

Arnica montana

Arnica

Dried underground parts of *Arnica montana* L., containing minimum 15 ml of essential oil per kilogram of the herbal drug

Description

The red-brown or light to black-brown rhizomes are 3 to 10 mm in thickness, curved to twisted into an S-shape, sometimes with multiple heads, with fine nodulation and indistinct annulation; they bear numerous brittle, light to dark brown roots about 1 mm thick. The rhizome has a narrow, yellowish to light brown cortex and a central cylinder occupying about three quarters of the diameter that comprises a hard, yellowish white to brownish, stellate woody part and a soft, yellowish white to brownish medulla. The roots have a broad, light-coloured cortex and a yellowish to yellowish white central cylinder that occupies no more than a quarter of the diameter.

Cut herbal drug: The cut herbal drug is characterized by numerous light to dark brown, varyingly twisted pieces of root about up to 1 mm thick and by red-brown or light to black-brown pieces of rhizome that are 3 to 10 mm thick, with indistinct annulation and finely nodular leaf and stem scars; the pieces of rhizome have a yellowish to light brown cortex and a yellowish white to brownish medulla interspersed by the varyingly distinct xylem parts of the vascular bundles. Visible in the cortex, in the immediate vicinity of the cambium, are wide excretory ducts.

Microscopic characteristics: The outer integument of the rhizome consists of a few layers of small brown cork cells, beneath which are one or two layer/s of tall, colourless phello-derm. The adjoining primary bark consists of many layers of rounded polygonal, axially elongated parenchyma cells, which are distinctly pitted and have coarse walls particularly in the outer layers. The middle part of the cortex contains numerous intercellular spaces and, mainly in the vicinity of the endodermis, a relatively large number of excretory ducts 40 to 300 µm in diameter, which are arranged in irregular rings and lined with a clearly defined epithelium. The endodermis consists of a single cell layer and in transverse section is interrupted only by numerous roots of endogenous origin that branch off to the outside; its cells show a marked Casparian strip. The endodermis surrounds a central cylinder that contains a relatively large number of vascular bundles of widely varying size arranged in a circle and separated by varyingly broad medullary rays. The xylem consist of numerous vessels, 5 to 30 (occasionally up to 40) µm wide that are mostly arranged around groups of adjoining lignified thick-walled fibres. Some of the vessels consist of greatly elongated elements with narrow lumens and helical wall thickening; the vast majority are reticular vessels with short elements that are quite distinct from one another. The medulla, which

occupies more than a third of the diameter of the rhizome, consists of rounded, only slightly thickened parenchyma cells that do not show axial elongation and are interspersed by numerous intercellular spaces. The parenchyma cells and intercellular spaces of the cortex and central cylinder frequently contain dark granular masses (phytomelan).

The outermost tissue of the root consists of a layer of small brown cells with a substantially thickened periclinal wall that shows slight papillose convexity, beneath which is a brownish hypodermis made up of a single layer of large cells. The primary cortex consists of axially extended cells that are a rounded polygonal shape in transverse section, the outer layers of which are almost free from intercellular spaces and show a slight degree of collenchymatous thickening. The coarse-walled inner parenchyma cells have a criss-cross wall texture that is occasionally discernible in longitudinal section and narrow diagonal pitting; they are arranged around intercellular spaces of varying size and a relatively large number of small excretory ducts lying close to the endodermis, the epithelium of which differs only slightly from the parenchyma cells. The radial tetrarch to hexarch vascular bundle is still in the primary stage. The vessels are 5 to 35 (occasionally up to 40) μm wide and show helical or reticular thickening. They are occasionally accompanied by axially elongated cells with thin walls that in longitudinal section appear finely wavy. The ground tissue consists of axially elongated rectangular cells that appear polygonal in cross section and have thickened, pitted, lignified walls.

The parenchyma cells of the root and rhizome contain inulin, but no starch nor oxalate crystals.

Identification

Thin-layer chromatography (2.2.27)

Test solution: To 2 g of the powdered herbal drug (710) add 10 ml of ethanol (90 per cent V/V) *R*. Heat the mixture on a water bath and filter.

Reference solution: Dissolve 10 mg of anethole *R* and 10 mg of thymol *R* in 10 ml of methanol *R*.

Plate: TLC silica gel plate *R*

Mobile phase: methanol *R*, ether *R*, cyclohexane *R*, (10:20:70 V/V/V)

Application: 20 μl of the test solution and 10 μl of the reference solution; as bands of 20 mm

Development: over a path of 15 cm

Detection: Allow the mobile phase to evaporate, then treat the plate with anisaldehyde solution *R*, heat at 100 to 105 $^{\circ}\text{C}$ for 8 to 10 min and examine the chromatograms in daylight within 20 min.

Results: The chromatogram obtained with the reference solution shows the orange thymol zone in the middle third and the violet anethole zone in the upper third.

The chromatogram obtained with the test solution shows two violet zones roughly midway between the baseline and the thymol reference substance. One or two violet zone/s may be present just below the thymol reference substance. A violet zone is present above the thymol reference substance, a red-violet zone between the two reference substances, a red-violet zone at about the height of the anethole reference substance and above it two blue-violet zones are present.

Tests

Foreign matter (2.8.2): maximum 2 per cent

Ash (2.4.16): maximum 15 per cent, determined on 1.00 g of the powdered herbal drug (180)

Hydrochloric acid-insoluble ash (2.8.1): maximum 8 per cent

Assay

Essential oil (2.8.12): Perform the determination using 20.0 g of the freshly powdered herbal drug (710) and 250 ml of water *R* in a 500 ml round-bottomed flask and 0.5 ml of xylene *R* in the graduated tube. Distil for 4 h at a distillation rate of 2 to 3 ml/min.

Dosage forms

Production

Prepare the mother tincture from the freshly powdered herbal drug (710) and liquid dilutions according to Method 4a, using ethanol (86 per cent *m/m*).

Characteristics

The mother tincture is a yellow liquid with a sharp, characteristic odour.

Identification

- A. The relative density of the mother tincture is within the range given below under "Tests".
- B. The mother tincture gives identification reaction of the herbal drug. Solution S is the mother tincture.

Tests

Relative density (2.2.5): 0.833 to 0.845

Dry residue (H 2.2.6): minimum 0.8 per cent

Storage

Store protected from light.