

**SINTESIS ANALOG KURKUMIN MONOKETON BERBAHAN DASAR  
3,4-DIMETOKSIBENZALDEHIDA DAN EFEK SINERGISITASNYA  
DENGAN ASAM FERULAT DALAM MENGHAMBAT ENZIM  
 $\alpha$ -AMILASE**

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**INTISARI**

Sintesis senyawa analog kurkumin 1 [1,5-bis(3,4-dimetoksifenil) penta-1,4-dien-3-on] dan senyawa analog kurkumin 2 [2,6-bis(3,4-dimetoksibenzilidin)sikloheksanon] telah dilakukan. Senyawa analog kurkumin hasil sintesis diuji aktivitas inhibisinya terhadap enzim  $\alpha$ -amilase dan efek sinergisitas dengan asam ferulat secara *in vitro*. Senyawa analog kurkumin 1 dan 2 disintesis melalui reaksi kondensasi aldol silang Claisen-Schmidt dengan cara mereaksikan aldehida aromatik, berupa 3,4-dimetoksibenzaldehida, dengan keton, berupa aseton dan sikloheksanon, pada kondisi basa menggunakan metode sonokimia. Sintesis berlangsung selama 10-30 menit pada temperatur ruang. Aktivitas inhibisi dan efek sinergisitas masing-masing senyawa analog kurkumin dengan asam ferulat diketahui melalui penurunan konsentrasi kompleks pati-iodin menggunakan reagen iodine serta melalui peningkatan konsentrasi maltosa menggunakan reagen DNS (asam 3,5-dinitrosalisilat) yang diukur serapannya melalui *microplate reader* pada panjang gelombang 700 nm dan 540 nm.

Hasil sintesis diperoleh senyawa analog kurkumin 1 berupa padatan berwarna kuning kunyit dengan randemen sebesar 82,40% dengan titik leleh pada rentang suhu 73-76 °C. Analog kurkumin 2 yang diperoleh berupa kristal berwarna kuning dengan randemen sebesar 77,52% dan memiliki titik leleh 139-140 °C. Analog kurkumin 1 dan 2 memiliki aktivitas inhibisi terhadap enzim  $\alpha$ -amilase tertinggi yaitu sebesar 38,99% dan 50,00% dengan metode uji menggunakan iodine, sedangkan dengan reagen DNS, diperoleh aktivitas inhibisi tertinggi senyawa analog kurkumin 1 dan 2, berturut-turut sebesar 85,11% dan 82,98%. Pada hasil uji efek sinergisitas senyawa analog kurkumin dengan asam ferulat, diketahui bahwa senyawa analog 1 dan 2 memiliki efek sinergis dengan asam ferulat dalam menghambat enzim  $\alpha$ -amilase. Namun berdasarkan perhitungan *Combination Index* (CI), diketahui bahwa efek sinergis hanya ditunjukkan oleh kombinasi antara senyawa analog kurkumin 1 dan asam ferulat pada perbandingan konsentrasi 25:25 dan 25:50.

Kata kunci: analog kurkumin, 3,4-dimetoksibenzaldehida, sonokimia,  $\alpha$ -amilase, efek sinergisitas.

**SYNTHESIS OF MONOKETON CURCUMIN ANALOGS FROM 3,4-DIMETHOXYBENZALDEHYDE AND ITS SYNERGISTIC EFFECT WITH FERULIC ACID IN INHIBITING  $\alpha$ -AMYLASE ENZYME**

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**ABSTRACT**

Synthesis of curcumin analog 1 [1,5-bis(3,4-dimethoxyphenyl) penta-1,4-dien-3-one] and curcumin analog 2 [2,6-bis(3,4-dimethoxybenzaldehyde)cyclohexanone] and their inhibition activity toward  $\alpha$ -amylase enzyme and their synergistic effect in combination with ferulic acid had been carried out in this study. The synthesis of these two curcumin analogs involved Claisen-Schmidt crossed aldol condensation reaction between 3,4-dimethoxybenzaldehyde and ketones (acetone and cyclohexanone) in base condition using sonochemistry method. The synthesis reaction occurred in 10-30 minutes at room temperature. Activity of curcumin analogs in inhibiting  $\alpha$ -amylase enzyme and their synergistic effect in combination with ferulic acid were obtained by calculating the value of starch-iodine complex using iodine reagent and by quantifying the amount of maltose using DNS (3,5-dinitrosalicylic acid) reagent. The absorbance was measured at 700 and 540 nm using microplate reader.

The results showed that curcumin analog 1 obtained as a yellow-orange solid with 82.40% in yield and melting point at 73-76 °C. Curcumin analog 2 was obtained as a yellow colored crystal with 77.52% in yield and melting point at 139-140 °C. Curcumin analog 1 and 2 showed an inhibition activity of  $\alpha$ -amylase enzyme, respectively, 38.99% and 50.00% using iodine reagent, whereas with DNS reagent, the highest inhibition activity of curcumin analog 1 and 2, respectively, 85.11% and 82.98%. The result of synergistic effect analyze showed that curcumin analog 1 and 2 have a synergy effect in combination with ferulic acid in inhibiting  $\alpha$ -amylase enzyme. On the other hand, the result of calculation of Combination Index (CI) showed that only combination between curcumin analog 1 and ferulic acid in 25:25 and 25:50 ratio that give a synergy effect.

Keywords: curcumin analog, 3,4-dimethoxybenzaldehyde, sonochemistry,  $\alpha$ -amylase, synergistic effect.