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และประเภทน้ำที่ผลิตในประเทศไทย



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จุฬาลงกรณ์มหาวิทยาลัย

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ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

DETERMINATION OF BISPHENOL-A-DIGLYCIDYL ETHER,  
BISPHENOL-F-DIGLYCIDYL ETHER AND THEIR DERIVATIVES  
IN OIL-IN-WATER AND AQUEOUS-BASED CANNED FOODS  
MANUFACTURED IN THAILAND



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การศึกษานี้ได้ครอบคลุมถึง การพัฒนาวิธีวิเคราะห์สารบิสฟีนอล-เอ-ไดโกลซิดิลอีเทอร์ บิสฟีนอล-เอฟ-ไดโกลซิดิลอีเทอร์ และสารอนุพันธ์ในอาหารกระป๋องโดยเทคนิคไฮเปอร์ฟอร์แมนลิควิดโครมาโทกราฟี โดยใช้เครื่องตรวจวัดแบบฟลูออเรสเซนซ์ โดยใช้เทอร์เทียรี-บิวทิล เมทิลอีเทอร์และอะซิโตรไนไตรล์ เป็นตัวสกัดในอาหารประเภทน้ำผสมน้ำมันและประเภทน้ำ ตามลำดับ จากนั้นทดสอบความถูกต้องและความเชื่อถือได้ของวิธีการที่พัฒนาขึ้นโดยการประเมินค่าร้อยละของการคืนกลับ และค่าความเที่ยงของวิธีการวิเคราะห์ในวันเดียวกันและต่างวันกันพบว่าวิธีการวิเคราะห์มีประสิทธิภาพดีสามารถวิเคราะห์ปริมาณการปนเปื้อนในอาหารได้ต่ำถึง 2 - 23 นาโนกรัมต่อกรัมของอาหาร (ปริมาณต่ำสุดที่วิเคราะห์ได้ของแต่ละสารไม่เท่ากัน) เมื่อนำวิธีการที่ได้พัฒนาขึ้นใช้วิเคราะห์การปนเปื้อนที่เกิดจากสารเคลือบกระป๋องในอาหารกระป๋องที่ผลิตในประเทศไทยประเภทน้ำผสมน้ำมัน 15 ชนิด และประเภทน้ำ 10 ชนิด พร้อมยืนยันแหล่งที่มาและชนิดของการปนเปื้อนเพิ่ม โดยการวิเคราะห์เชิงคุณภาพแบบ Beilstein พบว่าจากอาหารกระป๋องทั้งหมด 80 กระป๋อง ร้อยละ 41 มีการปนเปื้อนเกินข้อกำหนดของสหภาพยุโรป (อนุโลมการปนเปื้อนทั้งหมดไม่เกิน 1 mg/kg) นอกจากนี้ยังได้เสนอวิธีการเตรียมและตรวจสอบสมบัติทางเคมีของ BFDGE.H<sub>2</sub>O, BFDGE.HCl.H<sub>2</sub>O และ BFDGE.HCl ซึ่งเป็นสารมาตรฐานที่ไม่มีจำหน่ายในปัจจุบันเพื่อใช้ในการวิเคราะห์เชิงคุณภาพและเชิงปริมาณของการปนเปื้อนจากสารเคลือบกระป๋องอีกด้วย

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ORNTHIDA KHOW: DETERMINATION OF BISPHENOL-A-DIGLYCIDYL ETHER, BISPHENOL-F-DIGLYCIDYL ETHER AND THEIR DERIVATIVES IN OIL-IN-WATER AND AQUEOUS-BASED CANNED FOODS MANUFACTURED IN THAILAND.

THESIS ADVISOR: ASST. PROF. NATCHANUN LEEPIPATPIBOON, Ph.D., THESIS COADVISOR: M. L. SIRIPASTR JAYANTA, 165 pp. ISBN 974-17-5159-1.

A new method for simultaneous identification and quantification of bisphenol-A-diglycidyl ether (BADGE), bisphenol-F-diglycidyl ether (BFDGE), and their derivatives in foods is described. Analyses were carried out using RP-HPLC gradient elution with fluorescence detection. Extraction for oil-in-water foods used *tert*-butyl methyl ether as solvent but changed to acetonitrile for aqueous foods. The developed method was validated for the analyses for both types of samples. The quantitation limits ranged from 2 to 23 ng/g of food depend on compounds. Satisfactory method efficiency was evaluated from recovery and intra-and intermediate precision data. The method was used to investigate the presence of BADGE, BFDGE, and their derivatives in 15 types of oil-in-water canned foods and 10 aqueous types, all manufactured in Thailand. The level of contamination was determined by HPLC and reconfirmed types of internal coatings by Beilstein's test. Analysis results of 80 cans found 41% contaminated above the limit of 1 mg/kg restricted by the European Union. This report also presented the preparations and characterizations of the unavailable standard reference materials: BFDGE.H<sub>2</sub>O, BFDGE.HCl.H<sub>2</sub>O, and BFDGE.HCl.

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## LIST OF ABBREVIATIONS AND SYMBOLS

BADGE	Bisphenol-A-Diglycidyl Ether, 2,2-Bis[4-(glycidyloxy)phenyl]propane
BADGE.HCl	Bisphenol A (3-chloro-2-hydroxypropyl) glycidyl ether, 2-[4-(3-Chloro-2-hydroxypropyloxy)phenyl]-2-[4-(glycidyloxy)phenyl]propane
BADGE.2HCl	Bisphenol A bis(3-chloro-2-hydroxypropyl) ether, 2,2-Bis[4-(3-chloro-2-hydroxypropoxy)phenyl]propane
BADGE.H <sub>2</sub> O	Bisphenol A (2,3-dihydroxypropyl) glycidyl ether, 2-[4-(2,3-Dihydroxypropyloxy)phenyl]-2-[4-(glycidyloxy)phenyl]propane
BADGE.2H <sub>2</sub> O	Bisphenol A bis(2,3-dihydroxypropyl) ether, 2,2-Bis[4-(2,3-dihydroxypropoxy)phenyl]propane
BADGE.HCl.H <sub>2</sub> O	Bisphenol A (3-chloro-2-hydroxypropyl) (2,3-dihydroxypropyl) ether, 2-[4-(3-Chloro-2-hydroxypropyloxy)phenyl]-2-[4-(2,3-dihydroxypropyloxy)phenyl]propane
BFDGE	Bisphenol F diglycidyl ether, Bis[4-(glycidyloxy)phenyl]methane
BFDGE.HCl	Bisphenol F (3-chloro-2-hydroxypropyl) glycidyl ether,
BFDGE.2HCl	Bisphenol F bis(3-chloro-2-hydroxypropyl) ether, Bis[4-(3-chloro-2-hydroxypropoxy)phenyl]methane
BFDGE.H <sub>2</sub> O	Bisphenol F (2,3-dihydroxypropyl) glycidyl ether,
BFDGE.2H <sub>2</sub> O	Bisphenol F bis(2,3-dihydroxypropyl) ether, Bis[4-(2,3-dihydroxypropoxy)phenyl]methane
BFDGE.HCl.H <sub>2</sub> O	Bisphenol F (3-chloro-2-hydroxypropyl) (2,3-dihydroxypropyl) ether
HPLC	High Performance Liquid Chromatography
I.D.	internal diameter
MS	mass spectrometry

RSD	relative standard deviation
UV-Vis	Ultraviolet-Visible
ppm	part per million
ppb	part per billion
mL	milliter
g	gram
cm	centimeter
mm	millimeter
$\mu\text{m}$	micrometer
nm	nanometer
TLC	Thin Layer Chromatography
M.W.	molecular weight
$R^2$	correlation coefficient
$R_s$	resolution



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