Synthesis and antidiabetic activity from curcumin analogue of tiofen and furan derivatives

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Abstract

Three curcumin analogue of tiofen and furan derivatives have been synthesised from acetone and cyclohexanone with 2-tiofen carbaldehyde and furfur al through Claisen-Schmidt Condensation reaction in alkali condition by using grinding method. These compounds were \((1E,4E)-1,5\text{-di(tiofen-2-il)penta-1-4-dien-3-on (L1)}\), \((2E,6E)-2,6\text{-bis-(tiofen-2-il-methylene)cyclohexanone (L2)}\), \((2E,6E)-2,6\text{-bis-(furan-2-il-methylene)cyclohexanone (L3)}\) and resulted yield percentage of 55.04%, 68.05% and 59.30% respectively. All compounds were confirmed their structure by using UV, IR spectroscopy, \(^{13}\text{C}-\text{NMR}\) and \(^1\text{H}-\text{NMR}\). Furthermore, antidiabetic activity study revealed that all the compounds showed no activity.

Keyword: Curcumin, Condensation, Claisen-Schmidt, Antidiabetic activity

Introduction

Curcumin compounds can be found in many types of the Curcuma Genus and it is the main pigment in turmeric (\textit{Curcuma longa}). Some of the curcuminoid compounds found in turmeric are curcumin (1), 4- dimethoxycurcumin (2) and bisdimethoxycurcumin (3), which are the derivative compounds of diarylheptanoid. In addition, an asymmetric derivative of curcuminoid, dihydrocurcumin (4) (Achmad \textit{et al.}, 2007).

\begin{align*}
(1) & & & (2) & & & (3) & & & (4) \\
\text{H}_3\text{CO} & & \text{HO} & & \text{OCH}_3 & & \text{H}_3\text{CO} & & \text{HO} & & \text{OCH}_3 \\
\text{HO} & & \text{O} & & \text{HO} & & \text{HO} & & \text{O} & & \text{HO} \\
\text{H}_3\text{CO} & & \text{HO} & & \text{OCH}_3 & & \text{H}_3\text{CO} & & \text{HO} & & \text{OCH}_3
\end{align*}

Curcumin compounds are one of secondary metabolites from phenolic group. Various curcumin compounds have been reported possess biological activities such as anti-inflammatory (Kimi \textit{et al.}, 2003), antioxidant (Suzuki \textit{et al.}, 2005), anti-infectious and anti-allergy (Handler \textit{et al.}, 2007), hepatoprotector and HIV virus inhibitor (Di Santo., 2003).

The curcumin that was isolated from natural sources was found in a small amount of around 3-5% from the dry weight and has a limited structure variation; it becomes a problem in optimizing the function of curcumin (Stankovic, 2004). Therefore, there needs to be an effort to synthesize in the laboratory in order to get the analogue of curcumin analogues in the desired number and a wide range of structure variation. Generally, curcumin analogues can be synthesized by using Claisen-Schmidt condensation reaction from ketone and aromatic aldehyde. Aldol condensation reaction is very accepted and used in terms of carbon binding because it is simple, the material is easy to obtain and it is well-known as environmental-friendly reaction. Furthermore, this method makes possibility to synthesis curcumin analogue with various substituent and resulting curcumin molecule database.

This database can be used to find biological activities from curcumin analogues such as antimicrobe, anticancer, and anti-inflammatory. It is useful to find relationship between chemical structure and their biological activities and physical-chemistry properties.

Material and Methods

Equipments

Fisher Jhon melting point, incubator, FT-IR (Perkin Elmer 1600), NMR (JEOL JNM-ECA 500 MHz)

Materials

Acetone, cylohexanone (Aldrich), 2-tiofen carbaldehyde (Merck), furfural, sodium hydroxide octahydrate (Merck), methanol , dichloromethane, ethyl acetate, hexane, TLC plate GF\textsubscript{254} (Merck), alocasane tetrahydrate, glucose 5%, glibenclamide, NaCMC, Gluco Dr\textsuperscript{TM} Blood Glucose Test Strips.