THE STUDY ON THE INCLUSION COMPLEXES OF γ-CYCLODEXTRIN WITH SOME SELECTED PHENOLIC COMPOUNDS AND FATTY ACIDS

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Abstract

The aim of this study is to examin the physicochemical properties of the inclusion complexes of a number of vital phenolic compounds, including Caffeic acid (CA), Ferulic acid derivative 012(FAD012) and fatty acids like α-linolenic (ALA) and Eicosapentaenoic (EPA) acids , that are beneficial for human health and have important use in many applications with γ-cyclodextrin. The inclusion complexes of the selected compounds with γ-cyclodextrin could play an important role in improving the physicochemical properties of the included selected compounds due to complexation. Thus, enhancement of their effective use in various applications. Cyclodextrins (CDs) can form inclusion complexes with various organic compounds in which the physiochemical properties of the included organic molecules are changed and γ-cyclodextrin (γ-CD) was used in this study because of its unique properties such as having a larger internal cavity, which can trap larger molecules that cannot be trapped by α- and β-cyclodextrins and its noncoplanar and more flexible structure, which gives it the much higher solubility than α- and β-cyclodextrin. In this study, the selected phenolic and fatty acids with (γ-CD) as inclusion complexes were studied. The complexes were characterized by various analytical methods like Powder x-ray diffraction (PXRD), Differential scanning calorimetry (DSC), Fourier transform infrared (FT-IR) spectroscopy, and Scanning electron microscopy (SEM). Results showed that the formation of caffeic acid (CA) and γ-Cyclodextrins (γ-CD) inclusion complexes helped to increase the electron density of caffeic acid (CA) in the Cyclodextrin (CD) cavity, also the formation of the Perilla oil/γ-CD complexes helped to increase the bioavailability of α-linolenic acid which lead in turn to increase plasma n-3 fatty acids like Eicosapentaenoic (EPA) that play many important biological roles , finally a solubility test (25°C) for The 3D ground mixture (3DGM) of (FAD012)/γ-CD indicated that solubility improved about 5-fold in comparison to the solubility of FAD012 alone (about 140 μg/mL). And the results in this study emphasize the ablility of the selected compounds to form inclusion complexes in the hydrophobic cavity of γ-cyclodextrin by non-covalent bonds resulting in changing in their physicochemical properties due to the complex formation and thus enhancement their use in more potential life applications. In addition, the unique properties of γ-cyclodextrin, its chiral supramolecular assembly, mechanism of inclusion complex formation and its vital applications in various fields have been discussed.

Key Words: Cyclodextrin, γ–cyclodextrin, Chiral supramolecular assembly, Chiral recognition, Caffeic acid (CA), Ferulic acid derivative 012 (FAD012), Perilla oil, Inclusion complexes, Applications of γ–cyclodextrin.