Sintesis Ester Risinoleat, Oleat, Dekanoat, dan Palmitat dengan Kurkumin serta Uji Toksisitas terhadap Daphnia magna dan Uji Antimikroba = Synthesis of Ricinoleic, Oleic, Decanoate, and Palmitate Esters with Curcumin and Their Toxicity Tests against Daphnia magna and Antimicrobial Tests

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Abstrak

Asam lemak telah diketahui menghasilkan senyawa yang bermanfaat melalui transformasi secara sederhana, karena mengandung rantai hidrokarbon dan gugus karboksilat yang reaktif. Berbagai penelitian telah dilakukan tentang aktivitas antimikroba, antidiabetik, antiinflamasi, dan antikanker dari turunan asam lemak. Pada penelitian ini dilakukan sintesis senyawa ester asam lemak dengan kurkumin menggunakan esterifikasi Steglich, melalui reaksi kopling dengan DCC dan katalis DMAP. Senyawa ester diindentifikasi menggunakan KLT dengan eluen n-heksana:etil asetat (1:1, v/v) dan didapatkan nilai Rf untuk produk ester lebih tinggi daripada prekursor. Nilai Rf produk ester di asam lemak dengan kurkumin lebih tinggi daripada mono asam lemak dengan kurkumin. Purifikasi produk dilakukan dengan kromatografi kolom gel silika menggunakan eluen n-heksana:etil asetat (12:1, v/v). Hasil pemurnian produk dikarakterisasi dengan spektrofotometri FT-IR dan UV-Vis. Karakterisasi menggunakan FT-IR menunjukkan adanya serapan baru gugus fungsi ester C=O pada bilangan gelombang 1760 cm-1 – 1735 cm-1. Terdapat pula puncak serapan gugus fungsi C=O karboksil keton pada 1640 cm-1 -1620 cm-1, gugus fungsi C=C aromatik pada 1650 cm-1 – 1566 cm-1, gugus fungsi C-O aromatik pada 1310 cm-1 – 1250 cm-1, dan C-O-C pada 1075 cm-1 – 1020 cm-1. Perbedaan produk ester di dan mono yaitu, pada mono masih adanya serapan O-H fenolik yang tidak mengalami reaksi esterifikasi. Hasil karakterisasi produk ester dengan UV-Vis menunjukkan adanya pergeseran batokromik pada produk ester mono asam lemak. Hasil uji toksisitas terhadap Daphnia magna menunjukkan nilai LC50 produk senyawa ester dioleat-kurkumin sebesar 189,91 mg/L dan monooleat-kurkumin sebesar 98,68 mg/L. Berdasarkan nilai LC50, ester monooleat-kurkumin dikategorikan sangat toksik dan berpotensi sebagai senyawa bioaktif. Hasil uji antimikroba produk ester terhadap Staphylococcus aureus dan Escherichia coli menunjukkan aktivitas antimikroba yang lemah.
.....Fatty acids have been known to produce useful compounds through simple transformations, because they contain a reactive hydrocarbon chain and carboxylic group. Various studies have been conducted on the antimicrobial, antidiabetic, anti-inflammatory, and anticancer activities of fatty acid derivatives. In this study, the synthesis of fatty acid ester compounds with curcumin was carried out using Steglich esterification. Esterification was carried out by coupling reaction with DCC and DMAP catalyst. The ester compounds were identified using TLC with n-hexane: ethyl acetate (1:1, v/v) as the eluent and the Rf value for the ester product was higher than that of the precursor. The Rf value of di ester products fatty acids with curcumin was higher than mono fatty acids with curcumin. The product was then purified using silica gel column chromatography with n-hexane:ethyl acetate (12:1, v/v) as the eluent. Product purification was carried out using silica gel column chromatography with n-hexane:ethyl acetate (12:1, v/v) as the eluent. The purified product was characterized by FT-IR and UV spectrophotometry. Characterization using FT-IR showed new absorption of ester functional group C=O at wave number 1760 cm-1 – 1735 cm-1. There were

also absorption peaks of the C=O carboxyl ketone functional group at 1640 cm-1 -1620 cm-1, the aromatic C=C functional group at 1650 cm-1 – 1566 cm-1, the aromatic C-O functional group at 1310 cm-1 – 1250 cm-1, and C-O-C at 1075 cm-1 – 1020 cm-1. The difference between di and mono ester products is that only mono exhibited the O-H absorption of free phenolic group of curcumin. The monofatty acid ester product showed bathochromic shift by UV analysis. The toxicity test results on Daphnia magna showed that the LC50 value of the dioleic-curcumin ester compound was 189.91 mg/L and monooleate-curcumin was 98.68 mg/L. Based on the LC50 value, the monooleic-curcumin ester is categorized as very toxic and had potential as a bioactive compound. The antimicrobial test results of the ester products against Staphylococcus aureus and Escherichia coli showed that these compounds were categorized as weak antimicrobial agents.