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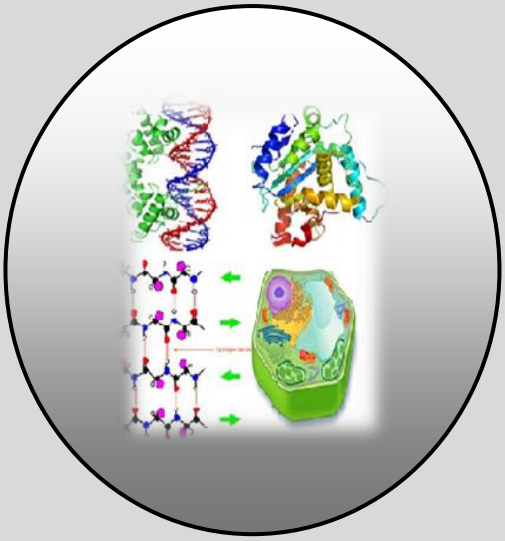

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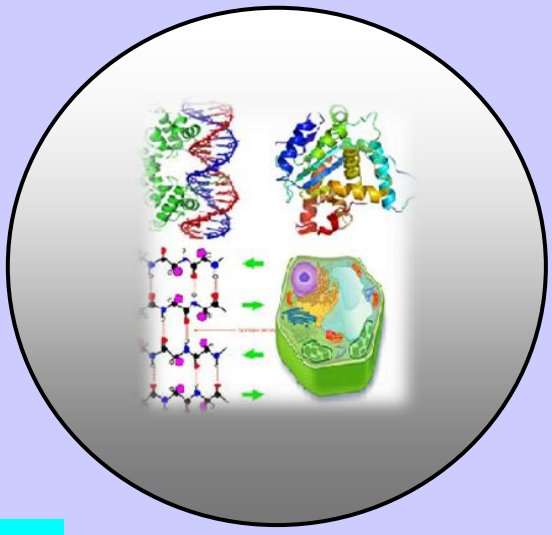

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RESEARCH PAPER
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Synthesis of Xanthone from 2-Phenoxy Benzoic Acid Using Sulfuric Acid Catalyst

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ABSTRACT

Synthesis of xanthone was conducted from 2-phenoxybenzoic acid by acid catalyzed cyclization. The products were characterized using FT-IR, 1H-NMR, 13C-NMR, LC-MS, spectrometers. Cyclization of 2-phenoxybenzoic acid using sulfuric acid catalyst gave xanthone in 94.0 % yield.

Keywords: Xanthone, 2-phenoxybenzoic acid, Sulphuric acid catalyst, FT-IR, 1H-NMR, 13C-NMR and LC-MS Spectrometers.

INTRODUCTION

Indonesia is well known as a rich country in natural resources, such as plants. In some generations, many of them are utilized as traditional medicines to maintain the health quality, to prevent and to cure the diseases. However, their applications in the medical aspect have not been based on the scientific evidences. To make the traditional medicine to be more applicable and useful in the formal health services, researches which is scientifically reliable are required to conduct. One of tropical plants employed as the traditional medicine is plant of *Garciniadulcis*. It can be classified into the family of Gutterferae and much found in Indonesia (well known as mangosteen plant). This plant has been proven to display antiplasmodium activity. Ethanol fraction from the root of *G. dulcis* had the activity of 15. 21 µg/mL (Amanatie et al, 2008). From 400 of Garcinia plants, it was found that xanthone was the major component, beside terpenoid, benzophenone and biflavonoid. Xanthone (Figure 1) had the potential biological activies. Xanthone and its derivative are mainly existed on the fruit, leaves, bark and the root of *G. dulcis*. Research on xanthone isolated from the root of *G. dulcis* had been reported by Amanatie et al, 2005. The application of xanthone as anti plasmodium agent has not been much reported.

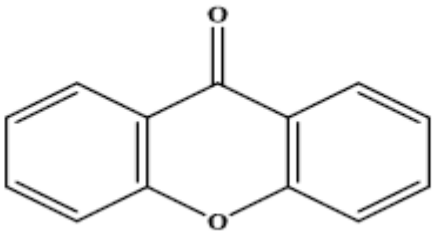

Figure 1.Structure of xanthone.

This research was firstly conducted by isolating and identifying the xanthone from *G. dulcis* (Amanatie et al 2004-2005). However, the yield was very low, thus, the author tried to get the xanthone in higher amount via the synthesis process. The aims researches were:

1. Synthesis of xanthone from 2-phenoxy benzoic acid.
2. Analysis of the synthesized xanthones using IR,1H-NMR and 13C-NMR, LC-MS spectrometers.

The specific problems were
1. How to synthesis xanthone from 2- phenoxybemzoicacid?,
2. How to analyze the synthesis xanthones?

This research was conducted with the main aims of synthesizing the xanthone. The specific aims were
1. To synthesize xanthone from of 2-phenoxybenzoic acid;
2. To analyze the synthesized xanthone derivatives using spectroscopy method (FTIR, 1H-NMR, 13C-NMR, HMBC, HMQC, DEPT and LC-MS spectrometer).

Xanthone and its derivatives were commonly obtained from isolation of natural products. Isolation of xanthone has been conducted from the leave (Koselaet *al,* 2000) and bark (Hanafi*et al*, 2004) of *Garciniadulcis*. Likhitwitayawuid*et al* (1998) has obtained new xanthone derivatives of 7-O-methyl garci-non-E from G. cowa with IC 50 of 1.50-3.00 µg/mL. Other xanthone derivatives of 1,3,7-trioxygenated and prenylatedxanthone have been isolated from *Calophylumcaledonicum* (Hay et al, 2004). In addition, Amanatie*et al* (2009) has reported that the IC 50 of the root extract of G. dulcis was 15.21 µg/mL. The synthesis of xanthone from 2-phenoxybenzoic acid has been conducted.

THEORETICAL BACKGROUND

Identification of xanthone

Chemically, xanthone is different with flavonoid as can be seen on the characteristic spectra (Harborne, 1987). Xanthone could be isolated using thin layer chromatography (TLC) with the eluents of chloroform: acetic acid (4:1) chloroform: benzene (7:3) or chloroform: ethyl acetate in various ratio.

It could give color with the reaction with ammonia under the UV light. Mangiferin (Figure 2) is practically different with all xanthone as it is soluble in water and can be separated well using paper chromatography. Xanthone has the maximum wave lengths in the region of 230-245, 250-265, 305-330 nm. As flavonoid, xanthone gives characteristic bathochromic shift by the reaction with base, aluminum chloride and sodium acetate-boric acid (Harborne, 1987).

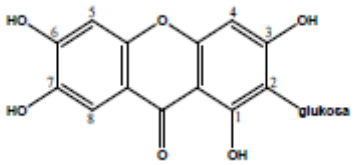

Figure 2.Structure of Mangiferin.

Synthesis of xanthone

Xanthone could be synthesis from 2-phenoxybenzoic acid via cyclization reaction using Sulfuric acid catalyst. The reaction is displayed in Figure 3.

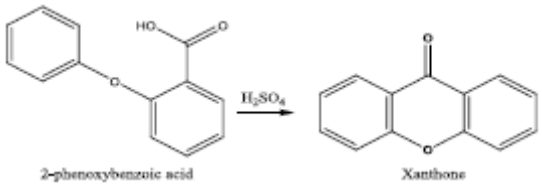

Figure 3.Synthesis of xanthone from 2-phenoxybenzoic acid.

MATERIAL AND METHODS

For the synthesis, extraction, TLC, column chromatography and recrystalization processes, the materials used were, 2-phenoxybenzoic acid, sulfuric acid, sodium hydroxide, sodium sulfat anhydrous, and aquadest. All the chemicals except aquadest were purchased from Merck.

Tools

For the synthesis, separation and purification purposes, several tools were used. There were laboratory glassware, vacuum pump, electrical heater, magnetic stirrer, TLC apparatus, UV lamp, rotary evaporator and column chromatography apparatus. Characterization of the product was conducted using melting point apparatus (electrothermal 9100), infrared spectrometer (FTIR 8201 Shimadzu PC), proton nucleas magnetic resonance (1HNMR JOEL, JNM MYGO 60 MHz, 1HNMR JOEL, JNM ECA 500 MHz) and liquid chromatography-mass spectrometer (LC-MS Shimadzu GC-17 A QP-500.).

RESULTS AND DISCUSSION

Synthesis of xanthone

Xanthone was synthesized via acid-catalyzed-cyclization of 2-phenoxybenzoic acid. The product was obtained as yellowish white needle crystal with m.p. of 173.5-173.9°C (theoretical m.p. of 172-174 °C) in 94.0% yield. Elucidation of the product was conducted using UV-VIS, FT-IR, NMR and LC-MS spectrometers.

The UV-Vis spectrum gave 4 maximum wavelengths at 334, 258, 236 and 202 nm. Furthermore, FT-IR spectrum showed strong absorption at 1689 cm-1 indicating the presence of carbonyl group (C=O). Peaks at 1604-2962 cm-1 showed functional groups of C=C and aromatic C-H. Band in the region of 1095-1141 cm-1 indicated the aromatic ether. According to IR spectrum, it could be indicated that the synthesized product contained carbonyl, aromatic and ether groups.

1H-NMR spectrum showed 4 peaks depicting 4 protons with different chemical environment. All peaks appeared in the absorption region of benzene ring. Peak of H1and H8 appeared at dH=8.3 ppm (d, J=7.65). Peak of H2 and H7 existed at dH=7.8 ppm (t, J=7.65). Protons of H4 and H5 gave peaks at dH=7.6 ppm (d, J=8.4). Then, protons of H3 and H6 gave peaks at dH=7.4 ppm (t, J=7.6).

13C-NMR spectrum showed 7 carbon peaks. Peak at dC 179 ppm showed the presence of C13 of carbonyl group. Absorption at dC 122 ppm came from C9 and C12. Carbon of C1 and C8 gave peaks at dC 127 ppm. Carbon of C2 and C7 gave peaks at dC 119 ppm. Carbon of C3 and C6 gave peaks at dC 125 ppm. Peak for C4 and C5 was at dC 136 ppm, while that for C10 and C11 was at dC 157 ppm.

Based on LC analysis, there was one peak at retention time of 46 minute. The peak was then analyzed using MS to find the molecular weight of compound. Method of MS applied in this analysis was ESI-MS positive ion. The spectrum of ESI-MS showed several peaks. The peak b with m/z 197.23 was the base peak. It represented the protonated product [M + H]+ ion. Therefore the molecular weight of the product was 196, i.e. the molecular weight of xanthone.

According to UV-Vis, IR, 1H- and 13C-NMR as well as LC-MS analyses, it could be concluded that the product was xanthone (Figure 15) with the molecular formula of C13H8O2.

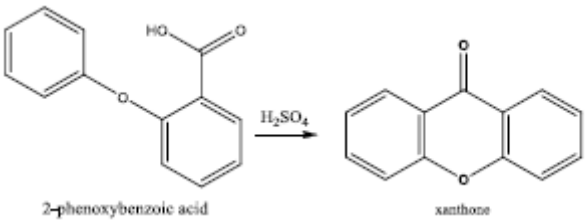

Figure 4.Synthesis of xanthone from 2-phenoxybenzoic acid.

CONCLUSIONS

According to results and discussion, it could be concluded that: Acid-catalyzed cyclization of 2-phenoxybenzoic acid produced xanthone in 94.0% yield.

SUGGESTIONS

According to results and discussion previously explained, there were suggestions:
Reaction conditions in the synthesis of xanthone should be optimized to get the high yield.

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