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SYNTHESIS, ANTIBACTERIAL AND ANTIOXIDANT ACTIVITIES OF 2-(4-CHLOROPHENYL)-4H-CHROMEN-4-ONE

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ABSTRACT

SYNTHESIS, ANTIBACTERIAL AND ANTIOXIDANT ACTIVITIES OF 2-(4-CHLOROPHENYL)-4H-CHROMEN-4-ONE

Flavones are a type of flavonoid that has the backbone of 2-phenylchromen-4-one (2-phenyl-1-benzopyran-4-one) with $C_{15}H_{10}O_2$ as its molecular formula. Flavones are abundant in fruits and vegetables. Besides that, flavones are known to have a special role in natural and synthetic organic chemistry because of their useful biological activities like antibacterial and antioxidant. The research of flavones has grown in popularity, as well as the demand for it in the market. However, due to the extraction procedure and the time required for plants to grow, the high demand for flavones is difficult to meet. Hence, this study aims to synthesize flavone which is 2-(4-chlorophenyl)-4H-chromen-4-one from chalcone via Claisen-Schmidt condensation without any extraction methods involving plants. The synthesis of the flavone along with chalcone was confirmed through the analysis from FTIR, GC-MS and NMR. Apart from that, the antibacterial activity was carried out. Four species of bacteria such as *Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus,* as well as *Streptococcus pyogenes* were used in this study. However, 2-(4-chlorophenyl)-4H-chromen-4-one and its chalcone were concluded to be weak inhibitors as they have weak activities against all four species of bacteria in both MIC and MBC. Meanwhile, the antioxidant activity was determined by DPPH free radical scavenging activity assay and was assessed in terms of inhibition concentration (IC_{50}). The positive control for this was quercetin. The IC_{50} of a substance is inversely related to its antioxidant activity. As a result, a sample with a lower IC_{50} has greater antioxidant activity. The chalcone, 3-(4-chlorophenyl)-1-(2-hydroxyphenyl)prop-2-en-1-one has greater free radical scavenging activity compared to the flavone, 2-(4-chlorophenyl)-4H-chromen-4-one with values of 1.5876 μg/mL and 1.6927 μg/mL, respectively. The chalcone also displayed greater free radical scavenging activity than the positive control, quercetin.

CHAPTER 1

INTRODUCTION

1.1 Background of study

Natural plant components that have the potency to strengthen health and medicinal properties have recently gained much interest (Lee, 2015). Flavonoids, a class of over 4000 polyphenolic compounds found naturally in plant-based foods, have been identified as a potential substance for health enhancement. Flavonoids share a standard phenylbenzopyrone structure and are classified based on the saturation level and opening of the central pyran ring (Patel and Shah, 2017). Flavon-3-ols, flavonols, flavones, flavanones, anthocyanins, and isoflavones are the six subclasses of flavonoids. They are abundant in beverages such as tea, coffee, and juices that are frequently consumed, as well as fruits, vegetables, and grains (Zujko et al., 2015). In general, flavonoids are pigments that are present in flowers, leaves, and fruits, which provide colours ranging from red to blue. Flavonoids also play significant parts in plant growth and development, including UV-B radiation protection, antifungal barrier formation, insecticidal, antimicrobial, and plant reproduction (Erdogdu et al., 2010).

CHAPTER 2

LITERATURE REVIEW

2.1 Preparation of chalcones

Chalcone, a starting ingredient for the synthesis of flavone can be produced in several methods. One of the methods to produce chalcone is through Claisen-Schmidt condensation of electrophilic substituted benzaldehyde with substituted acetophenone as the nucleophile in the presence of bases such as NaOH and KOH. Other bases include $Ba(OH)_2$, LiOH, NaH, hydrotalcite, MgO, Zeolites, Na_2CO_3, K_2CO_3, magnesium t-butoxide, alumina, and piperidine can also be used (Patel and Shah, 2017). Besides that, it was revealed that several chalcone derivatives could be synthesized through other methods, which are microwave irradiation and the conventional method (Septianingtyas et al., 2021).