Gartanin Compounds from Extract Ethanol Pericarp Mangosteen (Garcinia mangostana Linn.)

R.A. Oetari1*, Hasriyani Hasriyani1, Adi Prayitno2, Sahidin Sahidin3

1Department of Pharmaceutical, Faculty Pharmacy, Universitas Setia Budi, Surakarta, 57127, Indonesia; 2Department of Medical Tooth, Faculty Medical, Universitas Sebelas Maret, Surakarta, 57126, Indonesia; 3Department of Pharmaceutical Sciences, Faculty Pharmacy, Universitas Halu Oleo, Kendari, 93232, Indonesia

Abstract

AIM: The study aimed to isolate and identification secondary metabolite from pericarp Garcinia mangostana Linn.

METHODS: The first step of this research was maceration of sample using alcohol 70% solvent. The separation and purification of compounds using Vacuum Liquid Chromatography (VLC), Radial Chromatography (RC). The purity of isolate was analyzed by thin layer chromatography (TLC) and melting point. Compounds identified using spectroscopi IR, NMR-1D (1H, 13C-NMR and DEPT) and 2-D NMR (HMOC and HMBC).

RESULTS: The compound has melting point at 165-167°C. The result showed isolate was gartanin.

CONCLUSION: The secondary metabolite found in pericarp Garcinia mangostana Linn. is gartanin.

Introduction

Garcinia mangostana Linn. (mangosteen), is a functional plant because most of its parts can be used as medicine. Not only the fruit flesh which is consumed and believed to be beneficial for health, but according to research of mangosteen peel there are also a number of chemicals that are very beneficial for health [1]. G. mangostana Linn., Especially its peel has aroused interest for researchers to conduct intensive studies on the content of the compounds it contains. Mangosteen fruit peel is known to contain xanthon compounds which have the potential to be drug candidates. Xanthon is known to have antioxidants, anti-inflammatory activities [2], [3], antifungals [4], chemopreventions [2], [5], treatment of abdominal pain, diarrhea, dysentery, infection, pus, and chronic ulcers [6], anticancer [7], [8], antitumor [9], antimalarials [10], antiacne [11], antituberculosis [2], neuroprotective [12], antiproliferation [13], antimicrobial [14], cytoprotective [15], [16], anti-inflammatory [3]. Besides that, it also acts as an antioxidant [12], [15], [17], [16], [14].

Gartanin is the xanthon compound with the second most content after α-mangostin found in mangosteen, where the two compounds have the most role in biological activity (0.00082%). Gartanin has anti-cancer activities [18], antiviral influenza [19], antioxidants [20] and has strong activity against early stage lung cancer cells (NCIH187) [21]. Based on the above discussion, the purpose of this study is to
isolate the content of pericarp mangosteen using vacuum liquid chromatography and radial chromatography.

Material and Methods

Specification of material

Plant material: one thousand g dry powder pericarp G. mangostana Linn. was collected at Somongari Village, Kaligesing District, Purworejo Regency, Central Java. Alcohol 70%, methanol (technical), acetone (technical), ethyl acetate (technical), n-hexane (technical), dichloromethane (technical), chloroform pa (E. Merck), silica gel 60 GF$_{254}$ (E. Merck), silica gel 60 (0.2-0.5 mm) (E. Merck), silica gel 60 PF$_{254}$ containing gypsum (E. Merck), distilled water, cerium sulfate (CeSO$_4$), sulfuric acid (H$_2$SO$_4$). All solvents were distilled before being used, except chloroform. TLC was carried out using silica gel 60F$_{254}$ (E. Merck) and visualized under UV light short and long (254 and 366 nm). Vacuum liquid chromatography was performed on silica gel 60 GF$_{254}$ (E. Merck), the extract is impregnated with silica gel 60 (0.2-0.5 mm) (E. Merck), and radial chromatography was performed on silica gel 60 PF$_{254}$ containing gypsum (E. Merck).

Instrumentation

A set of distillation apparatus (Duran-Germany), a set of vacuum liquid chromatography (VLC), radial chromatography (RC), vacuum rotary evaporator (Buchi), oven (Gallenkamp Civilab-Australia), analytical scales (Explorer Ohaus), UV lamps (Strahlen Germany). Melting points were measured on a Sybron Thermolyne Melting Point Apparatus MP-12615 and are uncorrected. FT-IR Spectra was on Perkin Elmer FT-IR Frontier. $^1$H and $^{13}$C-NMR spectra were recorded with an Agilent DD2 system (Agilent Technologies, Santa Clara, CA, USA) operating at 400 ($^1$H) and 100 ($^{13}$C) MHz using residual. Unless otherwise indicated, vacuum liquid chromatography, radial chromatography and TLC were carried out using Merck silica gel 60 GF$_{254}$, silica gel 60 (finer than 0.2-0.5 mm) and precoated silica gel 60 PF$_{254}$ containing gypsum plates, respectively. Spots on TLC were visualized under UV light and by spraying with cerium (IV) sulfate reagent followed by heating.

Identification of Isolates

The pure compounds obtained were measured and collected by using various spectrometry methods, namely FT-IR, 1-D NMR ($^1$H, $^{13}$C and DEPT) and 2D NMR (HMBC and HMQC). The data obtained is translated by looking at the literature so that the structure can be known.

Results

Separation and purification in isolation of chemical compounds was carried out using chromatographic techniques. Chromatography is a way of physical separation with the elements to be separated distributed between two phases, the stationary phase and the mobile phase. The result of the separation can be seen in Figure 1.

Figure 1 shows that there are several fractions with compounds that have a very high Rf value which indicates that the fraction contains very nonpolar compounds. Separation prioritizes the fractions that still have the most stains, the results of which are then combined with other fractions with...
fewer stains. Separation by liquid vacuum column chromatography continued until a simpler subfraction was obtained, then purified using radial chromatography to obtain a single stain.

**Discussion**

TLC profile of the pericarp *G. mangostana* Linn. under UV light (254 nm) showed only the presence of one major spot of α-mangostin, one minor less polar spot and one minor more polar spot compared to that of α-mangostin. Isolation work on this EtOAc soluble fraction of the pericarp mangosteen gave the one minor less polar compounds in a very small quantity compared to that of α-mangostin. Attempt to isolate another more polar minor compound was unsuccessful because the amount was too small to isolate. Identification of the isolated compounds was done by spectroscopic method particularly NMR 1D (1H, 13C-NMR, and DEPT) and 2D (HMBC and HMQC).

Only the presence of two aromatic protons was observed (d, ppm, multiplicity, coupling constant); 7.22 (1H, d, J = 8.5 Hz) and 6.65 (1H, d, J = 9 Hz) which coupled to each other with coupling constant 7 Hz, indicating the presence of ortho-coupling of protons H6 and H7. The presence of two prenyl functions were also obvious by the signals of 4 methyl group (C-14; C-15; C-19 dan C-20) (d, ppm, multiplicity); 25.9, (3H, s), 18.1 (3H, s), 18.1 (3H, s), 25.8 (3H, s). There is no methoxyl signals were detected. Together with its 13C chemical shifts this compound was identified as known compound gartanin [22].

![Figure 1: Chromatogram merging the fraction VLC result](image1)

**Purity Test and Melting Point**

The amount of pure isolates obtained was 45 mg. Testing the purity of isolate 1 was done by TLC using three eluent systems, the stains of these compounds on the 3 types of eluents used can be seen in Figure 2.

![Figure 2: Chromatogram of three eluent system](image2)

The chromatogram in Figure 2 shows that isolate 1 has a single stain on the 3 three of eluent systems used. This shows that the compound has been pure and is supported by the results of the melting point test that has been carried out. The melting point of isolate 1 gave quite sharp results, namely at a temperature of 165-167°C.

![Figure 3: HMBC structure of compound (1)](image3)
with quinine reductase-inducing activity from the fruits of Garcinia mangostana (Mangosteen). Phytochemistry. 2008; 69(3):754-758. https://doi.org/10.1016/j.phytochem.2007.09.023 PMid:17991497
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In conclusion, the results of isolation and identification showed that in G. mangostana Linn. peel contained gartanin compounds.

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Authors’ Contributions

The writer and as the researcher of this paper is a postgraduate student of Faculty of Pharmacy in Setia Budi University, Indonesia.

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Table 1: 'H and 13C-NMR (400 MHz) spectral data of compound (1) and their references

| No | Compound (1) | Deft 135 | HNMR (1) | C12 | C13 | C14 |
|----|-------------|----------|----------|-----|-----|-----|
| 1  | Gartanin *  | C13      | 184.8    | C13 | C14 | C15 |
| 2  | Gartanin *  | C13      | 184.8    | C14 | C15 | C16 |
| 3  | Gartanin *  | C13      | 184.8    | C15 | C16 | C17 |
| 4  | Gartanin *  | C13      | 184.8    | C16 | C17 | C18 |
| 5  | Gartanin *  | C13      | 184.8    | C17 | C18 | C19 |
| 6  | Gartanin *  | C13      | 184.8    | C18 | C19 | C20 |
| 7  | Gartanin *  | C13      | 184.8    | C19 | C20 | C21 |
| 8  | Gartanin *  | C13      | 184.8    | C20 | C21 | C22 |
| 9  | Gartanin *  | C13      | 184.8    | C21 | C22 | C23 |
| 10 | Gartanin *  | C13      | 184.8    | C22 | C23 | C24 |
| 11 | Gartanin *  | C13      | 184.8    | C23 | C24 | C25 |
| 12 | Gartanin *  | C13      | 184.8    | C24 | C25 | C26 |
| 13 | Gartanin *  | C13      | 184.8    | C25 | C26 | C27 |
| 14 | Gartanin *  | C13      | 184.8    | C26 | C27 | C28 |
| 15 | Gartanin *  | C13      | 184.8    | C27 | C28 | C29 |
| 16 | Gartanin *  | C13      | 184.8    | C28 | C29 | C30 |

Description: a) Compound 1; b) Anggia et al., 2015 [23].

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