

# 行政院國家科學委員會專題研究計畫 期末報告

## 環境中雙酚 A 流佈及其母體暴露對於孩童健康之影響評估- -我國懷孕婦女及胎兒雙酚 A 暴露研究(I)

計畫類別：整合型  
計畫編號：NSC 100-2621-M-040-001-  
執行期間：100 年 08 月 01 日至 101 年 12 月 31 日  
執行單位：中山醫學大學職業安全衛生學系暨碩士班

計畫主持人：毛義方  
共同主持人：陳美蓮、王淑麗  
計畫參與人員：碩士級-專任助理人員：林靖雯  
學士級-專任助理人員：蔡宜螢  
碩士班研究生-兼任助理人員：陳建宇  
碩士班研究生-兼任助理人員：楊子慶  
碩士班研究生-兼任助理人員：江博安

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中華民國 102 年 02 月 26 日

中文摘要：2005年以來之科學研究，陸續發現尿中雙酚A(bisphenol A, BPA)之濃度與糖尿病、心臟病及肝臟毒性有關，且婦女懷孕時之BPA內在劑量暴露亦可能降低胎兒的存活率、出生體重及其生殖能力。至今我們尚無法有效了解國人全部的暴露途徑，因此進行懷孕母親與胎兒、嬰兒之BPA內在劑量的生物偵測，以作為健康危害評估的依據。雙酚A目前為商業上使用最多的化學物質之一，世界年產量320萬噸，除具雌激素活性會對人體內分泌造成干擾外，亦會造成水體物種之急毒性反應。BPA主要為環氧樹脂、聚碳酸酯、塑膠等製造之原料，大量使用製造之產品，如罐裝食物容器內襯塗料、速食便當盒、食物包裝、飲料包裝之紙杯容器、牙科密封劑等。雙酚A是2005年聯合國環境規劃署認定的12種環境荷爾蒙之一，它會從含塑膠容器內經由清潔劑、酸性、飲料果汁或高溫水液溶出，最近研究顯示美國國民90%尿液可測出BPA，同時也發現在極低BPA濃度(10ppb以下)會干擾小老鼠胎兒生長，及會造成細胞功能改變，因此BPA的污染重要性極度受到先進國家之重視。台灣目前有關BPA之環境暴露與人體生物偵測的基本資料較缺乏，尤其懷孕婦女及胎兒嬰兒之資料尚少見到，因此本研究欲配合BPA之整合型計劃(環境中雙酚A流佈及母體暴露對其孩童健康影響評估)，以了解母親與嬰兒之環境暴露及血液、尿中之BPA濃度；並提供其他子計畫應用，作為國人BPA健康影響評估的重要資料。研究對象為國內醫院懷孕檢查及待產的母親及胎兒，使用結構式問卷及化學分析方法探討母體之環境暴露及血液及尿液BPA濃度。第一年，「人體血及尿中BPA採樣及偵測方法建立」

中文關鍵詞：雙酚A、孕婦、胎兒、臍帶血、尿液、偵測方法

英文摘要：Since 2005, a large and well-controlled study of the possible health effect of bisphenol A(BPA) exposure on humans was conducted, they found positive associations between total urinary BPA concentration and prevalence of diabetes, heart disease, and liver toxicity. More important, BPA can be rapidly absorbed and easily pass through the placenta that maternal exposure to BPA results in the transfer of BPA to fetal tissue and cause many health adverse effect of baby and child. The need for human BPA bio-monitoring for risk assessment is undisputed because all resource of exposure have not been identified, and thus internal exposures can not be

accurately determined.

Due to an increase in the use of products that is used BPA as a material, such as in resins lining metal cans, food packaging and plastic bottles, and dental sealants, it has been showed that BPA molecules underwent hydrolysis, resulting in the release of free BPA into food, beverages, and the environment, and increased the human exposure potential. Numerous monitoring studies now show almost ubiquitous human exposure to biologically active levels of BPA. Bisphenol A has been proposed as one of 16 persistent organic products and one of 12 endocrine disruptors by U.N. EPA in 2005. In published findings, BPA manufactures persist in describing BPA as a estrogen and insist there is little effect with human health. However, BPA has been known to leach from plastics which are cleaned with detergents or used acidic or high temperature liquids. The recent studies show that 90% of US people urine can be detected BPA and even very low levels(<10ppb) of BPA can disrupt neural development in the rat fetus. Therefore, the BPA health concern rised again in the US and European countries. The data of all BPA exposure and the bio-monitoring data are limited in Taiwan, especially, little information exist concerning maternal and fetal exposure to BPA during pregnancy. This study purposed to evaluate the correlation between maternal and fetal exposure, and to assess exposure levels of BPA in maternal and their fetus; and provide the results of their study for the partners of intergrated research program to take health risk assessment of maternal and fetus. The all results will provide the valuable information to our official EPA and health authorities. A project is proposed here as following:

1. First year: sampling and analytic methods used in BPA bio-monitoring studies.

英文關鍵詞： bisphenol A, pregnant woman, fetus, umbilical core blood, urine, .determin methods

# 行政院國家科學委員會專題研究計畫成果報告

## 我國懷孕婦女及胎兒雙酚 A 暴露研究(1/1)

計畫編號：NSC 100-2621-M-040-001-

執行期限：100 年 8 月 1 日至 101 年 12 月 31 日

主持人：毛義方 中山醫學大學職業安全衛生學系暨碩士班

共同主持人：陳美蓮 陽明大學環境與職業衛生研究所

共同主持人：王淑麗 國家衛生院

計畫參與人員：林靖雯、程莉婷

### 中文摘要

2005 年以來之科學研究，陸續發現尿中雙酚 A(bisphenol A, BPA)之濃度與糖尿病、心臟病及肝臟毒性有關，且婦女懷孕時之 BPA 內在劑量暴露亦可能降低胎兒的存活率、出生體重及其生殖能力。至今我們尚無法有效了解國人全部的暴露途徑，因此進行懷孕母親與胎兒、嬰兒之 BPA 內在劑量的生物偵測，以作為健康危害評估的依據。

雙酚 A 目前為商業上使用最多的化學物質之一，世界年產量 320 萬噸，除具雌激素活性會對人體內分泌造成干擾外，亦會造成水體物種之急毒性反應。BPA 主要為環氧樹脂、聚碳酸酯、塑膠等製造之原料，大量使用製造之產品，如罐裝食物容器內襯塗料、速食便當盒、食物包裝、飲料包裝之紙杯容器、牙科密封劑等。雙酚 A 是 2005 年聯合國環境規劃署認定的 12 種環境荷爾蒙之一，它會從含塑膠容器內經由清潔劑、酸性、飲料果汁或高溫水液溶出，最近研究顯示美國國民 90% 尿液可測出 BPA，同時也發現在極低 BPA 濃度 (10ppb 以下) 會干擾小老鼠胎兒生長，及會造成細胞功能改變，因此 BPA 的污染重要性極度受到先進國家之重視。

台灣目前有關 BPA 之環境暴露與人體

生物偵測的基本資料較缺乏，尤其懷孕婦女及胎兒嬰兒之資料尚少見到，因此本研究欲配合 BPA 之整合型計劃(環境中雙酚 A 流佈及母體暴露對其孩童健康影響評估)，以了解母親與嬰兒之環境暴露及血液、尿中之 BPA 濃度；並提供其他子計畫應用，作為國人 BPA 健康影響評估的重要資料。研究對象為國內醫院懷孕檢查及待產的母親及胎兒，使用結構式問卷及化學分析方法探討母體之環境暴露及血液及尿液 BPA 濃度。第一年，「人體血及尿中 BPA 採樣及偵測方法建立」

關鍵詞：雙酚 A、孕婦、胎兒、臍帶血、尿液、偵測方法

### Abstract

Since 2005, a large and well-controlled study of the possible health effect of bisphenol A(BPA) exposure on humans was conducted, they found positive associations between total urinary BPA concentration and prevalence of diabetes, heart disease, and liver toxicity. More important, BPA can be rapidly absorbed and easily pass through the placenta that maternal exposure to BPA results in the

transfer of BPA to fetal tissue and cause many health adverse effect of baby and child. The need for human BPA bio-monitoring for risk assessment is undisputed because all resource of exposure have not been identified, and thus internal exposures can not be accurately determined.

Due to an increase in the use of products that is used BPA as a material, such as in resins lining metal cans, food packaging and plastic bottles, and dental sealants, it has been showed that BPA molecules underwent hydrolysis, resulting in the release of free BPA into food, beverages, and the environment, and increased the human exposure potential. Numerous monitoring studies now show almost ubiquitous human exposure to biologically active levels of BPA. Bisphenol A has been proposed as one of 16 persistent organic products and one of 12 endocrine disruptors by U.N. EPA in 2005. In published findings, BPA manufactures persist in describing BPA as a estrogen and insist there is little effect with human health. However, BPA has been known to leach from plastics which are cleaned with detergents or used acidic or high temperature liquids. The recent studies show that 90% of US people urine can be detected BPA and even very low levels(< 10ppb) of BPA can disrupt neural development in the rat fetus. Therefore, the BPA health concern rised again in the US and European countries.

The data of all BPA exposure and the bio-monitoring data are limited in Taiwan, especially, little information exist concerning

maternal and fetal exposure to BPA during pregnancy. This study purposed to evaluate the correlation between maternal and fetal exposure, and to assess exposure levels of BPA in maternal and their fetus; and provide the results of their study for the partners of intergrated research program to take health risk assessment of maternal and fetus. The all results will provide the valuable information to our official EPA and health authorities. A project is proposed here as following:

1. First year: sampling and analytic methods used in BPA bio-monitoring studies.

Keywords: bisphenol A, pregnant woman, fetus, umbilical core blood, urine, .determin methods

## 壹、前言

由於 BPA 對於人類胎兒(fetus)、嬰兒(infants)及新生兒(neonates)的器官發育及腦體內荷爾蒙的影響較為敏感(Vandenberg et al. 2009)，因此對於此些人的暴露特別關心。如何將動物實驗結果應用在人類上，BPA 生物偵測在各種不同族群的濃度則成為人類暴露評估的一個重要指標。

基本上，BPA 經口進入人體，由肝臟代謝並非 100%，因此在血液及尿中均能偵測到非結合性(unconjugated)BPA，利用生物偵測研究可以了解體內之內在劑量(internal dose)及排出濃度，可以有效計算可能的所有暴露來源。然而 BPA 的特性會影響到它存在不同檢體的濃度，有些 BPA 在血中會被酵素改變或改善成較不具毒性之物質，有些在尿中會被分解(Calafat & Needham, 2008)。

生物偵測方法的有效性及精確性，樣本

的收集方法及實驗室之汙染包括器皿及化學物，都會影響到測定結果，因此建立可信賴的生物偵測方法應用在系列研究上是最重要的步驟之一。

故除使用測定的儀器以外，使用到的設備、器具及容器必須避免含有 BPA 成分的製品，而一般塑膠製品均含 BPA 成分，故在測定生物偵測指標物 BPA 時，尤須重視污染的情形，以避免一些低濃度的生物檢體之 BPA 微量濃度是由實驗及儲存因素所造成的(Willhite et al. 2008)。

過去一些方法都可以來測定全部結合及非結合性 BPA，應用於人類的血液、尿及組織樣本，常用的儀器為 GC 及 HPLC 加上各種不同的偵測器包括質譜儀(mass spectrometry, MS)，tandem MS(MS/MS)，電化學，UV，螢光偵測器等。雖然 HPLC-MS/MS 是一種較可靠的儀器，但其儀器購置及維護費用偏高，常影響許多研究進行的可近性(Calafat et al. 2008)。

ELISA(enzyme-linked immunosorbent assay)已使用於體液及組織之測定與研究，其好處是方便、簡單、便宜。通常用於篩選大量的樣本用，但缺點是其方法特異性(specificity)較差於其他化學定性定量方法，因此，一般均認為 ELISA 之 BPA 定量方法較不適合應用於生物偵測上，因為較敏感，高精密度(precise)及精確度(accurate)的分析方法已經可以確立(Dekant & Volkel, 2008)(Fukata et al. 2006)(Kuklenyik et al. 2009)。

## 貳、研究目的

我國是石化業很發達的國家，國人塑膠製品使用非常普遍，而 BPA 是其主要原料之一。因 BPA 為環境荷爾蒙且最近五年來陸續發現在低微量(0.05mg/kg/day)即可造成一些細胞、生理上、生殖上之健康危害，本計劃欲研究國人血中及尿中 BPA 濃度，進

行我國孕婦及胎兒 BPA 之生物偵測。以下為本研究內容：

1. 建立血液及尿液中 BPA 採樣及分析之可行方法。

## 參、研究方法及材料

### ▲ 尿液

#### 一、研究方法

##### 1. 尿液樣本之收集

收集受試者清晨午餐後第一泡之尿液，尿量約 50 mL，收集後立即冷藏運回實驗室，在-25°C 之下冷凍直到分析。

##### 2. 分析項目：

(1)尿中總 BPA 濃度

(2)尿中 creatinine 濃度

##### 3. 尿液樣本之前處理分析方法：

尿液樣本之前處理方法參考 Chen et al.(2005)之分析方法。取 10 mL 尿液樣本以醋酸酸化至 pH=5.5 後，加入 1 mL 1M 醋酸銨緩衝溶液(pH=5.3)和 125  $\mu$ L  $\beta$ -glucuronidase 並均勻混合。接著將尿液樣本至於 37°C 水浴槽中震盪 15 小時，接著以超音波震碎機進行震碎 1 分鐘，再以 1M HCl 將尿液樣本酸化至 pH=3。另預先準備塞入約 2 公分玻璃棉之 PH phenyl sorbent 固相萃取管，依序加入 20mL 甲醇和 3mL 經 1M HCl 酸化至 pH=3 之去離子水進行流洗後，將上述處理過之尿液樣本通過此萃取管，再以 5 mL 去離子水清洗。接著在萃取管下端接上 PTFE 濾膜並裝置於真空抽取器上，以 3 mL 甲醇沖提出待測物，即可以 HPLC 進行分析。

##### 4. 尿液肌酸酐測定

將依 alkaline picrate 反應呈色法 (Folin Wu method) 測定尿中肌酸酐濃度，再將中 BPA 濃度以 creatinine 濃度作校正。肌酸酐濃度介於 0.3 g/L 至 3 g/L 之間的尿液才使用，太濃或太稀樣本將廢棄不用。

##### 5. 問卷調查

為了解懷孕婦女及胎兒體內的 BPA 含

量，針對本計畫參與之懷孕婦女及胎兒所食用之日常食物、罐裝食物、飲水及塑膠瓶裝水之消費情形，以進行食物中 BPA 總攝取量之估計，採面對面進行問卷訪視。問卷內容包括個人基本資料、每日平均飲食習慣、份量、頻數以及每日平均飲水習慣、份量及罐頭食品使用頻率等(如附件)。

## ▲ 血液

### 一、研究方法

#### 1. 血液樣本之收集

收集受試者為母體生產過程中之臍帶血約 15 mL 置入玻璃儲存管中並加以密封，收集後立即冷藏運回實驗室，在-25°C 之下冷凍直到分析。

#### 2. 分析項目：

##### (一) 血中總 BPA 濃度

#### 3. 血液樣本之前處理分析方法：

方法一：血液前處理方法參考

Matsumoto et al.(2003)及 Kim et al.(2003)之方法並以 Mao et al.(2005)加以修改使用。取 1mL 血漿用 20  $\mu$ L 之

$\beta$ -glucuronidase/arylsulfatase(type H-2, H. pomatia)在 60  $\mu$ L 之 2M acetate buffer

(pH=5.0) 37°C 之下水解 (hydrolyzed) 4 小時。再加入 internal standard (Bisphenol B, BPB 100ng) 及 4mL 之 MTBE，然後置入冰箱-20°C 去分離 MTBE 層，如此程序再進行 1 次，然後將 MTBE(Methyl tributyl ether) 層抽取液混合，再使用和緩的氮氣流蒸發 MTBE(8ml 約 45 分)，殘留物 (residues) 溶解在 200  $\mu$ L 的 60% acetonitrile 中 (含 40% 之水)。

方法二：取 1 mL 血漿用 200  $\mu$ L 之 0.01M acetate buffer (pH=4.5) 再加入 4 mL 之正己烷:乙醚(7:3)，混合 5 秒後震盪 2min 靜止 1min，加入 9  $\mu$ L 之 9.187M 過氯酸(純度 60-62%)，經離心 3000 轉 5 分鐘後抽取上層澄清液，再使用和緩的氮氣流蒸發液體 (4ml 約 30 分)，殘留物 (residues) 溶解在

200  $\mu$ L 的 80% methanol 中 (含 2% 之水)。

#### 4. 問卷調查

為了解懷孕婦女及胎兒體內的 BPA 含量，針對本計畫參與之懷孕婦女及胎兒所食用之日常食物、罐裝食物、飲水及塑膠瓶裝水之消費情形，以進行食物中 BPA 總攝取量之估計，採面對面進行問卷訪視。問卷內容包括個人基本資料、每日平均飲食習慣、份量、頻數以及每日平均飲水習慣、份量及罐頭食品使用頻率等(如附件)。

## ▲ 分析方法-尿液、血液

尿液及血液樣本經前處理後，利用高效能液相層析儀 / 螢光偵測器 (HPLC/fluorescence detection) 設定參數：

1.Column : Chromolith RP-18e ( 10cm  $\times$  4.6mm ID, 5  $\mu$ m particle size ) [ Merck Co. ]

2.Mobile phase : 30% acetonitrile and 70% D.I water

3.Flow-rate : 1.0mL/min

4.Fluorescence detector wavelength : 275 nm excitation wavelength、300 nm emission wavelength

5.Injection volume : 20  $\mu$ L

## ▲ 品質保證(QA)與品質管制(QC)：依環保署環境檢驗所制訂之 QA/QC 規範進行。

### (1) 空白樣本

尿液真正空白樣本可能無法取得，因國人之 BPA 檢出率可能達 80% 以上，因此採購人工合成尿液，每一批分析樣本皆有一個空白樣本，與樣本同樣前處理程序及測定分析。

### (2) 檢量線

約每一個禮拜均重新配製標準溶液，以確保標準液不因使用與存放時間過長而變質。每次檢量線每個化合物的 R 值皆  $>$  0.995。並設定檢量線範圍。

### (3) 精確度(precision)

利用添加各種濃度標準品之樣本，取三種添加濃度，添加每種濃度之樣本，重複作三次測定，以檢定其 CV(%) 值，並進行同日及異日之變異係數 CV(%)。





## 二、血液中 BPA 含量測定方法之建立

### (1) 血中 BPA 之檢量線及標準品圖譜

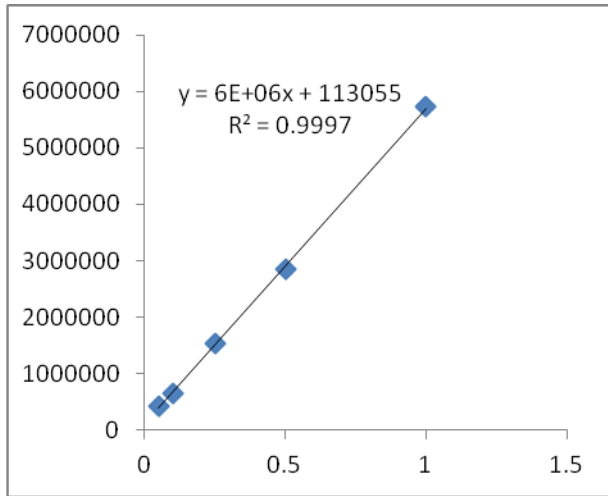


Fig1.血中 BPA 檢量線圖譜

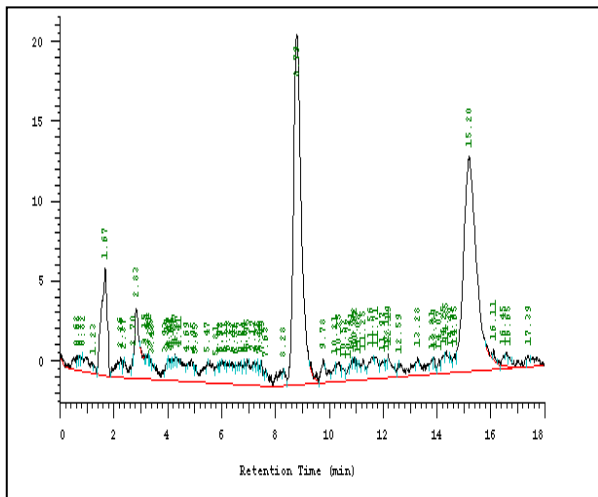


Fig2 血中 .BPA&BPB standard-0.1ppm

### (2) 偵測極限：

是多次測定檢量線最低點 0.02 ppm 之水溶液後，經過計算，其方法之偵測極限為 0.4 ppb。

### (3) 變異係數

Table1 建立血液中 BPA 測定方法之變異係數 (precision)

濃度(ppm)	CV%
0.05	13.37%
0.10	3.96%
0.25	3.61%
0.50	2.58%

1.00	1.93%
average	5.09%

### (4) 回收率(Recovery)：

Table 2 建立血液中 BPA 測定方法一之

### Recovery

濃度(ppm)	Avery Recovery
1.0	87.55%
4.0	76.20%
平均	81.88%

\* 於1mL血液樣本中各添加100 ppm 2 μL、8 μL，萃取至0.2 mL溶液。

Table 3 建立血液中 BPA 測定方法二之

### Recovery

濃度(ppm)	Avery Recovery
0.5	99.48%
1.0	75.58%
4.0	69.15%
平均	81.41%

\* 於1mL血液樣本中各添加100 ppm 0.5 μL、1 μL、4 μL，萃取至0.1 mL溶液。

本期末報告已建立血液中BPA的測定方法，其血液方法偵測極限為0.4 ppb，precision平均為5.09%，兩方法回收率平均為81.88%、81.41%，此方法可有效偵測我國成年人血液中BPA之濃度，並且準確度及精確度均佳。

## 三、我國內成人尿液BPA濃度測定結果：

Table3. BPA concentration of 61 samples from north-Taiwan

n=61	unadjust	adjust
detection rate	87%	
mean	0.104	0.172
median	0.021	0.024
concentration range	0.0007-1.325	0.0013-1.98

unit:mg/L, adjust :mg/g creatinine

Table4. Female urinary BPA concentration

n=22	Unadjust	adjust
detection rate		82%
Mean	0.112	0.269
Median	0.166	0.024
concentration range	0.0007-1.325	0.0017-1.98
unit:mg/L adjust: mg/g creatinine		

Table5. Male urinary BPA concentration

n=39	unadjust	adjust
detection rate		90%
mean	0.069	0.07
median	0.026	0.025
concentration range	0.0009-0.8	0.0013-0.643
unit:mg/L,mg/g creatinine		

尿液樣本已完成北部61個樣本的測定,.

#### 四、我國成人血液 BPA 濃度測定結果：

Table 6. Blood BPA concentration of 20 samples from adults

n=20	Blood BPA (PPb)
detection rate	100%
mean	5.4
median	3.9
concentration range	1.8-24.1

血液樣本部分已建立血中BPA含量測定方法，血液樣本截至目前經由實驗，已完成20個樣本的測定，接下來繼續完成其他血液樣本的測定。

#### 伍、討論：

由於血中及尿中生物偵測的基質都較複雜，所以在偵測方法上建立 BPA 測定方

法有其必要性且具困難性。在尿液部分參考 Chen et al.(2005)之分析方法後實驗並加以修改，建立一簡單、經濟、可靠可行的信賴方法。檢量線之濃度範圍為 0.02~1.00 ppm，R 值為 0.999，儀器之偵測極限 0.002 ppm，precision 範圍為 0.6-19%，平均為 5.6%，回收率範圍為 60-92%，平均為 77.5%，在尿液樣本中未調整濃度最高達 1.325 ppm、調整後濃度最高為 1.98 ppm，而男性最高 2.8 ppm、女性最高 1.98 ppm。而血液部分參考韓國及台灣方法後實驗並加以修改，進而建立簡單、經濟、可靠可行的信賴方法。本研究建立方法之檢量線之濃度範圍為 0.05-1 ppm，R 值為 0.999，精確性範圍為 1.93-13.37%，平均< 7%，血液儀器偵測極限達 2 ppb，血液樣本方法偵測極限為 8.87 ng/ml 及 4 ng/ml，方法一回收率範圍為 76.20-87.55% 平均達 81.88%、方法二回收率範圍為 69.15-99.48 平均達 81.41%。而兩個血液參考方法回收率高達 81.88%、81.41%，且在血液檢出率為 100%。顯示兩方法皆有良好的回收率透過此修改所建立之方法為具有簡單、可信、快速之偵測方法。

將本研究測得之尿液樣本 BPA 濃度結果與 Yang et al.(2006)對 172 位韓國人尿液樣本 BPA 濃度結果(97.5%、中位數 7.86 ng/mL)相比，本研究之中位數(11.7 ng/mL)較其高，但檢出率(85.2%)較其低，但本研究偵測極限(11 µg/L)較 Yang et al.(0.026µg/L)高，而 Melzer et al.(2010)調查了 2948 位(2003-2004:1455 位; 2005-2006:1493 位)美國 18-74 歲成年族群之尿液樣本 BPA 濃度，其所測得之 GM 2003-2004 年為 2.49 ng/mL、2005-2006 年則為 1.79 ng/mL，均較本研究(14 ng/ml)低。

由上述結果證明，我國成年人體內之尿液 BPA 濃度高於美國及韓國，推測我國成年人尿液 BPA 暴露程度可能較韓國及美國

嚴重，而尿液 BPA 濃度已知高於其他國家，在血液中 BPA 濃度可能相對更高於代謝出尿液之 BPA 濃度，這使得我國民眾可能高暴露在 BPA 中，高濃度之 BPA 暴露尤其又以懷孕婦女及體內之胎兒更為嚴重且需要更被重視。

雖然目前尚未有證據指出對人體有危害，但藉由得知體內尿液及血液 BPA 濃度值可有效了解相關之暴露來源以及暴露量，由此 BPA 暴露來源及 BPA 暴露量可得知懷孕婦女及體內胎兒所遭受之污染及危害，藉此可做一有效監測來降低懷孕婦女及胎兒的暴露量。

### 陸、結論:

本研究建立方法尿液部分檢量線範圍為 0.02~1.00ppm，方法之偵測極限為 0.5ppb，精確度平均為 3.8%，回收率平均為 82.3%，尿液檢出率 87% (52/60)。本研究建立方法血液部分檢量線之濃度範圍為 0.02-1 ppm，精確性平均 < 7%，方法之偵測極限為 0.4 µg/L(ppb) 方法一回收率為 81.88%、方法二回收率為 81.41%，顯示兩法皆有良好之回收效果。4ng/ml，方法一回收率範圍為 76.20-87.55% 平均達 81.88%、方法二回收率範圍為 69.15-99.48 平均達 81.41%，血液檢出率為 100%。

利用建立之方法分析尿液及血液樣本，發現雙酚 A 普遍存在於尿液及血液中，而尿液中濃度高達 1.98 ppm、血液中濃度高達 24.1 ppb。這使得我們對於測定懷孕婦女及胎兒體內之 BPA 濃度為一相當重要且迫切的課題，雖目前尚未有證據指出 BPA 對人體有危害，但藉由得知體內尿液及血液 BPA 濃度值可做一有效之監測及了解相關之暴露來源以期減少暴露源之暴露。

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# 國科會補助計畫衍生研發成果推廣資料表

日期:2013/02/26

國科會補助計畫	計畫名稱: 我國懷孕婦女及胎兒雙酚A暴露研究(I)
	計畫主持人: 毛義方
	計畫編號: 100-2621-M-040-001- 學門領域: 永續發展研究-生物科學
無研發成果推廣資料	

100 年度專題研究計畫研究成果彙整表

計畫主持人：毛義方		計畫編號：100-2621-M-040-001-					
計畫名稱：環境中雙酚 A 流佈及其母體暴露對於孩童健康之影響評估--我國懷孕婦女及胎兒雙酚 A 暴露研究(I)							
成果項目		量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）	
		實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比			
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	1	1	100%		
		研討會論文	2	2	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	1	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	1	0	100%		
國外	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		章/本
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

<p>其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)</p>	<p>無</p>
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	成果項目	量化	名稱或內容性質簡述
科 教 處 計 畫 加 填 項 目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與(閱聽)人數	0	

# 國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

達成目標

未達成目標（請說明，以 100 字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表  未發表之文稿  撰寫中  無

專利： 已獲得  申請中  無

技轉： 已技轉  洽談中  無

其他：（以 100 字為限）

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）

1. 開發 BPA 雙酚 A 在國人尿中濃度及血液中濃度之測定方法包含精確度, 精密度, 回收率及 field 採樣本之測定可能性.

2. 開發的方法可供國內其他研究者使用的可行方法, 增進國內研究者研究 BPA 對台灣國人健康影響之可近性及方便性.