# SINTESIS HIDROKSIKUMARIN DAN HASIL ALDOL KONDENSASINYA SERTA UJI AKTIVITASNYA SEBAGAI SENYAWA ANTIKANKER

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## INTISARI

Penelitian ini melaporkan sintesis senyawa hidroksikumarin serta produk aldol kondensasinya sebagai kandidat antikanker. Tujuan penelitian ini adalah melakukan sintesis senyawa hidroksikumarin yang dilanjutkan dengan reaksi aldol kondensasinya menggunakan metoksibenzaldehida serta menentukan nilai $IC_{50}$ dari semua produk sebagai agen antikanker. Sintesis hidroksikumarin dilakukan melalui reaksi kondensasi *Knoevenagel* antara 2,4 dihidroksibenzaldehida dan etil asetoasetat menggunakan basa piperidin dengan metode sonikasi. Kemudian reaksi kondensasi *Claisen-Schmidt* antara hidroksikumarin dengan 4-metoksibenzaldehida dan 3,4-dimetoksi benzaldehida dilakukan pada suhu ruang menggunakan basa NaOH. Produk sintesis dikarakterisasi menggunakan uji titik leleh, *TLC Scanner*, spektroskopi FTIR, $^{1}$H-NMR dan $^{13}$C-NMR. Aktivitas antikanker diuji secara *in vitro* terhadap sel T47D, MCF-7, dan WiDr serta sel Vero menggunakan metode MTT.

Senyawa hidroksikumarin diperoleh sebagai padatan berwarna kuning kecoklatan dengan persen hasil 76% dan titik leleh 234-235 °C. Reaksi aldol kondensasi terhadap hidroksikumarin menghasilkan senyawa **A** ((1*E*,4*E*)-1-(2,4-dihidroksifenil)-5-(4-metoksifenil)penta-1,4-dien-3-on) berupa padatan berwarna merah bata dengan persen hasil 32% serta titik lelehnya 205,7-207,1 °C, sedangkan senyawa **B** ((1*E*,4*E*)-1-(2,4-dihidroksifenil)-5-(3,4-dimetoksifenil)penta-1,4-dien-3-on)) berwujud padatan coklat tua dengan persen hasil 36% dan titik leleh 218,6-220,3 °C. Hasil uji sitotoksisitas menunjukkan bahwa senyawa **A** dan **B** memiliki aktivitas antikanker yang lebih tinggi dibandingkan hidroksikumarin dengan nilai $IC_{50}$<20 µg/mL. Senyawa **A** menunjukkan aktivitas terbaik dengan nilai $IC_{50}$ masing-masing 7,06 dan 10,22 µg/mL terhadap sel T47D dan MCF-7, serta indeks selektivitas 1,96 dan 1,46.

Kata kunci: aldol, antikanker, kumarin, MTT assay.

# *SYNTHESIS OF HYDROXYCOUMARIN AND ITS ALDOL CONDENSATION PRODUCTS AND EVALUATION* OF THEIR ANTICANCER ACTIVITY

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## ABSTRACT

This study reports the synthesis of hydroxycoumarin compound and its aldol condensation products as potential anticancer agents. This research aims to synthesize hydroxycoumarin, perform its aldol condensation reaction with methoxybenzaldehyde, and determine the $IC_{50}$ values of all synthesized products as anticancer agents. The hydroxycoumarin was synthesized via a Knoevenagel condensation reaction between 2,4-dihydroxybenzaldehyde and ethyl acetoacetate using piperidine as a base under sonication. Subsequently, Claisen-Schmidt condensation reactions between hydroxycoumarin and 4-methoxybenzaldehyde or 3,4-dimethoxybenzaldehyde were performed at room temperature using NaOH as the base. The synthesized products were characterized by melting point analysis, TLC Scanning, FTIR, $^{1}$H-NMR, and $^{13}$C-NMR spectroscopy. Anticancer activity was evaluated *in vitro* against T47D, MCF-7, and WiDr cancer cells, as well as Vero cells, using the MTT assay.

Hydroxycoumarin compound was obtained as a yellowish-brown solid with a yield of 76% and a melting point of 234-235 ℃. The aldol condensation reaction of hydroxycoumarin produced compound **A** ((1*E*,4*E*)-1-(2,4-dihydroxyphenyl)-5-(4-methoxyphenyl)penta-1,4-dien-3-one) as a brick-red solid with a yield of 32% and a melting point of 205.7-207.1 ℃, while compound **B** ((1*E*,4*E*)-1-(2,4-dihydro xyphenyl)-5-(3,4-dimethoxyphenyl)penta-1,4-dien-3-one) was obtained as a dark brown solid with a yield of 36% and a melting point of 218.6-220.3 ℃. The cytotoxicity tests showed that compounds **A** and **B** exhibited higher anticancer activity than hydroxycoumarin, with $IC_{50}$ values below 20 μg/mL. Compound **A** demonstrated the best activity, with $IC_{50}$ values of 7.06 and 10.22 μg/mL against T47D and MCF-7 cells, respectively, and selectivity indices of 1.96 and 1.46.

Keywords: aldol, anticancer, coumarin, MTT assay.