Research Paper

Enzymatic interesterification of structured lipids containing conjugated linoleic acid with palm stearin for possible margarine production

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Structured lipids containing conjugated linoleic acid as a functional ingredient were blended with palm stearin in the ratios of 30 : 70, 40 : 60, 50 : 50, 60 : 40 and 70 : 30 (wt/wt). The blends were subjected to enzymatic interesterification by *Candida antarctica* lipase. After interesterification of the blends, changes in the physical properties of the products, including lower melting points and solid fat contents along with different melting behaviors, were evidenced. Analysis of triacylglycerols (TAG) of the interesterified blends showed a decrease in the concentration of high-melting TAG. X-ray diffraction analysis revealed, that all the reacted blends were predominantly in the β' crystal form. The mixture could be used for the formulation of margarines or other, similar products.

Keywords: Conjugated linoleic acid / Enzymatic interesterification / Palm stearin / Structured lipids

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1 Introduction

Conjugated linoleic acid (CLA) refers to a group of geometrical and positional isomers of linoleic acid. Studies have revealed biological effects of two important isomers of CLA, *cis*9,*trans*11 and *trans*10,*cis*12, such as inhibiting tumor growth, reducing atherosclerotic risk and reducing body fat [1–4]. The major natural sources of CLA are fat tissues of ruminants (meat and dairy products). Vegetable oils contain small amounts of CLA (0.1–0.5 mg/g fat) which is formed as a result of industrial processing: oil refining processes (mainly deodorization) and the catalytic process of hydrogenation [5]. Even though CLA has beneficial effects, the consumption of dietary CLA has decreased during the past 20 years due to the replacement of milk and animal fats by vegetable oils; therefore, consuming CLA-enriched foods is useful to provide the acclaimed health benefits of CLA for the human body [6].

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Structured lipids (SL) are any lipids restructured by interesterification (IE) treatment to change their fatty acid (FA) composition; however, enzyme-catalyzed IE of CLA with any oil or fat is a common approach to increase the CLA content of triacylglycerols (TAG) in foods [6–8].

Most native fats and oils have only limited application in their original forms. To widen their uses, they may be modified by hydrogenation, IE, fractionation, or even simple blending. At the beginning of the 20th century, hydrogenation of vegetable oils was developed to improve their physicochemical properties and has been used for margarine production [9, 10]. However, since partial hydrogenation results in the formation (up to 50%) of *trans* fatty acids (TFA), which have detrimental effects on human health resulting in altered cell membrane integrity, lower high-density lipoprotein (HDL) and increased low-density lipoprotein (LDL) cholesterol, raising the risk of coronary heart diseases [9, 11], much attention has been focused on IE as an alternative method to develop low- and zero-*trans* solid fats in the food industry [12].

IE involves interchanging FA within and between TAG molecules, which changes the fat and oil structure. Two types of IE, chemical IE (CIE) and enzymatic IE (EIE), are currently in commercial use. Generally, EIE has certain advan-

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