Antraquinone

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Submission date: 03-Oct-2022 12:39PM (UTC+0900)
Submission ID: 1914986797
File name: ScopusTwo_antraquinone.pdf (2.11M)
Word count: 2085
Character count: 12131

ISSN 1561-8331 (Print)
ISSN 2524-2342 (Online)
УДК 577.1
https://doi.org/10.29235/1561-8331-2022-58-1-68-72

Поступила в редакцию 24.11.2021
Received 24.11.2021

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TWO ANTHRAQUINONE COMPOUNDS FROM THE WHOLE PLANTS OF *HEDYOTIS CORYMBOSA*

Abstract. Hedyotis corymbosa from the Rubiaceae family, widely distributed in tropical regions of Asia. Based on the traditional uses, researchers provided substantial scientific evidence revealing the beneficial impact of this plant highlighting its anticancer, hepatoprotective, antiulcer, antioxidant, anti-malarial, antibacterial and antifungal activities. This study aims to screen and identify anthraquinone from the methanol extract of whole plant *H. corymbosa*. The Anthraquinone was further fractionated and isolated using chromatographic techniques to obtain the purity of compounds. The anthraquinone structure was determined using spectroscopic analysis especially the Nuclear Magnetic Resonance (NMR) and Mass Spectrum (MS).

Keywords: Hedyotis Corymbosa, Anthraquinone, Nuclear Magnetic Resonance (NMR), Mass Spectrum (MS)

For citation. Desy Ambar Sari, Nurhayati Nurhayati. Two anthraquinone compounds from the whole plants of *Hedyotis corymbosa*. *Vestsi Natsyyanal'nai akademii navuk Belarusi. Seryya khimichnykh navuk = Proceedings of the National Academy of Sciences of Belarus. Chemical Series,* 2022, vol. 58, no. 1, pp. 68–72. https://doi.org/10.29235/1561-8331-2022-58-1-68-72

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ДВА СОЕДИНЕНИЯ АНТРАХИНОНА ИЗ ЦЕЛЫХ РАСТЕНИЙ *HEDYOTIS CORYMBOSA*

Аннотация. *Hedyotis corymbosa* из семейства Мареновых широко распространен в тропических регионах Азии. Основываясь на традиционном использовании, исследователи предоставили существенные научные доказательства, раскрывающие благотворное влияние этого растения, подчеркивая его противоопухолевую, гепатопротекторную, противоязвенную, антиоксидантную, противомалярийную, антибактериальную и противогрибковую активность. Это исследование направлено на скрининг и идентификацию антрахинона из метанольного экстракта цельного растения *H. corymbosa*. Антрахинон был дополнительно фракционирован и выделен с использованием хроматографических методов для получения чистоты соединений. Структура антрахинона была определена с помощью спектроскопического анализа, ядерного магнитного резонанса (ЯМР) и масс-спектрометрии (МС).

Ключевые слова: *Hedyotis corymbosa*, антрахинон, ядерный магнитный резонанс (ЯМР), масс-спектрометрия (МС)

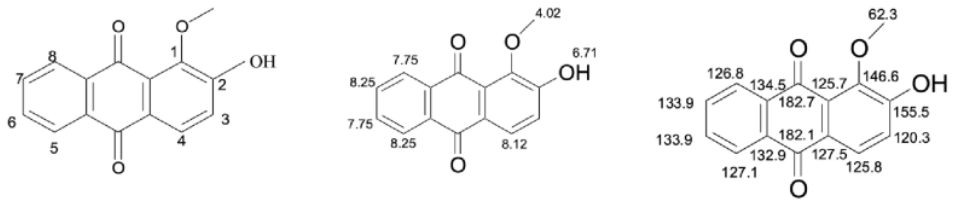
Для цитирования. Дези Амбар Сари. Два соединения антрахинона из целых растений *Hedyotis corymbosa* / Дези Амбар Сари, Нурхаяти Нурхаяти // Вес. Нац. акад. навук Беларусі. Сер. хім. навук. – 2022. – Т. 58, № 1. – С. 68–72. https://doi.org/10.29235/1561-8331-2022-58-1-68-72

Introduction. *Hedyotis corymbosa* is locally known as pearl grass and in Indonesia known as Rumput mutiara is one of the species from *Hedyotis* (genus) famous in Traditional Chinese Medicine (TCM). *Pearl grass* (*Hedyotis corymbosa* (L.) Lam) from the family *Rubiaceae* has been reported to have some properties traditionally as an anti-inflammatory, anticancer, and several other diseases [1]. Scientific studies on the chemistry of genus Hedyotis and showed that the genus contained iridoids, flavonoids, anthraquinones, alkaloids, lignans, coumarins and triterpenes [2].

Anthraquinones is one of secondary metabolites that are produced by various plants and are applied in a wide range of applications, for example, as coloring agents in the food and textile industries and as therapeutic agents for various diseases [3]. They are derived from 9,10-anthracenedione. Addition of hydroxyl (-OH), methyl (-C_3), carboxyl (-COOH), and methoxyl (-OCH_3) groups to 9,10-anthracenedione results in the formation of different anthraquinone derivatives, which possess a broad-spectrum of medicinal properties [4].

The group of anthraquinone compounds was used for multiple folk medicines like Senna species, which are utilized in Ayurvedic system of medicines and Traditional Chinese Medicines for the management of various infectious and non-infectious diseases [5]. Further, anthraquinone derivatives are also reported for anti-viral property [6] anti- inflammatory efficacy [7] and as immune booster [8]. These compounds that have been scientifically tested and proven to be Anthraquinone. The 2-hydroxy-1-methoxyanthraquinone was reported that can be inhibited the protein tyrosine kinases v-src and pp60src and the growth of Bcap37 cell line (IC_{50} 65 μM) [9]. As part of our ongoing efforts to evaluate the biopharmaceuticals against infectious diseases such as antiviral and antimicrobial activities of *Hedyotis corymbosa* species that are in use in traditional medicine we have investigated *Hedyotis corymbosa* (Pearl grass). Here in the very first phytochemical examination of its whole plants is presented. This prompted us to conduct the present study, where we isolated and evaluated the bioactive constituents based on their biological activities. This study aims to screen and identify Anthraquinone compounds from the methanol extract of *H. corymbosa* whole plant using chromatographic techniques to obtain pure compounds and evaluate the compound structure using spectroscopic analysis, especially the Nuclear Magnetic Resonance (NMR) and Mass Spectrometry (MS).

Results and Discussion. Our investigations commenced with the ethyl acetate layer was further fractionated and isolated using chromatographic techniques to obtain pure compounds. The bioactive compound's structure was determined using spectroscopic analysis especially the Nuclear Magnetic Resonance (NMR). The investigation of Anthraquinone from *H. corymbosa* resulted in the isolation of two anthraquinones. The compounds were identified as 2-hydroxy-1-methoxyanthraquinones, 3-hydroxy-1,2-dimethoxyanthraquinone.



1a **1b** **1c**

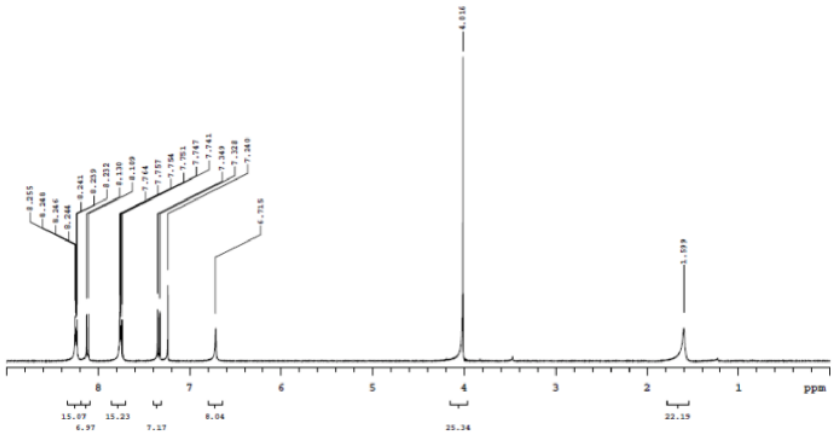
Scheme 1. Synthesis of 2- hydroxy-1- methoxyanthraquinone **1a**, ^{1}H and ^{13}C NMR spectral data (**1b**, **1c**)

Compound **1** was isolated as yellow powder. EI-MS (Scheme 3) spectrum exhibited amolecular ion peak at m/z 254 [M]+ [10] correspond with molecular weight 254.241 [11].

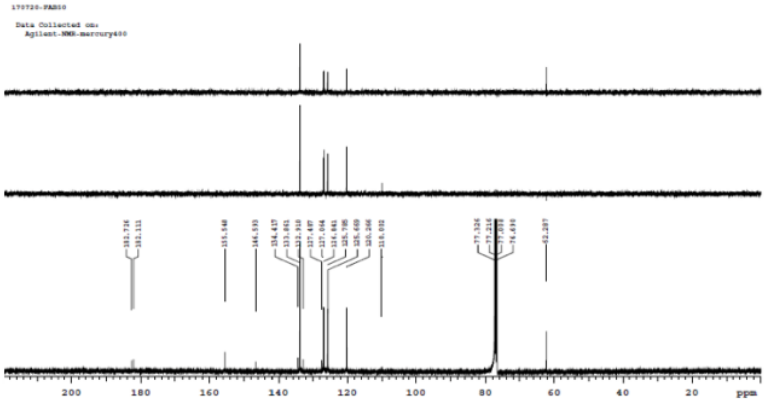
The ^{1}H NMR spectrum in Scheme **2a** indicated two *ortho*-coupled aromatic protons at *δ*H 7.34 (1H, *d*, 8.4 Hz, H-3) and 8.12 (1H, *d*, 8.4 Hz, H-4) of the first ring, which are characteristic signals of the anthraquinone type. Typical aromatic proton signals of the A2B2 substituted ring appeared at δH 8.25 (2H, m, H-5, H-8) and 7.75 (2H, m, H-6, H-7) of the second ring and an aromatic methoxy group signal at δH 4.02. The compound 1 was identified as 2- hydroxy-1- methoxyanthraquinone by contrast of its spectral data with data from [10].

The 13C NMR spectrum in scheme **2b** indicated the two carbonyl carbons at δC182.7 and 182.1 and six aromatic quaternary carbons comprising one hydroxy-carbon at *δ*C 155.6; a carbon connected to a methoxy group at δC 146.6 [10].

The second anthraquinone compound was isolated as yellow solid with the melting point of 230–232°C and the molecular formula is $C_{16}H_{12}O_5$ correspond with molecular ion peak at 284 $[M]^{+}$[12]. The ^{1}H NMR spectrum for compound **2** in Scheme **4** and Scheme **5a** showed the proton signals of the methoxy group at δ_H 3.83 and 3.86 for 1-OCH_3 and 2-OCH_3. A set A_2B coupled signals δ_H 7.83 assigned to H-5 and H-7, while δ_H 8.08 assigned to H-6 and H-8. The ^{13}C NMR spectrum for compound **2** resolved 16 carbon signal, including 2 primary carbon, 5 tertiary carbon and 9 quaternary carbons, and the spectrum showed two conjugated ketones at δ_C 182.3 and 180.5 for C-9 and C-10 [13]. Compound **2** was identified as 3-hydroxy-1,2-dimethoxyanthraquinone [13].

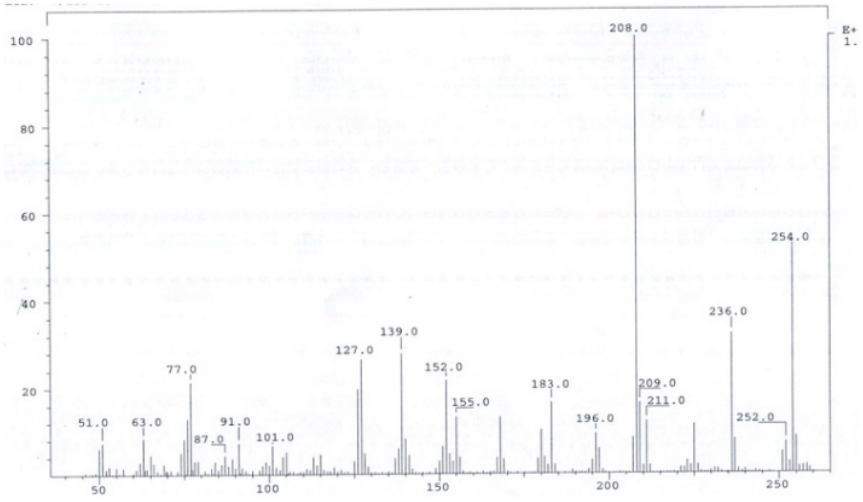


2a

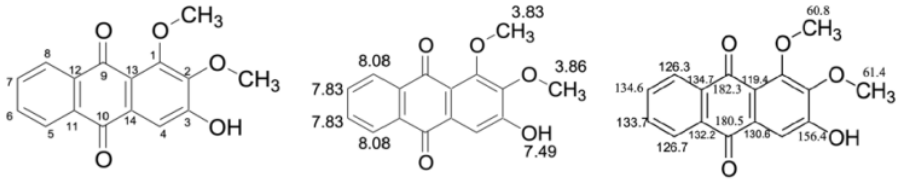


2b

Scheme 2. ^{1}H spectrum of compound **1** (400 MHz, $CDCl_3$) **2a**, ^{13}C NMR spectrum of compound **1** (100 MHz, $CDCl_3$) **2b**

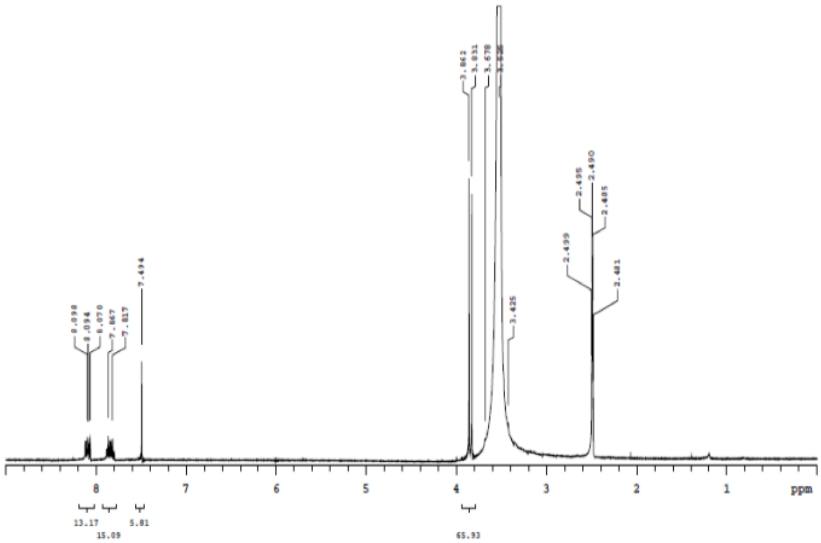


Scheme 3. EI-MS spectrum of compound **1**

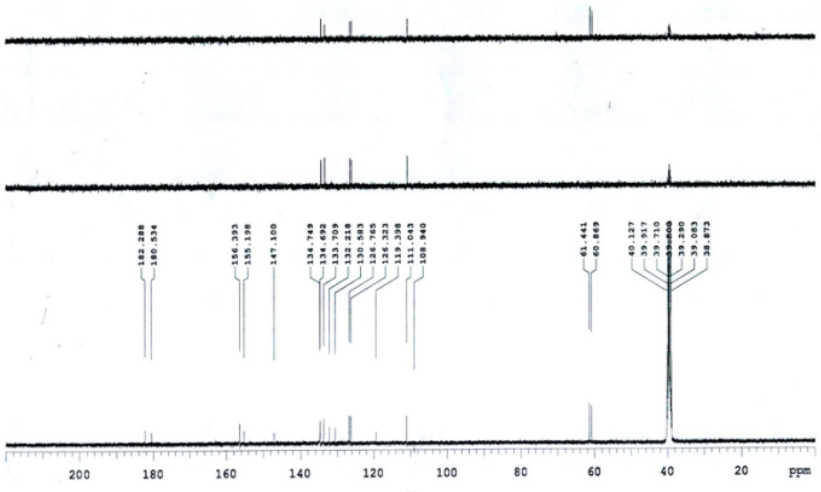


4a **4b** **4c**

Scheme 4. Synthesis of 3-hydroxy-1,2-dimethoxyanthraquinone **4a**, ^{1}H and ^{13}C NMR spectral data (**4b**, **4c**)



5a



5b

Scheme 5. ^{1}H spectrum of compound **2** (400 MHz, DMSO-d_6). **5a**, ^{13}C NMR spectrum of compound **2** (100 MHz, DMSO-d_6). **5b**

Conclusion. The conclusion of this report that studied isolation and identification of anthraquinones extracts from *Hedyotis corymbosa*. Anthraquinones extracted from *Hedyotis corymbosa* identified important compounds which may be used to develop biopharmaceuticals against infectious diseases such as antiviral and antimicrobial activities in future.

Acknowledgement. The authors would like to thank to anonymous reviewers for their insightful suggestions and careful reading of the manuscript and the director of Muhammadiyah Research (RisetMu) Council for Higher Education Research and Development of the Central Leadership of Muhammadiyah. This research was supported by the Hibah Riset Muhammadiyah Batch V with contract number: 0842.00/PMI/I.3/C/2021.

Благодарности. Авторы выражают благодарность рецензентам за внимательное прочтение рукописи и содержательные предложения, а также директору Исследовательского совета Мухаммадии (RisetMu) по исследованиям и разработкам в области высшего образования Центрального руководства Мухаммадии. Работа выполнена при поддержке Hibah Riset Muhammadiyah Batch V номер контракта: 0842.00/PMI/I.3/C/2021.

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