

มะนาว, ผิว (MANAO, PHIO)

บั๊กนาว, ผิว (BAK NAO, PHIO), ส้มนาว, ผิว (SOM NAO, PHIO)

Citri Aurantiifoliae Exocarpium et Mesocarpium

Lime Peel

Synonyms Common Lime Peel, Sour Lime Peel

Category Carminative, antifatulent.

Lime Peel is the dried exocarp with unremovable mesocarp of *Citrus × aurantiifolia* (Christm.) Swingle [*C. × javanica* Blume, *C. × medica* f. *aurantiifolium* (Christm.) M. Hiroe, *Limonia × aurantiifolia* Christm.] (Family Rutaceae), Herbarium Specimen Number: DMSC 5329, Crude Drug Number: DMSc 1261.

Constituents Lime Peel contains volatile oils consisting of limonene, β -pinene, and α -terpineol. It also contains limonoids and flavonoids, i.e., hesperidin. Other compounds are coumarins, phenolic acids, carotenoids, etc.

Description of the plant (Fig. 1) Shrub or small tree, 0.5 to 5(–8) m tall, much branched; stem glabrous; branchlets compressed-angular when young, spiny; spines numerous. Leaves unifoliate, alternate or spirally arranged, elliptic, elliptic-oblong, oblong-ovate, or ovate, 2 to 8(–11) cm long, 1 to 5.5 cm wide, apex acute, obtuse to cuneate, base cuneate or obtuse to rounded, margin entire to crenulate, subcoriaceous, shiny, with scattered pellucid dots; petiole broadly winged, triangular, obovate, or oblanceolate, 2 to 3 cm long, 2 to 9 mm wide. Inflorescence axillary or terminal, raceme, cyme, or solitary, 7(–15)-flowered in fascicled, fragrant; peduncle 3 to 5 mm long. Flower white to yellowish white; pedicel 2 to 5 mm long; calyx cupular, 2 to 3 mm long, 4- to 5-lobed, lobe broadly triangular or ovate, about 1 mm long, fleshy, glabrous or puberulent; petals 4 to 5, oblanceolate, oblong-lanceolate, oblong, or ovate, 0.7 to 1.5 cm long, 2.5 to 5 cm wide, apex acute, fleshy, reflexed at anthesis; stamens white, numerous, filament 2 to 6 mm long, polyadelphous, anther bright yellow, oblong, linear, to linear-sagittate, 2 to 3 mm long, intrastaminal disc about 1 mm high; ovary superior, style white, 2 to 3 mm long, glabrous, caducous, stigma capitate, bright yellow. Fruit a hesperidium, ellipsoid, obovoid to globose, 2.5 to 6 cm in diameter, sometimes with apical papilla; exocarp thin, glabrous, glossy, greenish when young, turning greenish yellow to yellowish when ripe; mesocarp white, spongy; segments 9 to 12; fruit-pulp pale greenish, juicy, sour, aromatic. Seeds whitish, few to numerous, elliptic-oblong to ovoid, about 5 mm long.

Description Odour, aromatic, characteristic; taste, slightly bitter.

Macroscopical (Fig. 1) Dried external peels with some unremovable mesocarp, varied in shape and size; outer surface, yellowish green to brownish green, slightly rough, hard, brittle; inner surface whitish to pale yellowish.

Microscopical (Figs. 2a–2c) Transverse section of the peel shows exocarp with some unremovable mesocarp. Exocarp: a layer of rectangular epidermal cells containing yellowish green substances and some containing prismatic crystals or oil droplets, and stomata, covered with thick cuticle layer. Mesocarp: parenchyma, several layers of slightly thick-walled cells, some containing yellowish green substances, oil droplets or prismatic crystals; schizolysigenous oil cavities; vascular tissue, phloem and xylem.

Lime Peel in powder possesses the diagnostic microscopical of the unground drug. Epidermal layer with stomata, oil droplets, and prismatic crystals can be seen in abundance. Part of oil cavity and thick-walled parenchyma of mesocarp can also be seen.

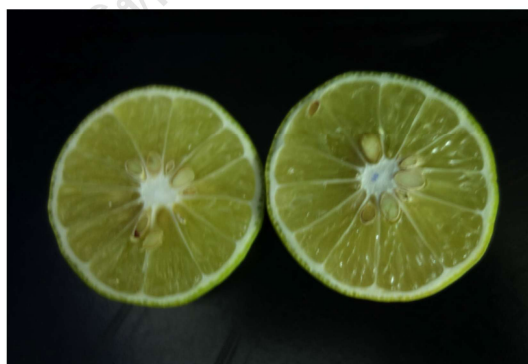
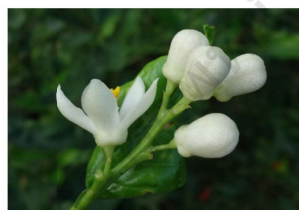


Fig. 1a *Citrus x aurantiifolia* (Christm.) Swingle

1. habit 2. inflorescence 3. flowers 4. leaves and fruits 5. fruits 6. halved fruit 7. crude drug

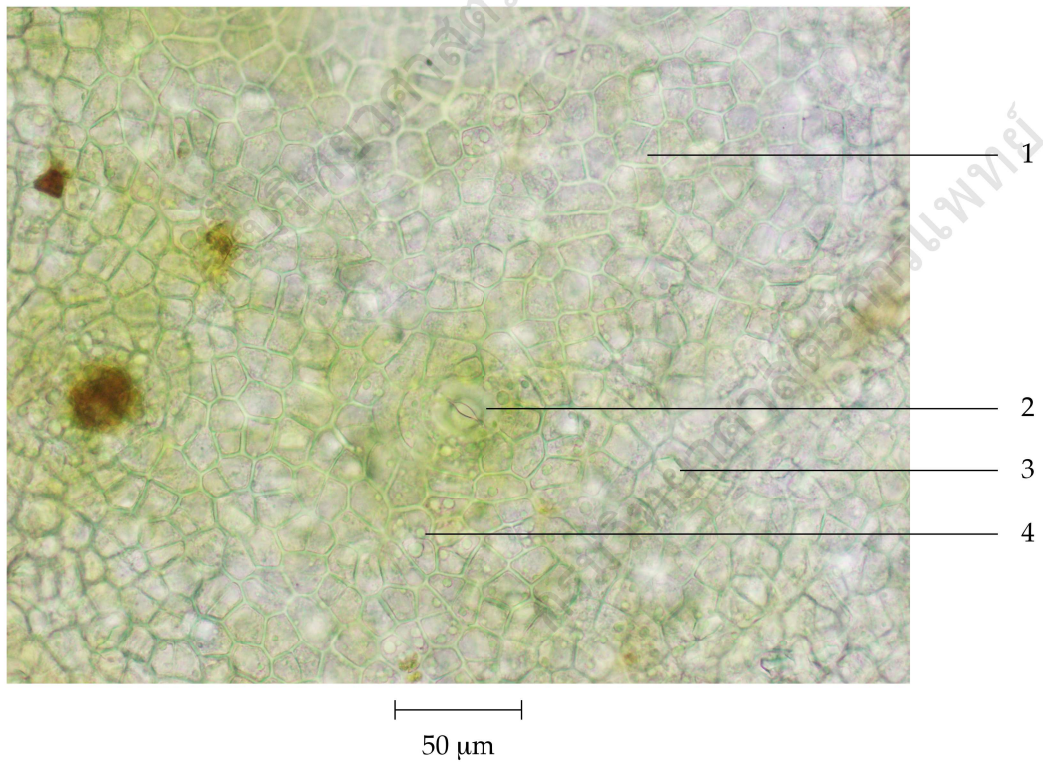


Fig. 2a Photomicrograph of Surface View of the Exocarp of *Citrus × aurantiifolia* (Christm.) Swingl

- 1. epidermal cell
- 2. paracytic stoma

- 3. prismatic crystal
- 4. oil droplet

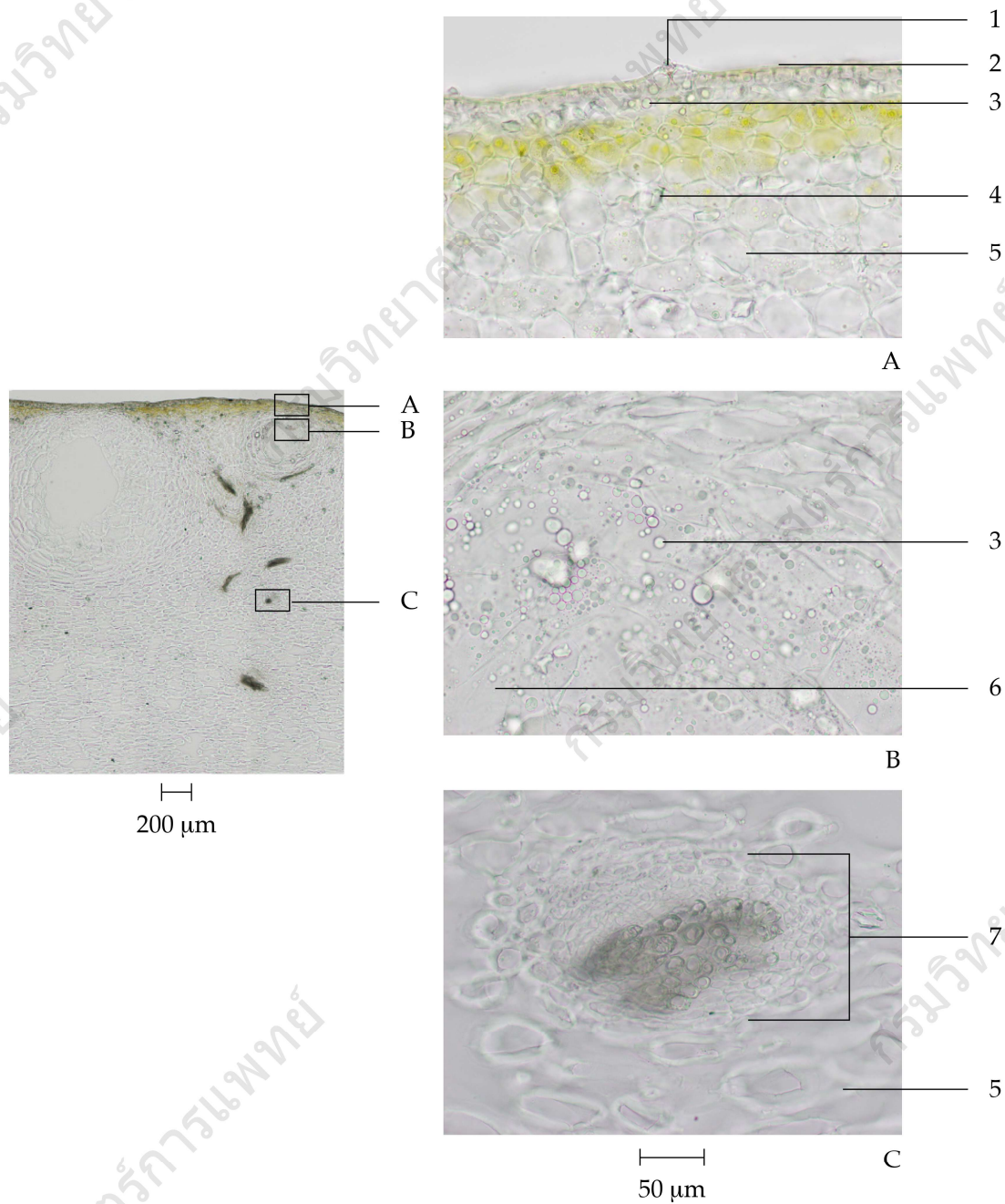


Fig. 2b Photomicrographs of Transverse Sections of the Exocarp and Mesocarp of *Citrus × aurantiifolia* (Christm.) Swingle

A. Exocarp and Mesocarp

B. and C. Mesocarp

1. stoma

2. epidermis with cuticle layer

3. oil droplet

4. prismatic crystal

5. parenchyma

6. schizolysigenous oil cavity

7. vascular tissue

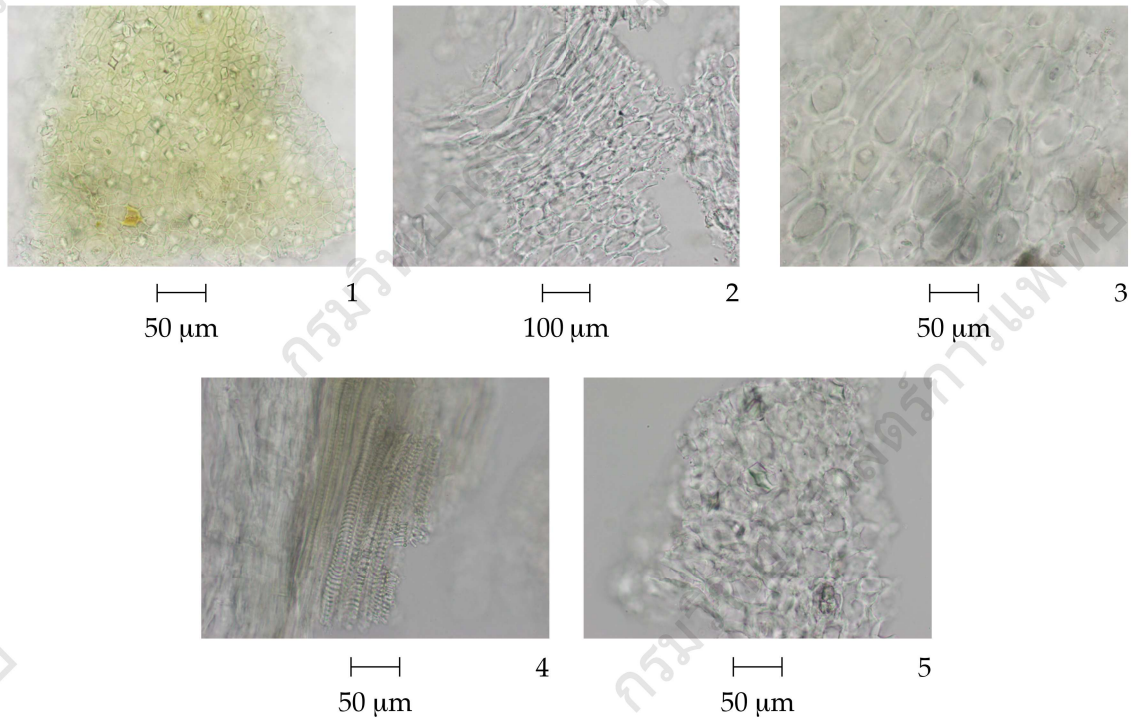


Fig. 2c Photomicrographs of Powdered Drug of the Exocarps and Mesocarps of *Citrus × aurantiifolia* (Christm.) Swingle

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|--|---|
| 1. epidermis, some containing prismatic crystals, and stomata, in surface view | 4. spiral, reticulate vessels, parenchyma, and fibres |
| 2. part of schizolysigenous oil cavity and mesocarp parenchyma | 5. parenchyma of mesocarp, some containing prismatic crystals |
| 3. parenchyma, some containing prismatic crystals | |

Packaging and storage Lime Peel shall be kept in well-closed containers, preferably of metal or glass, protected from light, and stored in a dry place.

Identification

A. To 500 mg of the sample, in powder, add 15 mL of *ethanol*, shake, allow to stand for 30 minutes, and filter (solution 1). To 2 mL of solution 1, add 2 or 3 pieces of *magnesium ribbon*, shake well, mix with a few drops of *hydrochloric acid*, and warm on a water-bath for 5 to 10 minutes: a red-pink colour develops.

B. To 2 mL of solution 1, add a few drops of a 10 per cent w/v solution of *phosphomolybdic acid*, mix well, and warm on a water-bath for 5 to 10 minutes: a blue-green colour develops.

C. Carry out the test as described in the “Thin-Layer Chromatography” (Appendix 3.1), using a high-performance plate with *silica gel GF254* as the coating substance and a mixture of 75 volumes of *ethyl acetate*, 15 volumes of *methanol*, and 10 volumes of *water* as the mobile phase and allowing the solvent front to ascend 8 cm above the line of application. Apply separately to the plate as bands of 8 mm, 20 µL of solution (A) and 10 µL of solution (B). Prepare solution (A) by adding 5 mL of *ethanol* to 500 mg of the sample, in *fine powder*, shaking, allowing to stand for 30 minutes, and filtering. For solution (B), dissolve 1 mg of *hesperidin* in 2 mL of *ethanol*. After removal of the plate, allow it to dry in air, spray the plate with a 1 per cent w/v solution of *aluminium chloride* in *ethanol*, and examine under ultraviolet light (366 nm). The chromatogram obtained from solution (A) shows a green fluorescent band (R_f value 54 to 57), corresponding to the hesperidin band obtained from solution (B). Six blue fluorescent bands are also observed (Fig. 3).

Water Not more than 7.0 per cent v/w (Azeotropic Distillation Method, Appendix 4.12).

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

Total ash Not more than 10.0 per cent w/w (Appendix 7.7).

Ethanol-soluble extractive Not less than 6.0 per cent w/w (Appendix 7.12).

Water-soluble extractive Not less than 19.0 per cent w/w (Appendix 7.12).

Volatile oil Not less than 2.0 per cent v/w, calculated on the anhydrous basis (Appendix 7.3H). Use 20 g, in *fine powder*, freshly prepared and accurately weighed. Use 250 mL of *water* as the distillation liquid and a 500-mL round-bottomed flask. Distil at a rate of 2 to 3 mL per minute for 5 hours. Use 2.0 mL of *xylene* in the graduated tube.

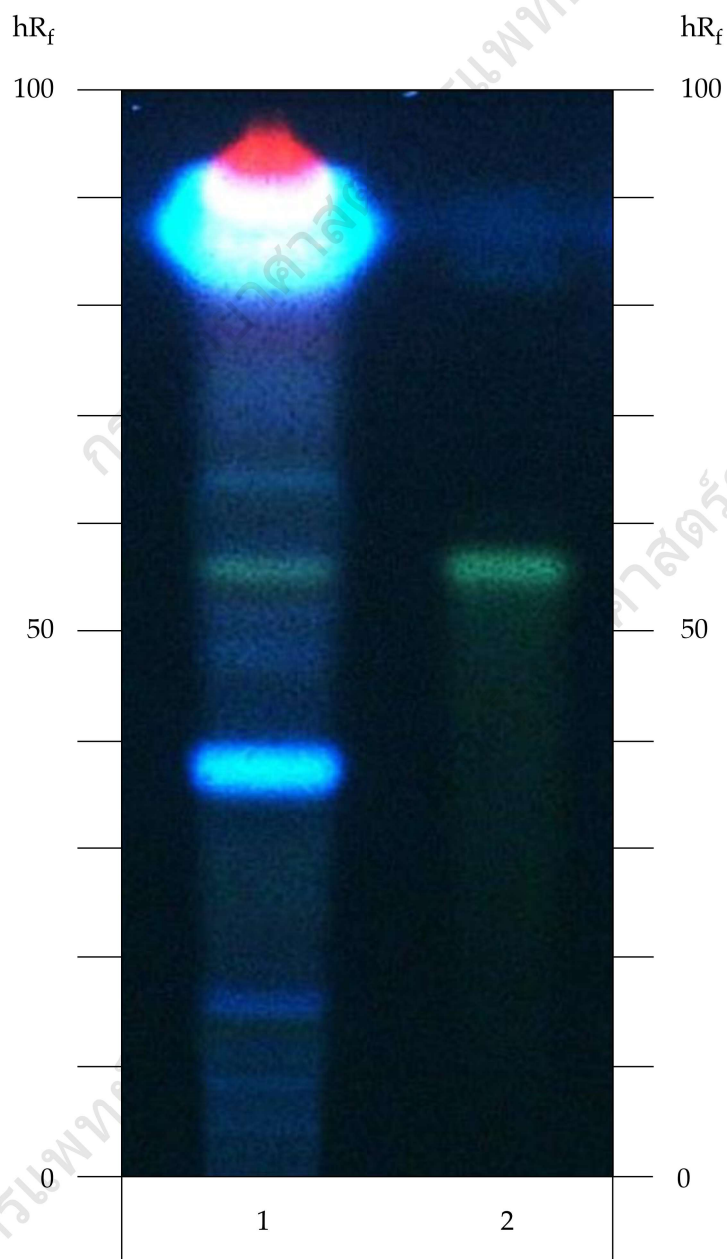


Fig. 3 Thin-Layer Chromatogram of Ethanolic Extract of the Exocarps and Mesocarps of *Citrus × aurantiifolia* (Christm.) Swingle, Detected Under UV light (366 nm) After Spraying With a 1 Per Cent W/V Solution of *Aluminium Chloride* in *Ethanol*
1 = solution (A)
2 = solution (B)