

# Characteristics of Flavanones from the Genus *Artocarpus*

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**Abstract.** All patterns of order that exist in nature, have been listed in the scriptures. One such order can be seen in the secondary metabolite compounds of the genus *Artocarpus*. Some species of genus *Artocarpus* have been investigated the contained secondary metabolites. Flavonoid group is the most found from *Artocarpus* plant. One of flavonoid derivatives which is successfully isolated from *Artocarpus* plant is flavanon. The oxygenation pattern of flavanones in ring B was trioxygenation at position 2', 4', 6', or dioxygenation 2', 4', or monohydroxide 4. The pattern did not follow the shikimic acid and acetic malonate biogenesis pathways. The structures were determined based on IR and NMR spectroscopic data.

**Keywords:** *Artocarpus*, flavanones, shikimic acid, acetic malonate, biogenesis pathways.

## 1 Introduction

All patterns of order that exist in nature are listed in the Koran. The verses that mention order in the universe are Surah Al Furqan, Al Qamar, and Hijr. "Who has the kingdom of heaven and earth, does not have children, there is no ally for Him in (His) power, and He created all things, then set their measurements accordingly," (Surah al-Furqan: 2). "Indeed, We create everything according to size," (Surah Al-Qamar: 49). "And there is nothing, but on the side of us is the treasury. We did not reduce it but with a certain size," (Surah al-Hijr: 21). One such order can be seen in the secondary metabolite compounds of the genus *Artocarpus*.

*Artocarpus* is the main genus of the Moraceae family [1]. *Artocarpus* belongs to the clan of jackfruit plants. Plant species included in this genus such as jackfruit or breadfruit which are widely used for fruit, wood, skin, and sap [2]. Research on the chemical content of the genus *Artocarpus* has been carried out. The chemical compounds reported in the *Artocarpus* include triterpenes, steroids, flavonoids, stilbenoids, and lignans [3,4]. The phenolic compound which is the most abundant compound found in the genus *Artocarpus* is a class of flavonoids. These phenolic compounds are reported to have anti-bacterial activity [5], anti-fungal [6], anti-malaria [7] and cytotoxic [8]. These activities are related to the content of secondary metabolites [9-13].

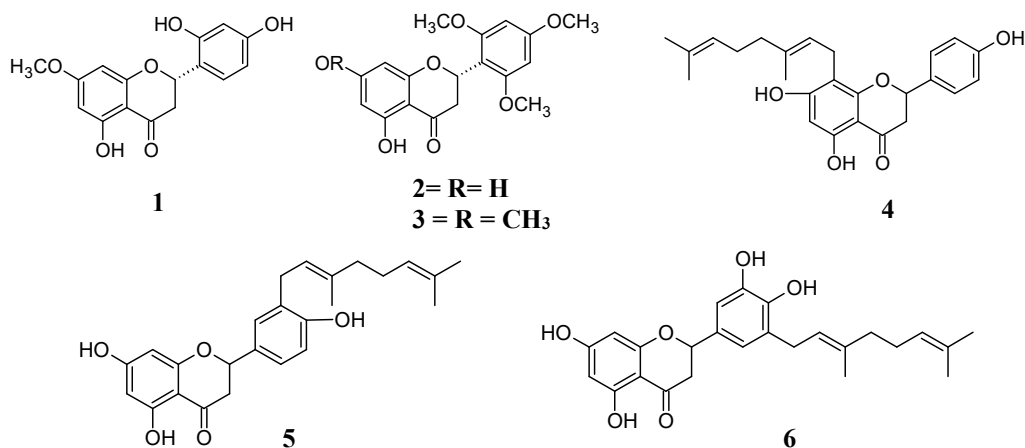
## 2 The Isolation Procedures

The extracts is made from powder, extraction, solvent separation, and extract concentration. The extraction repeated until less colorful supernatant. Rotary evaporator is used to produced crude extract. Futhermore, the TLC (Thin Layer Chromatography) used for obtained extraction using various eluents. The TLC chromatogram was a basis for fractionation by vacuum liquid chromatography (VLC). The main fractions from VLC were analyzed again by TLC. Fractions that have same spots (Rf) is pooled. Purification were done repeatedly by radial chromatography. The TLC chromatogram was used for the quality of the purity of an isolate. The pure compound shows a single spot on the three different eluent systems.

Spectroscopic methods was used to determine the structures of secondary metabolites. (i) The presence of double bond conjugation in the structure of secondary metabolites was determined using UV-Vis spectrum. (ii) The functional groups ware determined using Infrared spectrum. (iii) NMR (Nuclear Magnetic Resonances) were a great tools for determinining of secondary metabolites structures.

## 3 Flavonoids

The flavonoid compounds originated from the shikimat acid and malonic acetate pathways. Many variety of flavonoid of *Artocarpus* frameworks. This article described flavanones that have been isolated from *Artocarpus*. The main compound of secondary metabolites of *Artocarpus* is flavonoid. Flavanones compounds is flavonoid derivatives. Some flavanones compounds that isolated from *Artocarpus* consist of: Artocarpanone (1) from *A. champeden* is isolated by Djakaria [14]. Artoindonesianin E (2) and heteroflavanone A (3) isolated from *A. champeden* by Hakim et al. [15]. Nomura et al. [16] also isolates compound 3 from the root bark of *A. champeden*. 8-geranyl-4'-O,7-dihydroxyflavanon (4), 3'-geranyl-4',5,7-trihydroxyflavanon (5) and isonimfaeol-B (6) isolated by Jayasinghe et al. [17] from *A. nobilis*. Oxygenation pattern of flavanones have in ring B is trioxygenation at position 2', 4', 6' or dioxygenation 2', 4', 3', 4' or monohydroxide 4'.



## Figure 1. Flavanones from *Artocarpus*

### 4 Conclusion

Natural order as explained in the Qur'an can be seen in the regularity of flavanones from *Artocarpus*. Oxygenation pattern of flavanones from *Artocarpus* in ring B is trioxygenation at position 2', 4', 6', or dioxygenation 2', 4', or monohydroxide 4'. Pattern of flavanones compounds is not in accordance with the pattern of the acetate malonate pathway and the shikimat pathway which is the biogenesis pathway of the flavonoid group

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