มังคุด, เปลือกผล (MANGKHUT, PLUEAK PHON)

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Garciniae Mangostanae Pericarpium
Mangosteen Rind

Category Antidiarrheal, wound healing, anti-inflammatory.

Mangosteen Rind is the dried pericarp, without persistent calyx, of *Garcinia mangostana* L. (*Mangostana garcinia* Gaertn.) (Family Guttiferae), Herbarium Specimen Number: DMSC 5359, Crude Drug Number: DMSc 1242.

Constituents Mangosteen Rind contains xanthones (e.g., garcinone B, α-, β-, and γ-mangostins). It also contains tannins, procyanidin, pectin, etc.

Description of the plant (Fig. 1) Tree up to 25 m tall, with orangish yellow latex. Leaves simple, opposite, ovate to oblong-ovate, 6.5 to 25 cm long, 3.5 to 13 cm wide, apex acute or acuminate, base obtuse or cuneate, margin entire, blade coriaceous, glabrous, upper surface dark green, shiny, lower surface yellowish green, midrib prominent on both sides, lateral veins 15 to 20 pairs, parallel, curving toward margin, then united into 2 intramarginal veins; petiole 1 to 2 cm long, stout, with basal appendage; stipule absent. Inflorescence cyme, 1- to 5(–7)-flowered, terminal; bracteole caducous. Flower bisexual or unisexual. Male flower absent or usually caducous. Female and/or perfect flowers 3.2 to 5 cm in diameter; pedicel green, stout, terete or slightly 4-angled, 1 to 2.5 cm long, glabrous; sepals 4(–5), concave, free, pale green outside, bright red or yellowish red inside, coriaceous, suborbicular, orbicular or broadly elliptic, 1 to 2.5 cm long, 1 to 2.2 cm wide, apex rounded, persistent; petals 4(–5), yellowish pink, fleshy, suborbicular, broadly elliptic, broadly obovate, or broadly ovate, 1 to 2.5 cm long, 1.2 to 2.8 cm wide, unequal, apex rounded, margin entire and undulate; staminodes 10 to 18, free, filament filiform, about 5 mm long, anther small, pale yellow or brownish yellow, caducous; ovary superior, subglobose, pale green, glabrous, stigma pale yellow, 4- to 8-lobed. Fruit a berry, globose or subglobose, 3.5 to 8 cm in diameter, smooth, reddish purple to blackish purple when ripe; pericarp 0.4 to 1.2 cm thick, fleshy, becoming woody when dry; persistent stigma dark brown or blackish brown, deeply 4- to 8-lobed, lobes wedge-shaped; persistent calyx coriaceous, 1.2 to 2.5 cm long, 1.2 to 2.8 cm wide, green, sometimes tinged with reddish purple. Seeds (1–)4 to 8, large, mostly not fully developed, flattened, embedded in fleshy, whitish pulp.

Description Odour, mild; taste, astringent.

Macroscopical (Fig. 1) Dried rind, varied in shape, size, and length, hard, some with persistent calyx and stigma; externally purplish brown to brown, smooth; internally brown, slightly shiny, with small ridges at the centre and lighter coloured lines radiating from the ridges.

Microscopical (Figs. 2a, 2b) Transverse section of the pericarp shows exocarp and mesocarp. Exocarp: epidermis, a layer of rectangular cells, some containing reddish purple or brown substances, covered with thick cuticle layer. Mesocarp: parenchyma, several layers of oval to round cells, varied in shape and size, some containing rosette aggregate crystals or brown substances; secretory ducts, scattered, some containing brown or yellow substances; sclereids, several layers of cells in various sizes and shapes; vascular bundles, scattered. Endocarp, irregular-shaped parenchyma, cannot be differentiated from mesocarp.

Mangosteen Rind in powder possesses the diagnostic microscopical of the unground drug. Secretory ducts with yellow or brown substances, and various sizes and shapes of grey sclereids can be characteristic.

2

1 3

4

5

6

2 cm

Fig. 1 *Garcinia mangostana* L.
1. habit 2. flowers 3. branches with flowers 4. young and mature fruits
5. ripe fruits 6. crude drug

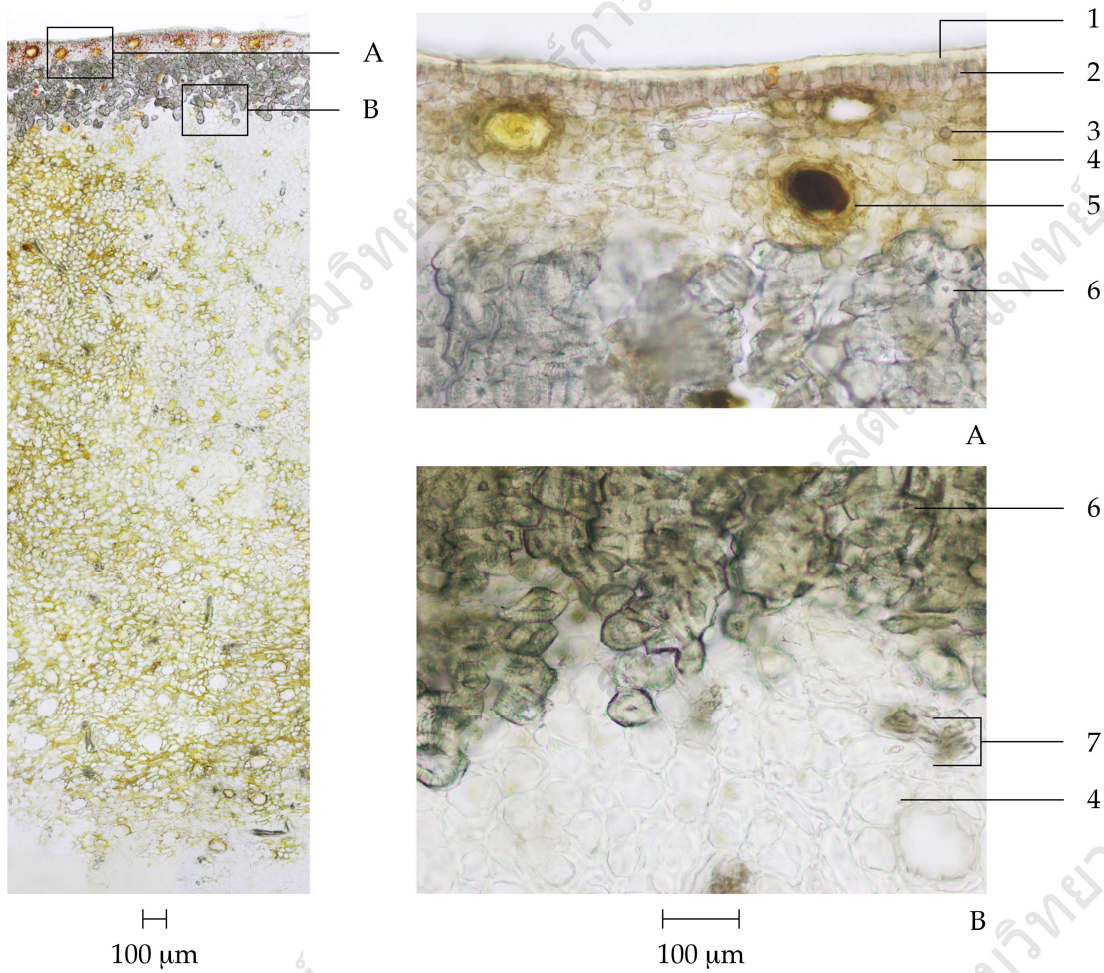

Fig. 2a Photomicrographs of Transverse Section of the Pericarp of *Garcinia mangostana* L.
A. Exocarp and Mesocarp
B. Mesocarp
1. cuticle layer
2. epidermis
3. rosette aggregate crystal
4. parenchyma
5. secretory duct
6. sclereid
7. vascular tissue

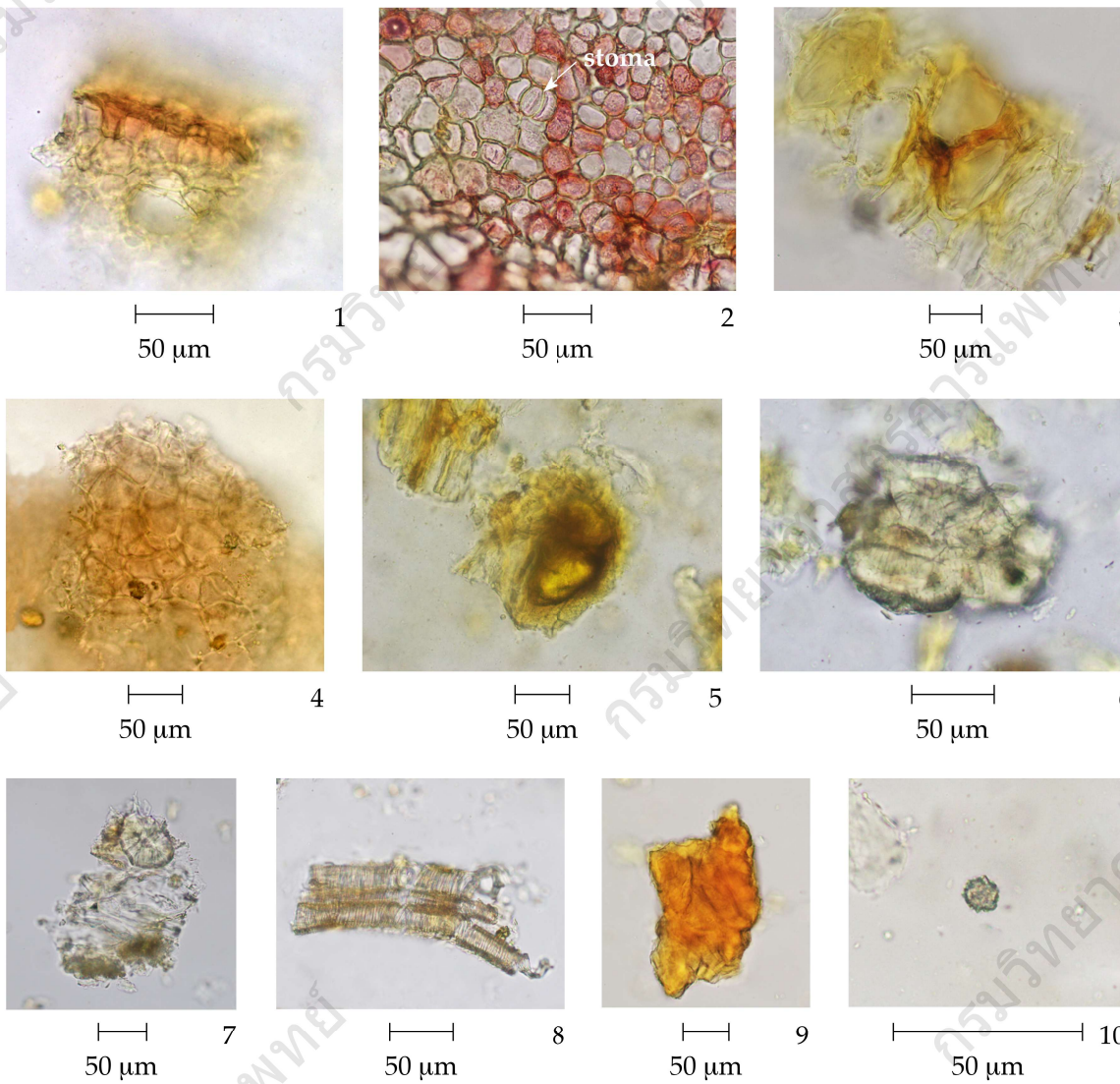

Fig. 2b Photomicrographs of Powdered Drug of the Pericarps of *Garcinia mangostana* L.

1. epidermis, parenchyma, and secretory duct, in sectional view
2. epidermis and stoma in surface view
3. parenchyma with brown substances
4. parenchyma and rosette aggregate crystals
5. parenchyma and secretory duct, containing brown substances
6. sclereids
7. sclereids and parenchyma
8. reticulate vessels
9. brown substance
10. rosette aggregate crystal

Packaging and storage Mangosteen Rind shall be kept in well-closed containers, protected from light, and stored in a dry place.

Identification

A. Reflux 1 g of the sample, in powder, with 20 mL of *ethanol* on a water-bath for 15 minutes and filter (solution 1). To 2 mL of solution 1, add 1 mL of *iron(III) chloride TS* and mix well: a bluish black colour develops.

B. To 2 mL of solution 1, mix with a few drops of *gelatin TS*: a white precipitate forms.

C. To 2 mL of solution 1, add 1 to 2 pieces of *magnesium ribbon*, shake well, and mix with a few drops of *hydrochloric acid*: a pinkish red colour develops.

D. The chromatogram of the Sample preparation shows several peaks, one of which corresponds to the *α*-mangostin peak of the standard preparations, as obtained in the *α-Mangostin content* (Fig. 3).

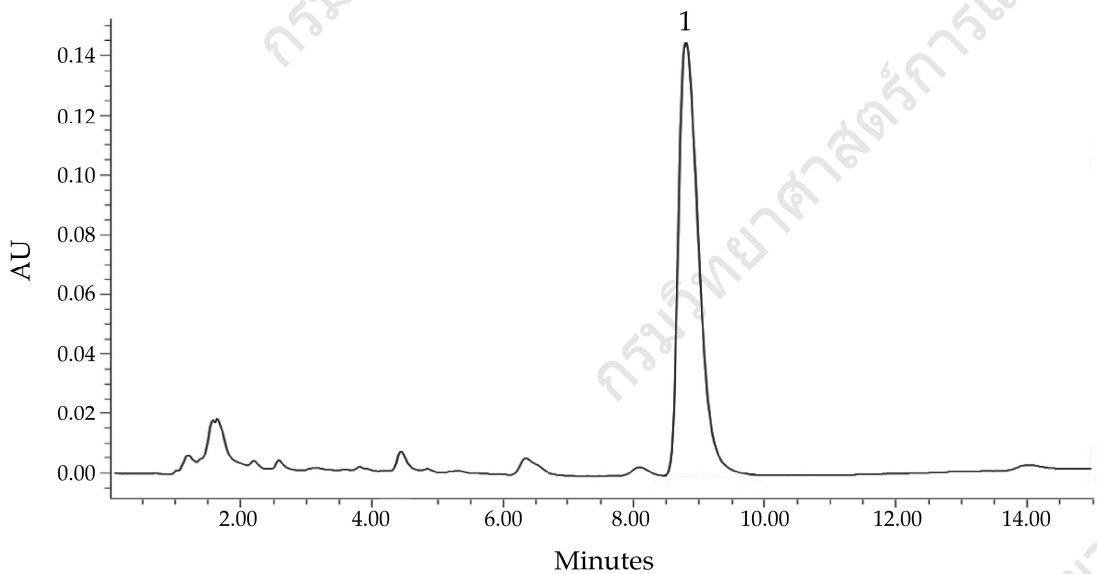

Fig. 3 HPLC Chromatogram of Mangosteen Rind Showing *α*-Mangostin (1)

E. Carry out the test as described in the "Thin-Layer Chromatography" (Appendix 3.1), using *silica gel GF254* as the coating substance and a mixture of 88 volumes of *chloroform*, 10 volumes of *ethyl acetate*, and 2 volumes of *methanol* as the mobile phase and allowing the solvent front to ascend 10 cm above the line of application. Apply separately to the plate, 5 µL each of solutions (A) and (B). Prepare solution (A) by refluxing 1 g of the sample, in *fine powder*, with 20 mL of *ethanol* for 15 minutes and filtering. Evaporate the filtrate to dry under reduced pressure at 45°. Dissolve the residue in 2 mL of *ethanol*. For solution (B), dissolve 1 mg of *α-mangostin* in 2 mL of *ethanol*. After removal of the plate, allow it to dry in air and examine under ultraviolet light (254 nm), marking the quenching spots. The chromatogram obtained from solution (A) shows a quenching spot (hR_f value 60 to 64), corresponding to the *α*-mangostin spot obtained from solution (B). Other nine quenching spots are also observed. Subsequently examine the plate under ultraviolet light (366 nm). The spot due to *α*-mangostin is dark fluorescent. Other two dark and four blue fluorescent spots are also observed. Spray the plate with a 10 per cent v/v solution of *sulfuric acid* in *ethanol*, heat at 110° for about 10 minutes. The spot due to *α*-mangostin is yellow. One brown and two yellow spots are also observed (Fig. 4).

Loss on drying Not more than 10.0 per cent w/w after drying at 105° to constant weight (Appendix 4.15).

Foreign matter Not more than 2.0 per cent w/w (Appendix 7.2).

Total ash Not more than 3.0 per cent w/w (Appendix 7.7).

Ethanol-soluble extractive Not less than 18.0 per cent w/w (Appendix 7.12).

Water-soluble extractive Not less than 15.0 per cent w/w (Appendix 7.12).

***α*-Mangostin content** Not less than 4.0 per cent w/w of *α*-mangostin ($C_{24}H_{26}O_6$), calculated on the dried basis. Carry out the determination as described in the "Liquid Chromatography" (Appendix 3.5).

Standard preparations Dissolve a suitable quantity of *α*-Mangostin RS, accurately weighed, in sufficient *methanol* to obtain a stock solution having a known concentration of about 500 μg of *α*-mangostin per mL. Dilute the solution quantitatively and stepwise with *methanol* to obtain six solutions having known concentrations of about 10, 20, 30, 40, 50, and 60 μg per mL of *α*-mangostin.

Sample preparation Reflux about 100 mg of Mangosteen Rind, in *fine powder* and accurately weighed, with 25 mL of *methanol* for an hour and filter. Wash the marc with sufficient *methanol*. Combine the washings and the filtrate, transfer quantitatively to a 100-mL volumetric flask, and adjust to volume with *methanol*.

Mobile phase Prepare a mixture of 70 volumes of *water* and 30 volumes of *methanol*. Make adjustments if necessary.

Chromatographic system The chromatographic procedure may be carried out using (a) a stainless steel column (15 cm × 4.6 mm) packed with octadecylsilane chemically bonded to porous silica or ceramic microparticles (4.6 μm), equipped with a similarly packed guard column (b) *Mobile phase* at a flow rate of about 1.2 mL per minute, and (c) an ultraviolet photometer set at 243 nm.

To determine the suitability of the chromatographic system, chromatograph *Standard preparation*, and record the peak response as directed under *Procedure*: the relative standard deviation for replicate injections is not more than 2.0 per cent.

Procedure Separately inject about 20 μL each of *Standard preparations* into the chromatograph, record the chromatograms, and measure the responses for *α*-mangostin peaks. Plot the readings and draw the standard curve of best fit: the curve shows the correlation coefficient of not less than 0.999. Inject about 20 μL of *Sample preparation* into the chromatograph, record the chromatogram, and measure the responses for *α*-mangostin peaks.

Calculation By reference to the standard curve, calculate the content of *α*-mangostin ($C_{24}H_{26}O_6$) in the portion of the Mangosteen Rind taken.

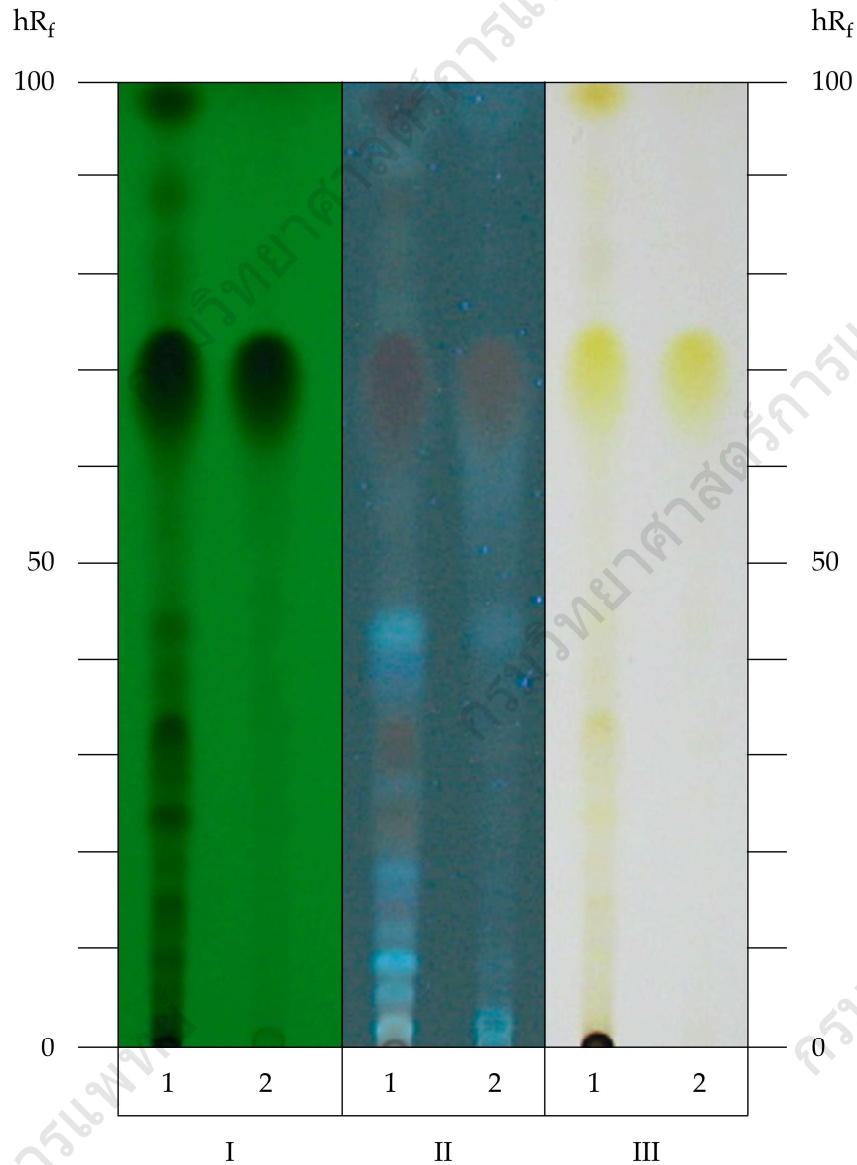

Fig. 4 Thin-Layer Chromatogram of Ethanolic Extract of the Pericarps of *Garcinia mangostana* L.

1 = solution (A)
2 = solution (B)
I = detection under UV light (254 nm)
II = detection under UV light (366 nm)
III = dectection with a 10 per cent v / v solution of *sulfuric acid* in *ethanol*