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關鍵字(中)	反式脂肪酸 氣相層析-火燄離子偵檢器 氣相層析質譜儀 雞腿 薯條
關鍵字(英)	Trans fatty acids GC-FID GC-MS Chicken legs French fries
摘要(中)	氫化油脂廣泛的被應用於烘焙食品、油炸食品和人造奶油等食品中，因此，在許多食品中都可發現反式脂肪酸的存在。根據流行病學的研究指出，攝取過量反式脂肪酸可能會導致血液中膽固醇含量上升及癌症發生。

	本研究之目的即在開發分析食品中反式脂肪酸的方法，並探討反式脂肪酸於油脂及油炸食品加熱過程中的生成。以雞腿及薯條為原料，利用未經氫化大豆油和氫化大豆油以 160、180 和 200 ℃油炸。此外，將未經氫化大豆油和氫化大豆油於相同溫度下單獨加熱，並將加熱時間延長為 24 小時。油炸雞腿及薯條以氯仿和甲醇（2:1, v/v）混合溶劑萃取反式脂肪酸，再進行皂化及甲基酯化；油炸油部分則直接進行皂化及甲基酯化。以氣相層析儀配合火燄離子偵檢器和質譜儀，分析及鑑定樣品及油脂於不同加熱條件下，反式脂肪酸生成的種類和含量。評估的毛細管柱包括 DB-1（J&W, 60 m × 0.32 mm I.D., 0.25 μm film thickness）、INNOWax（Agilent, 30 m × 0.32 mm I.D., 0.25 μm film thickness）、INNOWax（Agilent, 60 m × 0.32 mm I.D., 0.25 μm film thickness）及 HP-88 (Agilent, 100 m × 0.25 mm I.D., 0.2 μm film thickness)。結果顯示，HP-88 管柱具有最佳的分離效果，注射器分流比 10:1，管柱初始溫度 170℃，維持 24 分鐘，每分鐘昇高 7.5 ℃至 220 ℃，再每分鐘昇高 10 ℃至 230 ℃，維持 5 分鐘；可於 31 分鐘同步分離 8 種反式脂肪酸。 新鮮大豆油中並未發現反式脂肪酸，經 160~200 ℃加熱 24 小時後亦未偵測到反式脂肪酸。相反的，新鮮氫化大豆油中含有三種反式油酸（C18: 1, Δ6t , Δ9t 及 Δ11t）及一種反式亞麻油酸（C18: 2, Δ9t,Δ12t），但經 160~200 ℃加熱 24 小時後亦未發現反式脂肪酸有明顯生成的現象。單獨加熱未經氫化大豆油和氫化大豆油的脂肪酸含量變化會隨加熱時間及溫度增加而減少，且以 200 ℃加熱 24 小時的減少最為劇烈。 未經氫化大豆油油炸的薯條中並未發現反式脂肪酸的生成，氫化大豆油油炸的薯條中則有發現反式脂肪酸，可能是因油炸過程吸收油炸油所致，但於油炸過程並未偵測到反式脂肪酸的生成。雞腿肉部分則無論是以未經氫化大豆油或是氫化大豆油油炸，在油炸過程中皆未發現反式脂肪酸的生成。生雞腿皮於未經氫化大豆油油炸過程中亦未發現反式脂肪酸的生成。經氫化大豆油油炸後的雞腿皮則有發現反式脂肪酸。此種結果顯示，反式脂肪酸必須於更劇烈的加熱條件下才有可能形成。
摘要(英)	Hydrogenated oil has been widely applied in baking products, frying products and margarine. Thus, trans fatty acids could be found in most of the food products. Epidemiological studies have shown that the intake of excessive amount of trans fatty acids may increase the cholesterol content in blood and lead to occurrence of cancer. The objectives of this research were to develop an improved method for analysis of trans fatty acids and study their formation in fried oil and foods. Both chicken legs and French fries were fried in soybean oil or hydrogenated soybean oil at 160, 180 and 200℃, respectively. In addition, fresh soybean oil and hydrogenated soybean oil were heated separately at different temperatures for 24 h. In fried chicken legs and French fries, the trans fatty acids were extracted using a solvent system of chloroform and methanol(2:1, v/v), followed by saponification and methylation. However, for frying oils, a direct saponification and methylation method was employed. Both fried foods and oils were analyzed separately to study the formation of trans fatty acids and determine their contents by gas chromatography coupled with flame ionization and mass spectrometry detectors. Four types of columns, including DB-1 (J & W, 60 m × 0.32 mm I.D., 0.25 μm film thickness), INNOWax (Agilent, 30 m × 0.32 mm I.D., 0.25 μm film

	thickness), INNOWax (Agilent, 60 m × 0.32 mm I.D., 0.25 μm film thickness) and HP-88 (Agilent, 100 m × 0.25 mm I.D., 0.2 μm film thickness) were compared for their separation efficiency of trans fatty acids. Results indicated that a HP-88 column provided better separation than the other columns. The injector split ratio was 10:1, and the column temperature was 170℃ in the beginning, maintained for 24 min, increased to 220℃ at 7.5℃/min, to 230℃ at 10℃/min, and maintained for 5 min. A total of eight trans fatty acids were separated within 31 min. The trans fatty acids were not detected in fresh soybean oil even after heating at 160~200 ℃ for 24 h. Conversely, three trans oleic acids (C18: 1, Δ6t, Δ9t and Δ11t) and one trans linoleic acid (C18: 2, Δ9tΔ12 t) were found in unheated hydrogenated soybean oil. However, the hydrogenated soybean oil did not show any trans fatty acids formation after heating at 160~200℃ for 24 h. The amounts of trans fatty acids in the fresh soybean oil and hydrogenated soybean oil decreased both with increasing heating time and temperature, and reached a plateau at 200℃ for 24 h. Trans fatty acids were not detected in French fries fried in fresh soybean oil, but were found in those fried in hydrogenated soybean oil, probably because of absorption of oil by French fries during frying. However, no obvious trans fatty acids formation occurred during frying. For chicken leg meat, trans fatty acids did not form as well during frying in fresh soybean oil or hydrogenated soybean oil. Likewise, trans fatty acids were not detected in chicken leg skin fried with soybean oil but were present in chicken leg skin fried with hydrogenated soybean oil. All in all, the trans fatty acids may only be formed under drastic frying condition.
論文目次	

參考文獻

第六章、參考文獻 丁詩同，劉秉勳，許哲銘。2003。多不飽和脂肪酸調控脂質代謝基因表達之機制。科學農業。51(7,8): 160-168。 王中奇。1996。食品工業月刊。10: 8-15。 王美芩，李敏雄，鍾玉明。1997。油脂中油離態脂肪酸及總脂肪酸之簡易定量分析。中國農業化學會誌。35: 581-595。 何國榮，鄭杏玲。1997。快速氣相層析質譜儀。科儀新知。19: 49-58。 李敏雄，王美芩，閔丙宇。1990。甲基酯化方法對脂肪酸分析結果之影響。食品科學。17:1-10。 林振宏，陳潔如，徐近平，劉麗雲。2001。市售休閒食品脂質及反式脂肪酸含量與其品質分析。台灣農業化學與食品科學。30(3): 218-222。 張為憲，李敏雄，呂政義，張永和，陳昭雄，孫璐西，陳怡宏，張基 郁，顏國欽，林志成，林慶文。1996。食品化學。華香園出版社。 徐雅萍。1998。反式脂肪酸之製備及其對倉鼠脂質代謝之影響。國立台灣海洋大學水產食品科學碩士論文。 菅野道廣。1996。不飽和脂肪酸の營養生理機能:シス?トランスの問題。食品と開發。31: 9-12。 葉伶宜。1996。氣相層析儀之最佳分析條件探討。食品工業月刊。6:36-41。 潘志寬。2003。國內速食業者使用之烹飪油中反式脂肪酸含量之調查。藥物食品簡訊。267:1-2。 蔡文斌，黃伯超。1993。市售部分富含脂質加工食品之各種不同飽和度脂肪酸含量分析。食品科學。20: 178-186。 Abbey M, Nestel P. 1994. Plasma cholesteryl ester transfer protein activity is increased when trans-elaidic acid is substituted for cis-oleic acid in the duet. Atherosclerosis 106: 99-107. Adlof RO. 1994. Separation of cis and trans unsaturated fatty acid methyl esters by silver ion high performance liquid chromatography. J Chromatogr 659: 95-99. Adlof RO, Copes LC, Emken EA. 1995. Analysis of the monoenoic fatty acid distribution in hydrogenated vegetable oils by silver-ion high-performance liquid chromatography. J Am Oil Chem Soc 72: 571-574. Alonso L, Fraga MJ, Ju?rez M, Carmona P. 2002. Fatty acid composition of special emphasis on trans unsaturation content as determined by fourier transform infrared spectroscopy and gas

chromatography. J Am Oil Chem Soc 79: 1-6. American Oil Chemists' Society. 1990. Official methods and recommended practices, official method Ce 1c-89. Andrikopoulos NK, Kalogeropoulos N, Falirea A, Barbagianni MN. 2002. Performance of virgin olive oil and vegetable shortening during domestic deep-frying and pan-frying of potatoes. Inter J Food Sci Technol 37: 177-190. Arie van T, Zock PL, Teus van G, Scheek M, Kantan MB. 1995. Dietary trans fatty acids increase serum cholesteryl ester transfer protein in man. Atherosclerosis 115: 129-134. Arkad O, Wiener H, Garti N, Sasson Y. 1987. Catalytic transfer hydrogenation of soybean oil methyl ester using inorganic formic acid salts as donors. J Am Oil Chem Soc 64: 1529-1532. Aro A, Jauhiainen M, Partanen R, Salminen I, Mutanen M. 1997. Stearic acid, trans fatty acids, dietary fat: effect on serum and lipoprotein lipids, apolipoproteins, lipoprotein(a), and lipid transfer proteins in healthy subjects. Am J Clin Nutr 65: 1419-1426. Aro A, Amaral E, Kesteloot H, Rimestad A, Thamm M, Poppel Gvan. 1998. Trans fatty acids in French fries, soups, and snacks from 14 European countries: the transfair study1. J Food Compos Anal 11: 170-177. Bang JO, Dyerberg J, Dielsen AB. 1971. Plasma lipid and lipoprotein pattern in Greenlandic west-coast Eskimos. The Lancet 1: 1143-1146. Barrera-Arellano D, Ruiz-M?ndez V, Velasco J, M?rquez-Ruiz G, Dobarganes C. 2002. Loss of tocopherols and formation of degradation compounds at frying temperatures in oils differing in degree of unsaturation and natural antioxidant content. J Sci Food Agric 82: 1696-1702. Brieger G, Nestrick TJ. 1974. Catalytic transfer hydrogenation. Chem rev 74: 567-580. Brinkmann B. 2000. Quality criteria of industrial frying oil and fats. Eur J Lipid Sci Technol 102: 539-541. Bucher HC, Hengstler P, Schindler C. 2002. N-3 polyunsaturated fatty acids in coronary heart disease: a meta-analysis of randomized controlled trials. Am J Med 112: 298-304. Caceres L, Diosady LL, Graydon WF, Rubin LJ. 1985. Supported gold catalysis in the hydrogenation of canola oil. J Am Oil Chem Soc 62: 906-910. Calder PC, Zurier RB. 2001. Polyunsaturated fatty acids and rheumatoid arthritis. Curr Opin Clin Nutr Metab Care 4: 115-121. Chappell JE,Clandinin MT, Kearney-Volpe C. 1985. Trans fatty acids in human milk lipids : influence of maternal diet and weight loss. Am J Clin Nutr 42: 49-56. Chiang MT, Lu YS. 1996. Variation of plasm cholesterol levels in rat fed trans fatty acid or cis fatty acids. Internat J Vit Nutr Res 66: 263-269. Christie WW, Breckenridge GHM. 1989. Separation of cis and trans isomers of unsaturated fatty acids by high performance liquid chromatography in the silver ion mode. J Chromatogr 469: 261-269. Christie WW. 1973. The structures of bile phosphatidylcholines. Biochim Biophys Acta 316: 204-211. Christy AA, Egeberg PK, ?stensen ET. 2003. Simultaneous quantitative determination of isolated trans fatty acids and conjugated linoleic acids in oil and fats by chemometric analysis of the infrared profiles. Vibrational Spectroscopy 33: 37-48. Chu YH, Lin LH. 1992. Effect of minor compounds on hydrogenation rate of soybean oil. J Am Oil Chem Soc 69: 880-883. Chung J, Lee J, Choe E. 2004. Oxidative stability of soybean and sesame oil mixture during frying of flour dough. J Food Sci 69(7): 574-578. Craig-Schmidt M, Weete JD, Faircloth SA, Wickwire MA, Livant EJ. 1984. The effect of hydrogenated fat in the diet of nursing mothers on lipid composition and

prostaglandin content of human milk. Am J Clin Nutr 39: 778-786. Delany JP, Bray GA. 1993. Differental oxidation of various fatty acids. Obes Res 1: 415. deMan JM, Pogorzelska E, deMan L. 1983. Effect of the presence of sulfur during the hydrogenation of canola oil. J Am Oil Chem Soc 60: 558-562. Drozdowski B, Zajac M. 1977. Effect of concentration of some nikel catalyst poisons in oil on the course of hydrogenation. J Am Oil Chem Soc 54: 595-599. Dutton HJ. 1979. Hydrogenation of fats and its significane. In:Geometrical and positional fatty acid isomers. ed. by Emken EA, Dutton HJ, Champaign IL: Am Oil Chem Soc 1-16. Duxbury D. 2005. Omega-3s offer solutions to trans fat substitution prombles. Food Technol 59(4): 34-39. Dyerberg J, Bang JO. 1982. A hypothesis on the development of acute myocardial infarction in Greelanders. Scand J Clin Lab Invest 42: 7-13. Emken EA. 1979. Utilization and effects of isomeric fatty acids in human. In: Geometrical and positional fatty acidisomers. ed. by Emken EA, Dutton HJ, Champaign IL: Am Oil Chem Soc 99-175. Emken EA. 1984. Nutrition and biochemistry of trans and positional fatty acid isomers in hydrogenated oils. Annu Rev Nutr 4: 339-376. Emken EA. 1995. Physicochemical properties, intake, and metabolism. Am J Clin Nutr 62: 659-669. Engelhart MJ, Geerlings MI, Ruitenberg A, van Swieten JC, Hofman A, Witteman JCM, Breteler MMB. 2002. Diet and risk of dementia: Does fat matter. Neurology 59: 1915-1921. Firestone D, Sheppard A. 1992. Advances in lipid methodology-one. 273-322. (edite by Christie WW. The Oily Press, Ary) Folch J, Lee M, Sloanestanley GH. 1957. A sample method for the isolation and purification for total lipids from animal tissues. J Biol Chem 226: 497-509. Fox R. 2001. Frying oils. In K. Good burn (Ed.), EU food law: a practical guide. Boca Raton, FL: CRC. Gatto LM, Sullivan DR, Samman S. 2003. Postprandial effects of dietary trans fatty acids on apolipoprotein(a) and cholesteryl ester transfer. J Am Clin Nutr 77: 1119-24. Gertz CZ. 1997. Trans-Fettsauren in lebensmitteln. Lebensmittel Unters Forsch 50: 50-52. Gorringe JA. 1988. Why blame butter? J Royal Soc Med 79: 661-663. Han SN, Leka LS, Lichtenstein AH Ausman LM, Schaefer EJ, Meydani SN. 2002. Effect of hydrogenated and saturated, relative to polyunsaturated, fat on immune and inflammatory responses of adults with moderate hypercholesterolemia. J Lipid Res 43: 445-452. Hayashi K, Hirata Y, Kurushima H, Saeki M, Amioka H, Nomura S, Kuga Y, Ohkura Y, Ohtani H, Kajiyama, G. 1993. Effect of dietary hydrogenated corn oil (trans octadecenoate rich oil) on plasma and hepatic cholesterol metabolism in the hamster. Atherosclerosis 99: 97-106. Hoy CE, Gunhild H. 1990. Influence of dietary linoleic acid and trans fatty acids on the fatty acid profile of cardiolipins in rats. Lipids 25:455-459. Hopkins GY. 1972. Topics in lipid chemistry. 37-87. (edite by Gunstone FD. Logos Press, London) Innis SM, King DJ, Peggy J, Werker J. 1998. Relation of n-6, n-3 and trans fatty acids to growth and visual acuity in exclusively breast fed infants. Fed Proc 12: A970. Indarti E, Majid MIA, Hashim R, Chong A. 2005. Directc FAME synthesis for rapid total lipid analysis from fish oil and cod liver oil. J Food Compos Anal 18: 161-170. Juan?da P. 2002. Utilisation of reversed-phase hight performance liquid chromatography as an alternative to silver-ion chromatography for the separation of cis and trans C18:1 fatty acid isomers. J

Chromatogr 954: 285-289. Kamei M, Ohgaki S, Kanbe T, Niita I, Mizutani H, Matsui-Yuasa I, Otani S, Morita S. 1995. Effects of highly hydrogenated soybean oil and cholesterol on plasma, liver cholesterol, and fecal steroids in rats. Lipids 30: 533-539. Kamel B, Kakuda Y. 1994. Technological Advances in Improved and Alternative Sources of Lipids. U.K. Chapman & Hall : 296-303. Karabulut I, Kayahan M, Yaprak S. 2003. Determination of changes in some physical and chemical properties of soybean oil during hydrogenation. Food Chem 81: 453-456. Kemp P, White RW, Lander DJ. 1975. The hydrogenation of unsaturated fatty acids by five bacterial isolates from the sheep rumen, including a new species. J Gen Microbiol 90: 100-114. Kinsella JE, Bruckner G, Mai J, Schimp J. 1981. Metabolism of trans fatty acids with emphasis on the effect of trans,trans-octadecadienoate on lipid composition, essential fatty acids and prostaglandins: an overview. Am J Clin Nutr 34: 2307-2318. Kitayama Y, Muraoka M, Takahashi M, Kodama T, Itoh H, Takahashi E, Okamura M. 1997. Catalytic hydrogenation of linoleic acid on nickel, copper, and palladium. J Am Oil Chem Soc 73: 1311-1316. Klimmer H. 1984. Influence of various catalyst poisons and other impurities on fatty acid hydrogenation. J Am Oil Chem Soc 61: 200-204. Koga T, Nonaka M, Gu JY, Sugano M. 1997. Linoleic and alpha-linolenic acids differently modify the effects of elaidic acid on polyunsaturated fatty acid metablism and some immune indices in rats. Br J Nutr 77: 645-656. Koning SD, Meer BVD, Alkema G, Janssen HG, Brinkman UAT. 2001. Automated determination of fatty acid methyl ester and cis / trans methyl ester composition of fats and oil. J Chromatogr 922: 391-397. Koritala S, Friedrich JP, Mounts TL. 1980. Selective hydrogenation of soybean oil : X. ultra high pressure and low pressure. J Am Oil Chem Soc January: 1-5. Kose?glu SS, Lusas EW. 1990. Recent advances in canola oil hydrogenations. J Am Oil Chem Soc 67: 39-47. Kris-Etherton PM. 1995. Trans fatty acids and coronary heart disease risk. Am J Clin Nutr 62: 655-708. Kummerow FA, Zhou Q, Mahfouz MM, Smiricky MR, Grieshop CM, Schaeffer DJ. 2004. Trans fatty acids in hydrogenated fat inhibited the synthesis of the polyunsaturated fatty acids in the phospholipid of arterial cells. Life Sci 74: 2707-2723. Lanser AC, Emken EA, Ohhlrogge JB. 1986. Oxidation of oleic and elaidic acids in rat and human heart homogenates. Biochim Biophys Acta 875: 510-515. Larsson R. 1983. Hydrogenation theory: Some aspects. J Am Oil Chem Soc 60: 275-281. Lemaitre RN, King IB, Raghunathan TE, Pearce RM, Weinmann S, Knopp RH, Copass MK, Cobb LA, Siscovick DS. 2002. Cell membrane trans-fatty acids and the risk of primary cardiace arrest. Circulation 105: 697-701. Lichtenstein AH. 2000. Trans fatty acids and cardiovascular disease risk. Curr Opin Lipidol 11: 37-42 Mahfouz MM, Johnson S, Holman RT. 1980. The effect of isomeric trans 18:1 acids on the desaturation of palamitic, linoleic and eicosa-8,11,14-trienoic acids by rat liver microcosms. Lipids 15: 100-107. Mauger JF, Lichtenstein AH, Ausman LM, Jalbert SM, Jauhiainen M, Ehnholm C, Lamarche B. 2003. Effect of different forms of dietary hydrogenated fats on LDL particle size. J Am Clin Nutr 78: 370-5. Martin CA, Carapelli R, Visantainer JV, Matsushita M, Souza NE. 2005. Trans fatty acid content of Brazilian biscuits. Food Chem 93: 445-448. Medina-Ju?rez LA, G?mez-Meza N, Ortega-Garc?a J, Noriega-

Rodriguez JA, Angulo-Guerrero O. 2000. Trans fatty acids composition and tocopherol content in vegetable oils produced in mexico. J Am Oil Chem Soc 51: 721-724. Mensink RP, Katan MB. 1990. Effect of dietary trans fatty acids on high-density and low-density lipoprotein cholesterol levels in healthy subjects. N Engl J Med 323: 439-445. Mensink RP, Katan MB. 1993. Trans monounsaturated fatty acids in nutrition and their impact on serum lipoprotein levels in man. Prog Lipid Res. 32: 111-122. Mikes F, Schurig V, Gil-Av E. 1973. Complex-forming stationary phases in high-speed liquid chromatography. J Chromatogr 83: 91-97. Moore CE, Alfin-Slatter RB, Aftergood L. 1980. Incorporation and disappearance of trans fatty acids in rat tissues. Am J Clin Nutr 33: 2318-2323. M?lleken H. 1998. Trans fatty acids in heated hemp seed oil. J Inter Hemp Association 5(1): 21-25. Mossoba M. 1993. Applications of capillary GC-FTIR. Inform 4:854-859. Mossoba M, MacDonald, RE, Armstrong DJ, Page SW. 1991. Identification of minor C18 triene and conjugated diene isomers in hydrogenated soybean oil and margarine by GC-MI-FT-IR spectroscopy. J Chromatogr Sci 29: 324-330. Nugteren DH. 1970. Inhibition of prostaglandin biosynthesis by 8cis, 12trans, 14cis-eicosatrienoic acid and 5cis, 8cis, 12trans, 14cis-eicosatetraenoic acid. Biochim Biophys Acta 210: 171-176. P?rez-Camino MC, M?rquez-Ruiz G, Ruiz-M?ndez MV, Dobarganes MC. 1991. Lipid changes during frying of frozen prefried foods. J Food Sci 56: 1644-1650. Romero A, Cuesta C, S?nchez-Muniz FJ. 1998. Effect of oil replenishment during deep-fat frying or frozen foods in sunflower oil and high-oleic acid sunflower oil. J Am Oil Chem Soc 75: 161-167. Romero A, Cuesta C, S?nchez-Muniz FJ. 2000. Trans fatty acid production in deep fat frying of frozen foods with different oils and frying modalities. Nutr Res 20: 599-608. Ruiz-Jimenez J, Priego-Capote F, Luque de Castro MD. 2004. Identification and quantification of trans fatty acids in bakery products by gas chromatography-mass spectrometry after dynamic ultrasound-assisted extraction. J Chromatograohy A 1045: 203-210. Samman S. 1995. Dietary trans fatty acids and coronary heart disease. Food Australia 47: 10-13. S?nchez-Muniz FJ, Viejo JM, Medina R. 1992. Deep-frying of sardines in different culinary fats. Changes in the fatty acids composition of sardines and frying fats. J Agric Food Chem 40: 2252-2256. Schmidt S. 2000. Formation of trans unsaturation during partial catalytic hydrogenation. Eur J Lipid Sci Technol 102: 646-648. S?b?dio JL, Grandgirard A, Prevost J. 1988. Linoleic acid isomers in heat treated sunflower oils. J Am Oil Chem Soc 68: 183-189. S?b?dio JL, Catte M, Boudier MA, Prevost J, Grandgirard A. 1996. Formation of fatty acid monomers during the finish frying of frozen prefried potatoes. Food Res International 29: 109-116. S?b?dio JL, Christie WW. 1998. Trans fatty acids in human nutrition. The oil press. Dundee. Simopoulos AP. 1989. Summary of the NATO advanced re-search workshop on dietary ω-3 and ω-6 fatty acids: biological effects and nutritional essentiality. J Nutr 119: 521-528. Smidovnik A, Kobe J, Leskovsek S, Koloini T. 1994. Kinetics of catalytic transfer hydrogenation of soybean oil. J Am Oil Chem Soc 71: 507-511. Smidovnik A, Stimac A, Kobe J. 1992. Catalytic transfer hydrogenation of soybean oil. J Am Oil Chem Soc 69: 405-409. Sprecher H. 1992. Interconversions between 20-and 22-carbon n-3 and n-6 fatty acids via 4-desaturase

	independent pathways. In: Essential fatty acids and eicosanoids. ed. by Sinclari A, Gibson R Champaign, IL: Am Oil Chem Soc 18-22. Stender S, Dyerberg J, Holmer G, Ovesen L, Sandstrom B. 1995. The influence of trans fatty acids on health: a report form the Danish Nutr Council Clin Sci 88: 375-392. Sugano M, Ikeda I. 1996. Metabolism interactions between essential and trans fatty acids. Curr Opin Lipidol 7: 38-42. Sugano M, Ryu K, Ide T. 1984. Cholesterol dynamics in rats fed cis- and trans- octadecenoate in the form of triglyceride. J lipid Res 25: 474-485. Thorsten B, Martijn MP, Zieverink MT, Kreutzer FK, Jacob AM, William PA. 2004. Monolithic catalysts as an Alternative to slurry systems: hydrogenation of edible oil. Ind Eng Chem Res 43: 2337-2344. Uauy R, Hoffman DR, Peirano P, Birch DG, Birch EE. 2001. Essential fatty acids in visual and brain development. Lipids 36: 885-895. Vicario IM, Griguol V, Leon-Camacho M. 2003. Multivariate characterization of the fatty acid profile of spanish cookies and bakery products. J Agric Food Chem 51: 134-139. Wahle KWJ, Gillan MGC, Palmer RM, Earl CRA. 1987. The influence of isomeric cis and trans monoenoic fatty acids on arachidonic acid metabolism in rabbit aorta. Biochem Soc Trans 15: 1124. WHO. 1993. Fats and oils in human nutrition. Report of a Joint Consultation, Food and Agriculture Organization of the United Nations and the World Health Organization. Wu AB, Juan WH, Cheng HW, Lin CW, Chen CY. 1995. Quantitation of fatty acids in milk by gas chromatography. J Food and Drug Anal 3: 163-172. Zock PL, Katan MB. 1992. Hydrogenation alternatives: effects of trans fatty acids and stearic acids versus linoleic acid on serum lipids and lipoproteins in humans. J Lipid Res 33: 399-410. Zock PL, Katan MB. 1997. Trans fatty acids, lipoproteins, and coronary. Can J Physiol Pharmacol 75: 211-216. Zock PL, Mensink RP. 1996. Dietary trans-fatty acids and serum lipoprotein in humans. Curr Opin Lipidol 7: 34-37. Zschau W. 1984. The use of bleaching earth in fatty acid production. J Am Oil Chem Soc 61: 214-218.
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