PREPARASI NANOPARTIKEL ANALOG KURKUMIN MONOKETON DAN UJI AKTIVITASNYA SEBAGAI INHIBITOR ENZIM α-AMILASE

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INTISARI

Sintesis senyawa (2E,6E)-2,6-bis(3,4-dimetoksibenzilidin)sikloheksanon one (AK1) dan senyawa (2E,6E)-2,6-bis(3,4,5-trimetoksibenzilidin)sikloheksanon (AK2) telah dilakukan. Senyawa AK1 dan AK2 disintesis melalui reaksi kondensasi Claisen-Schmidt, dimana aldehida aromatik berupa 3,4 dimetoksibenzaldehida dan 3,4,5-trimetoksibenzaldehida dengan sikloheksanon dalam kondisi basa menggunakan sonikasi. Hasil sintesis analog kurkumin diubah menjadi nanopartikel dengan metode nanopresipitasi penguapan pelarut menggunakan tween 60 sebagai zat penstabil untuk mencegah aglomerasi analog kurkumin. Sintesis analog kurkumin dan nanopartikel analog kurkumin diuji aktivitasnya sebagai inhibitor enzim α-amilase melalui penurunan konsentrasi kompleks pati-iodin menggunakan reagen iodin. Senyawa AK1 dan AK2 dilihat interaksinya dengan penambatan molekul.

Hasil sintesis AK1 dan AK2 diperoleh rendemen masing-masing 87% dan 72%. Pembuatan nanopartikel didapatkan ukuran partikel mayoritas pada senyawa AK1-NP dan AK2-NP masing-masing 17,83 nm dengan nilai PDI 0,1535 dan 147,1 nm dengan nilai PDI 0,2990. Senyawa AK1, nanopartikel AK1 (AK1-NP) dan nanopartikel AK2 (AK2-NP) memiliki aktivitas inhibisi terhadap enzim α-amilase yang lebih baik dibandingkan akarbosa dengan nilai inhibisi masing-masing 62,69 %, 88,38%, 63,01% dan akarbosa 53,76%. Senyawa nanopartikel analog kurkumin memiliki nilai inhibisi lebih baik dibandingkan kurkumin dikarenakan adanya peningkatan kelarutan. Senyawa AK1 dan AK2 berinteraksi dengan residu asam amino spesifik Tyr380, His395, Thr392 pada sisi aktif protein enzim α-amilase. Senyawa AK1 memiliki interaksi dengan residu asam amino spesifik dan nilai afinitas ikatan terendah terhadap protein enzim α-amilase.

Kata kunci : analog kurkumin, nanopartikel, penambatan molekul, α-amilase

PREPARATION OF NANOPARTICLES ANALOGOUS CURCUMIN MONOKETONE AND ACTIVITY ASSAY AS α-AMYLASE ENZYME INHIBITORS

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ABSTRACT

The synthesis of compounds (2E,6E)-2,6-bis(3,4-dimethoxybenzylidene) cyclohexanone (AK1) and (2E,6E)-2,6-bis(3,4,5-trimethoxybenzylidene) cyclohexanone (AK2) has been conducted. Compounds AK1 and AK2 were synthesized via Claisen-Schmidt condensation reaction, where aromatic aldehydes in the form of 3,4-dimethoxybenzaldehyde and 3,4,5-trimethoxybenzaldehyde reacted with cyclohexanone under basic conditions using sonication. The synthesis products of curcumin analogues were transformed into nanoparticles using the nanoprecipitation solvent evaporation method with tween 60 as a stabilizing agent to prevent curcumin analogue agglomeration. The synthesized curcumin analogues and curcumin analogue nanoparticles were tested for their activity as α-amylase enzyme inhibitors by measuring the reduction in starch-iodine complex concentration using iodine reagent. Compounds AK1 and AK2 were observed for their interaction with molecular docking.

The synthesis yields of AK1 and AK2 were 87% and 72%, respectively. Nanoparticle production resulted in the majority particle sizes of AK1-NP and AK2-NP compounds at 17.83 nm with a PDI value of 0.1535 and 147.1 nm with a PDI value of 0.2990, respectively. Compound AK1, AK1 nanoparticles (AK1-NP), and AK2 nanoparticles (AK2-NP) exhibited better α-amylase enzyme inhibition activity compared to acarbose with inhibition values of 62.69%, 88.38%, 63.01%, and acarbose 53.76%, respectively. Nanoparticle curcumin analogue compounds showed better inhibition values than curcumin due to increased solubility. Compounds AK1 and AK2 interacted with specific amino acid residues Tyr380, His395, and Thr392 on the active site of the α-amylase enzyme protein. Compound AK1 exhibited interactions with specific amino acid residues and the lowest binding affinity value to the α-amylase enzyme protein.

Keywords: curcumin analog, nanoparticles, molecular docking, α-amylase.