilage.

Drug (g)	g	Swelling value
Agar-agar	1.0	
Althaeae folium	0.2	
Althaeae radix	0.5	
Farfarae folium	1.0	
<u>Lini placentae farina</u>	1.0	
Lini semen	1.0	
Psvllii semen	1.0	
Lichen islandicus	1.0	
Malvae sylvestris flos	1.0	
Psylli semen farina	1.0	
Gummi arabicum	1.0	

4.2 Acidity of starches

Shake a 20 g sample with 100 ml of freshly boiled and cooled water. Titrate the mixture with 0.1 N sodium hydroxide solution, using I-phenolphthalein solution as indicator. Near to the end point, add a few more drops of the indicator.