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Synthesis and Anti-cancer effect of Monoacylglyceride and their Derivatives from Fish Oil, using Chemo-Enzymatic Methods

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Introduction

Many different types of lipase have been investigated for enzymatic modifications of lipid or fatty acid. Based on their specificity or selectivity, these lapases can be classified into three types; regio-specific, fatty acid type-specific, and specific for a certain of acylglycerol. The reactions like hydrolysis, glycerolysis, esterification, acidolysis, and interesterfication were catalyzed by these lipases. Using these reactions, the aim is to obtain specific products at the highest yield and purity. Fish processing by-products including head, intestine, skin, and skeletal bone are up to 50-80% of whole fish body weight. Wastes from fish processing are used to produce fish meal, fish oil, or soil fortifier. Lipid content in fishery wastes ranges between 1.4 and 40.1% depending on the species and tissue. Therefore, fish processing waste is considered as an important source of fish oil.

In this presentation, we showed how to synthesize bioactive derivatives of fish oil by enzymatic modification, and identified its anti-cancer effect.

Materials and Methods

Materials

Lipase from Porcine. pancrease, Candida.cylindracea were purchased from Sigma-Aldrich Co, Ltd. (St. Louis, MO, USA). Lipase from Rhizomucor.miehei were purchased Genofocus Co. Ltd. (Daejeon, Korea). Molecular sieve 5Å was purchased from Sigma-Aldrich (St.Louis, MO, USA). Solvents were either of HPLC grade or AR grade.

Lipase catalyzed synthesis of MG

Reaction between glycerol and FA(molar ratios 1:6)was performed in mmol scale in polar organic solvent. Typically, glycerol(0.2304g, 2.5mmol), fatty acid(4.2162,15mmol), 2.5g lipase, 200mg molecular sieve, and 25ml of dioxane were placed into 100ml round bottom flask. The reaction mixture was incubated in a water bath at 30 ℃ and magnetically stirred for 72hours. After removal of the enzyme by filtration and evaporation of the solvent, a crude
mixture was recrystallized from hexane.

Monoacylglyceride derivatives synthesis

Lysophosphatidicacid(LPA) and Lysophosphatidylcholine(LPC) was synthesized according to the procedure described by Haftendorn *et al.* Scheme 1 show the synthetic route for LPA and LPC.

Results and Discussion

In this study, we synthesized MG and their derivatives. Enzyme used were *Porcine. pancrease, Candida.cylindracea* and *Rhizomucor.miehei.* Their conversion of MG were investigated in various conditions such as substrate molar ratios, enzyme amounts, solvent and temperature. The conversion of PPL was 10~20% higher than that of the others. Furthermore, the MG conversion of 100mg/ml PPL was the highest among tested enzyme. The conversion conditions of substrate molar ratios, solvent ant temperature were 1:6, Dioxane and 30 ℃, respectively.

And, synthesized MG derivative such as LPA and LPC. Their Anti-cancer activity of LPA determined by MTT assay. LPC was effectively for cell cytotoxicity, but MG and LPA were ineffectively.

Reference

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