# SINTESIS ANALOG KURKUMIN MONO-KETON BERBAHAN DASAR 4-BENZILOKSI-3-METOKSIBENZALDEHIDA DAN UJI AKTIVITASNYA SEBAGAI INHIBITOR ENZIM α-AMILASE

**Rio Abdurrahman**
**14/365686/PA/16137**

## INTISARI

Sintesis senyawa analog kurkumin mono-keton berbahan dasar 4-benziloksi-3-metoksibenzaldehida dan uji aktivitasnya sebagai inhibitor enzim α-amilase telah dilakukan. Penelitian ini diawali dengan sintesis senyawa 4-benziloksi-3-metoksibenzaldehida dari vanilin dengan reagen benzil klorida, kalium iodida dan kalium karbonat dalam pelarut dimetil formamida menggunakan metode refluks selama 1 jam. Sintesis senyawa analog kurkumin dilakukan dengan cara reaksi kondensasi aldol silang Claisen-Schmidt senyawa 4-benziloksi-3-metoksibenzaldehida dengan aseton (kurkumin analog A) dan siklopentanon (kurkumin analog B) dan penambahan katalis kalium hidroksida 5% serta menggunakan metode refluks selama 1 jam. Struktur senyawa hasil sintesis dielusidasikan dengan spektrometer FTIR, *Direct Inlet-MS*, $^{1}$H-NMR dan $^{13}$C-NMR. Senyawa analog kurkumin hasil sintesis diuji aktivitas penghambatannya terhadap enzim α-amilase dengan penentuan presentase inhibisi dan tipe inhibitornya. Aktivitas inhibisi senyawa analog kurkumin tersebut dibandingkan dengan akarbosa sebagai kontrol positif.

Hasil penelitian diperoleh senyawa 4-benziloksi-3-metoksibenzaldehida berupa padatan berwarna putih dengan rendemen 90,4% dan titik leleh 56-58 °C. Pada senyawa analog kurkumin A diperoleh padatan berwarna kuning pucat dengan rendemen 81,3% dan titik leleh 139-141 °C, sedangkan pada senyawa analog kurkumin B diperoleh padatan berwarna kuning cerah dengan rendemen 94,5% dan titik leleh 154-155 °C. Senyawa analog kurkumin A menunjukkan aktivitas inhibisi tertinggi sebesar 98,0% pada konsentrasi 1 mM, senyawa analog kurkumin B menunjukkan aktivitas inhibisi tertinggi sebesar 95,6% pada konsentrasi 0,5 mM dan akarbosa sebagai kontrol positif menunjukkan aktivitas inhibisi tertinggi sebesar 90,2% pada konsentrasi 1 mM. Parameter kinetika enzim α-amilase menunjukkan nilai $K_M$ sebesar 16,9 g/L dan $V_{maks}$ sebesar 1,68 g.L$^{-1}$/menit. Parameter kinetika enzim α-amilase dengan adanya inhibitor berupa senyawa analog kurkumin A dan B menunjukkan penurunan nilai $K_M$ dan $V_{maks}$. Hal tersebut menyatakan bahwa senyawa analog kurkumin A dan B merupakan tipe inhibitor unkompetitif.

Kata kunci: 4-benziloksi-3-metoksibenzaldehida, analog kurkumin, benzilasi, enzim α-amilase.

# *SYNTHESIS OF MONO-KETONE CURCUMIN ANALOGUES FROM 4-BENZYLOXY-3-METHOXYBENZALDEHIDE AND THEIR ACTIVITY ASSAY AS INHIBITOR OF α-AMYLASE ENZYME*

**Rio Abdurrahman**
**14/365686/PA/16137**

## ABSTRACT

Synthesis of mono-ketone curcumin analogues from 4-benzyloxy-3-methoxybenzaldehyde have been successfully conducted. This research was firstly initiated by synthesizing 4-benzyloxy-3-methoxybenzaldehyde from vanillin using benzyl chloride, potassium iodide and potassium carbonate in dimethyl formamide under reflux condition for an hour. Synthesis of mono-ketone curcumin analogues was performed through Claisen-Schmidt reaction by refluxing 4-benzyloxy-3-methoxybenzaldehyde with acetone (curcumin analogue A) and cyclopentanone (curcumin analogue B) using potassium hydroxide 5% catalyst for an hour. The structures of the products were elucidated by FTIR Spectrometer, Direct Inlet-Mass Spectrometer, $^{1}$H-NMR and $^{13}$C-NMR. Mono-ketone curcumin analogues were evaluated for their activity assay towards inhibition of α-amylase enzyme. The inhibition type of mono-ketone curcumin analogues was also investigated. The inhibition results of mono-ketone kurkumin analogues were compared to acarbose as positive control.

The results showed that 4-benzyloxy-3-methoxybenzaldehyde was obtained as white solid with a yield of 90.4% and melting point of 58-60 °C. Mono-ketone curcumin analogue A (acetone) was also obtained as pale yellow solid with a yield of 81.3% and melting point 139-141 °C, while mono-ketone curcumin analogue B was obtained as bright yellow solid with a yield of 94.5% and melting point of 154-155 °C. The results of inhibition activities of α-amylase enzyme showed that mono-ketone curcumin analogue A had the highest inhibition activity of 98.0% at concentration of 1 mM, while mono-ketone analogue curcumin B showed the highest inhibition activity of 95.6% at concentration of 0.5 mM. Acarbose as positive control showed the highest inhibition activity of 90.2% at concentration of 1 mM. The starch substrate was then hydrolized by α-amylase with $K_M$ value of 16.9 g/L and $V_{max}$ of 1.68 g.L$^{-1}$/min. The presence of two inhibitors of mono-ketone curcumin analogue A and B showed the decline both of $K_M$ and $V_{max}$ values towards α-amylase enzyme. Therefore, both curcumin analogue A and B were considered as uncompetitive inhibitor in inhibiting α-amylase enzyme.

Keywords: 4-benzyloxy-3-methoxybenzaldehyde, α-amylase enzyme, benzylation, curcumin analogues.