

## 試驗報告

## Test Report

號碼(No.) : KA/2018/C2479 日期(Date) : 2019/01/03

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SENJU METAL INDUSTRY CO., LTD.

23 SENJU HASHIDO-CHO ADACHI-KU TOKYO 120-8555 JAPAN

以下測試樣品係由客戶送樣，且由客戶聲稱並經客戶確認如下 (The following samples was/were submitted and identified by/on behalf of the client as) :

樣品名稱(Sample Description) : ECO SOLDER BALL S  
樣品型號(Style/Item No.) : M30(Sn/3.5Ag)  
收件日期(Sample Receiving Date) : 2018/12/27  
測試期間(Testing Period) : 2018/12/27 TO 2019/01/03  
送樣廠商(Sample Submitted By) : SENJU METAL INDUSTRY CO., LTD.

### 測試需求(Test Requested)

- 依據客戶指定，參考RoHS 2011/65/EU Annex II及其修訂指令(EU) 2015/863測試鎘、鉛、汞、六價鉻、多溴聯苯、多溴聯苯醚，DBP, BBP, DEHP, DIBP. (As specified by client, with reference to RoHS 2011/65/EU Annex II and amending Directive (EU) 2015/863 to determine Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP contents in the submitted sample(s).)
- 其他測試項目請見下一頁。(Please refer to next pages for the other item(s).)

### 測試結果(Test Results)

: 請見下一頁 (Please refer to next pages).

### 結論(Conclusion)

:

- 根據客戶所提供的樣品，其鎘、鉛、汞、六價鉻、多溴聯苯、多溴聯苯醚，DBP, BBP, DEHP, DIBP的測試結果符合RoHS 2011/65/EU Annex II暨其修訂指令(EU) 2015/863之限值要求。(Based on the performed tests on submitted sample(s), the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.)

Ray Chang



報告簽署人/Ray Chang Ph.D./Manager -Tech

Signed for and on behalf of

SGS Taiwan Limited

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## 測試結果(Test Results)

測試部位(PART NAME) NO.1 : 銀色 ECO SOLDER BALL S (SILVERY ECO SOLDER BALL S)

測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測 極限值 (MDL)	結果 (Result)	法規 限值 (Limit)
				NO. 1	
鎘 / Cadmium (Cd)	mg/kg	參考 IEC 62321-5: 2013, 以感應耦合電漿原子發射光譜儀檢測. / With reference to IEC 62321-5: 2013 and performed by ICP-AES.	2	n. d.	100
鉛 / Lead (Pb)	mg/kg		2	59.7	1000
汞 / Mercury (Hg)	mg/kg	參考 IEC 62321-4: 2013, 以感應耦合電漿原子發射光譜儀檢測. / With reference to IEC 62321-4: 2013 and performed by ICP-AES.	2	n. d.	1000
六價鉻 / Hexavalent Chromium Cr(VI)(#2)	µg/cm <sup>2</sup>	參考 IEC 62321-7-1:2015, 以UV-VIS 檢測. / With reference to IEC 62321-7-1:2015 and performed by UV-VIS.	0.10	n. d.	-
<b>多溴聯苯總和 / Sum of PBBs</b>	mg/kg	參考 IEC 62321-6:2015, 以氣相層析/質譜儀檢測. / With reference to IEC 62321-6:2015 and performed by GC/MS.	-	n. d.	1000
一溴聯苯 / Monobromobiphenyl			5	n. d.	-
二溴聯苯 / Dibromobiphenyl			5	n. d.	-
三溴聯苯 / Tribromobiphenyl			5	n. d.	-
四溴聯苯 / Tetrabromobiphenyl			5	n. d.	-
五溴聯苯 / Pentabromobiphenyl			5	n. d.	-
六溴聯苯 / Hexabromobiphenyl			5	n. d.	-
七溴聯苯 / Heptabromobiphenyl			5	n. d.	-
八溴聯苯 / Octabromobiphenyl			5	n. d.	-
九溴聯苯 / Nonabromobiphenyl			5	n. d.	-
十溴聯苯 / Decabromobiphenyl	5	n. d.	-		

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測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測 極限值 (MDL)	結果 (Result)	法規 限值 (Limit)
				NO. 1	
多溴聯苯醚總和 / Sum of PBDEs	mg/kg	參考IEC 62321-6:2015, 以氣相層析/質譜儀檢測. / With reference to IEC 62321-6:2015 and performed by GC/MS.	-	n. d.	1000
一溴聯苯醚 / Monobromodiphenyl ether			5	n. d.	-
二溴聯苯醚 / Dibromodiphenyl ether			5	n. d.	-
三溴聯苯醚 / Tribromodiphenyl ether			5	n. d.	-
四溴聯苯醚 / Tetrabromodiphenyl ether			5	n. d.	-
五溴聯苯醚 / Pentabromodiphenyl ether			5	n. d.	-
六溴聯苯醚 / Hexabromodiphenyl ether			5	n. d.	-
七溴聯苯醚 / Heptabromodiphenyl ether			5	n. d.	-
八溴聯苯醚 / Octabromodiphenyl ether			5	n. d.	-
九溴聯苯醚 / Nonabromodiphenyl ether			5	n. d.	-
十溴聯苯醚 / Decabromodiphenyl ether	5	n. d.	-		
銻 / Antimony (Sb)	mg/kg	參考US EPA 3052: 1996, 以感應耦合電漿原子發射光譜儀檢測. / With reference to US EPA 3052: 1996.	2	65.2	-
鈹 / Beryllium (Be)	mg/kg	Analysis was performed by ICP-AES.	2	n. d.	-
多氯聯苯 / Polychlorinated Biphenyls (PCBs)	mg/kg	參考US EPA 3550C: 1996, 以氣相層析/質譜儀檢測. / With reference to US EPA 3550C: 1996. Analysis was performed by GC/MS.	0.5	n. d.	-
多氯萘 / Polychlorinated Naphthalene (PCNs)	mg/kg		5	n. d.	-
多氯三聯苯 / Polychlorinated Terphenyls (PCTs)	mg/kg		0.5	n. d.	-
短鏈氯化石蠟 / Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) (CAS No. : 085535-84-8))	mg/kg	參考US EPA 3550C: 2007, 以氣相層析儀/電子捕獲偵測器檢測. / With reference to US EPA 3550C: 2007. Analysis was performed by GC/ECD.	100	n. d.	-

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測試項目 (Test Items)	單位 (Unit)	測試方法 (Method)	方法偵測 極限值 (MDL)	結果 (Result)	法規 限值 (Limit)
				NO. 1	
六溴環十二烷及所有主要被辨別出的異構物 / Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified ( $\alpha$ -HBCDD, $\beta$ -HBCDD, $\gamma$ -HBCDD) (CAS No.: 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8))	mg/kg	參考IEC 62321: 2008, 以氣相層析/質譜儀檢測. / With reference to IEC 62321: 2008. Analysis was performed by GC/MS.	5	n. d.	-
聚氯乙烯 / PVC	**	以紅外光譜分析及焰色法檢測. / Analysis was performed by FTIR and FLAME Test.	-	Negative	-
全氟辛烷磺酸 / Perfluorooctane sulfonates (PFOS)	mg/kg	參考US EPA 3550C: 2007, 以液相層析/質譜儀檢測. / With reference to US EPA 3550C: 2007. Analysis was performed by LC/MS.	10	n. d.	-
全氟辛酸(銨) / PFOA (CAS No.: 335-67-1)	mg/kg		10	n. d.	-
<b>鹵素 / Halogen</b>					
鹵素(氟) / Halogen-Fluorine (F) (CAS No.: 14762-94-8)	mg/kg	參考BS EN 14582:2016, 以離子層析儀檢測. / With reference to BS EN 14582:2016. Analysis was performed by IC.	50	n. d.	-
鹵素(氯) / Halogen-Chlorine (Cl) (CAS No.: 22537-15-1)			50	n. d.	-
鹵素(溴) / Halogen-Bromine (Br) (CAS No.: 10097-32-2)			50	n. d.	-
鹵素(碘) / Halogen-Iodine (I) (CAS No.: 14362-44-8)			50	n. d.	-

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				NO. 1	
<b>有機錫 / Organic-tin compounds</b>					
氧化雙三丁基錫 / Bis(tributyltin)oxide (TBTO) (CAS No. : 56-35-9)	mg/kg	參考ISO 17353: 2004, 以氣相層析儀/火焰光度偵測器檢測; 由三丁基錫測試結果計算得之。 / With reference to ISO 17353: 2004. Analysis was performed by GC/FPD. Calculated from the result of Tributyl Tin (TBT).	0.03 (▲)	n. d.	-
三丁基錫 / Tributyl Tin (TBT)			0.03	n. d.	-
三苯基錫 / Triphenyl Tin (TphT)			0.03	n. d.	-
二丁基錫 / Dibutyl Tin (DBT)			0.03	n. d.	-
二辛基錫 / Dioctyl Tin (DOT)			0.03	n. d.	-
<b>可塑劑定量分析 / Phthalates</b>					
鄰苯二甲酸二異丁酯 / DIBP (Di-isobutyl phthalate) (CAS No. : 84-69-5)	mg/kg	參考IEC 62321-8:2017, 以氣相層析儀/質譜儀檢測。 / With reference to IEC 62321-8:2017. Analysis was performed by GC/MS.	50	n. d.	1000
鄰苯二甲酸丁苯甲酯 / BBP (Butyl Benzyl phthalate) (CAS No. : 85-68-7)			50	n. d.	1000
鄰苯二甲酸二丁酯 / DBP (Dibutyl phthalate) (CAS No. : 84-74-2)			50	n. d.	1000
鄰苯二甲酸二(2-乙基己基)酯 / DEHP (Di-(2-ethylhexyl) phthalate) (CAS No. : 117-81-7)			50	n. d.	1000
鄰苯二甲酸二異癸酯 / DIDP (Di-isodecyl phthalate) (CAS No. : 26761-40-0, 68515-49-1)			50	n. d.	-
鄰苯二甲酸二異壬酯 / DINP (Di-isononyl phthalate) (CAS No. : 28553-12-0, 68515-48-0)			50	n. d.	-
鄰苯二甲酸二正辛酯 / DNOP (Di-n-octyl phthalate) (CAS No. : 117-84-0)			50	n. d.	-

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				NO. 1	
鄰苯二甲酸二(C6-8支鏈與直鏈)烷基酯, 富 C7 / DIHP (1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich) (CAS No. : 71888-89-6)	mg/kg	參考 IEC 62321-8:2017, 以氣相層析儀/質譜儀檢測。 / With reference to IEC 62321-8:2017. Analysis was performed by GC/MS.	50	n. d.	-
鄰苯二甲酸二(C7-11支鏈與直鏈)烷基酯 / DHNUP (1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters) (CAS No. : 68515-42-4)			50	n. d.	-
鄰苯二甲酸二(2-甲氧基乙基)酯 / DMEP (Bis (2-methoxyethyl) phthalate) (CAS No. : 117-82-8)			50	n. d.	-
鄰苯二甲酸二異戊酯 / DIPP (Diisopentyl Phthalat) (CAS No. : 605-50-5)			50	n. d.	-
鄰苯二甲酸二己酯 / DNHP (Di-n-hexyl phthalate) (CAS No. : 84-75-3)			50	n. d.	-
鄰苯二甲酸二乙酯 / DEP (Di-ethyl phthalate) (CAS No. : 84-66-2)			50	n. d.	-
鄰苯二甲酸二甲酯 / DMP (Dimethyl phthalate) (CAS No. : 131-11-3)			50	n. d.	-
鄰苯二甲酸二戊酯 / DPP (Di-pentyl phthalate) (CAS No. : 131-18-0)			50	n. d.	-
鄰苯二甲酸二正戊酯 / DNPP (Di-n-pentyl phthalate) (CAS No. : 131-18-0)			50	n. d.	-

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### 備註(Note) :

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. n. d. = Not Detected (未檢出)
3. MDL = Method Detection Limit (方法偵測極限值)
4. "-" = Not Regulated (無規格值)
5. (#2) =
  - a. 當六價鉻結果大於0.13  $\mu\text{g}/\text{cm}^2$  , 表示樣品表層含有六價鉻. / The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13  $\mu\text{g}/\text{cm}^2$ . The sample coating is considered to contain Cr(VI).
  - b. 當六價鉻結果為n. d. (濃度小於0.10  $\mu\text{g}/\text{cm}^2$ ) , 表示表層不含六價鉻. / The sample is negative for Cr(VI) if Cr(VI) is n. d. (concentration less than 0.10  $\mu\text{g}/\text{cm}^2$ ). The coating is considered a non-Cr(VI) based coating.
  - c. 當六價鉻結果介於 0.10 及 0.13  $\mu\text{g}/\text{cm}^2$  時, 無法確定塗層是否含有六價鉻. / The result between 0.10  $\mu\text{g}/\text{cm}^2$  and 0.13  $\mu\text{g}/\text{cm}^2$  is considered to be inconclusive - unavoidable coating variations may influence the determination.
6. \*\*= Qualitative analysis (No Unit) 定性分析(無單位)
7. Negative = Undetectable 陰性(未偵測到); Positive = Detectable 陽性(已偵測到)
8. (▲) : MDL是針對元素/測試化合物之評估. / The MDL was evaluated for element / tested substance.

換算公式 (Conversion Formula) :  $AX = A \times F$

AX	A	F
氧化雙三丁基錫 / Bis(tributyltin)oxide (TBTO)	三丁基錫 / Tributyl Tin (TBT)	1.0276

### PFOS參考資訊(Reference Information) : 持久性有機污染物 POPs - (EU) 757/2010

PFOS濃度在物質或製備中不得超過0.001%(10ppm), 在半成品、成品或零部件中不得超過0.1%(1000ppm), 在紡織品或塗層材料中不得超過 $1\mu\text{g}/\text{m}^2$ 。

(Outlawing PFOS as substances or preparations in concentrations above 0.001% (10ppm), in semi-finished products or articles or parts at a level above 0.1%(1000ppm), in textiles or other coated materials above  $1\mu\text{g}/\text{m}^2$ .)

全氟辛烷磺酸指全氟辛烷磺酸和它的衍生物包括全氟辛烷磺酸, 全氟辛基磺醯胺, N-甲基全氟辛烷磺醯胺, N-乙基全氟辛烷磺醯胺, N-甲基全氟辛基磺醯基氨基乙醇, N-乙基全氟辛基磺醯基氨基乙醇。(PFOS refer to Perfluorooctanesulfonic acid and its derivatives including Perfluorooctanesulfonic acid, Perfluorooctane sulfonamide, N-Methylperfluorooctane sulfonamide, N-Ethylperfluorooctane sulfonamide, N-Methylperfluorooctane sulfonamidoethanol and N-Ethylperfluorooctane sulfonamidoethanol.)

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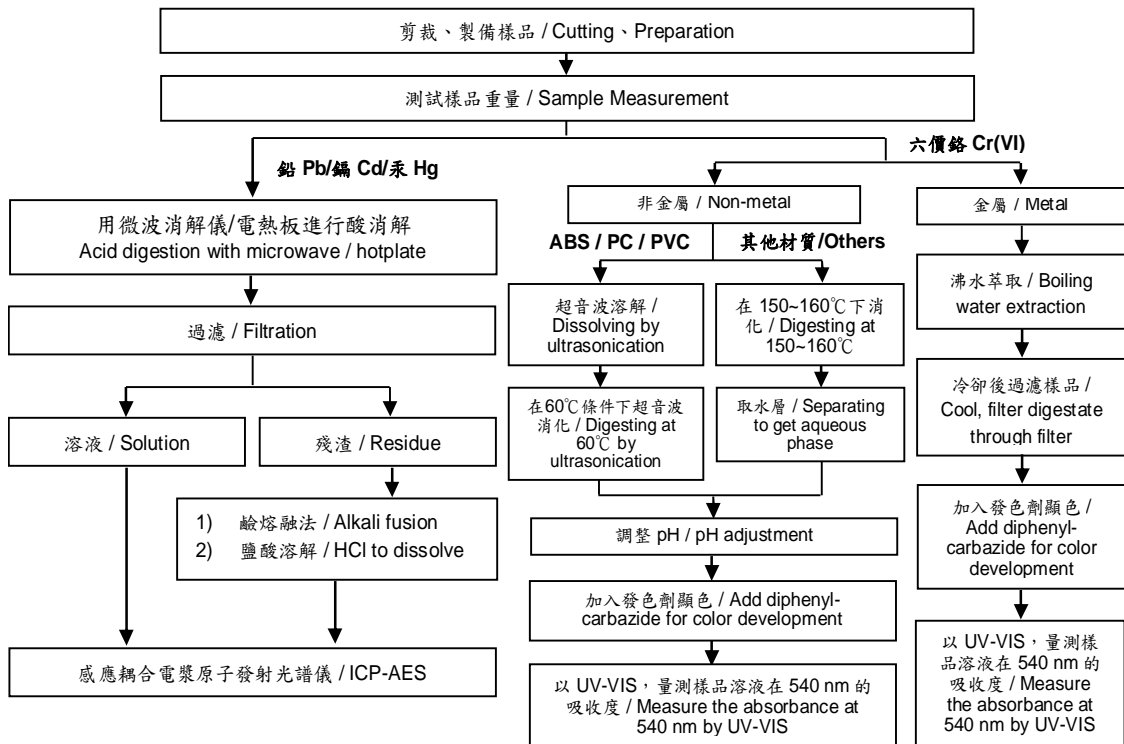
23 SENJU HASHIDO-CHO ADACHI-KU TOKYO 120-8555 JAPAN

### 重金屬流程圖 / Analytical flow chart of Heavy Metal

根據以下的流程圖之條件，樣品已完全溶解。(六價鉻測試方法除外)

These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr<sup>6+</sup> test method excluded)

- 測試人員：劉俊宏 / Technician : Jony Liu
- 測試負責人：張伯睿 / Supervisor: Ray Chang





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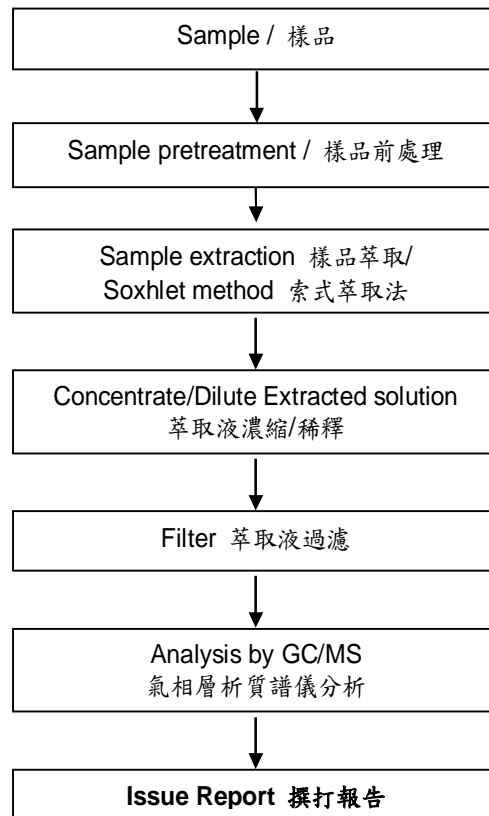
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### 多溴聯苯/多溴聯苯醚 分析流程圖 / PBB/PBDE analytical FLOW CHART

- 測試人員：陳威錚 / Technician : Dorothy Chen
- 測試負責人：張伯睿 / Supervisor: Ray Chang



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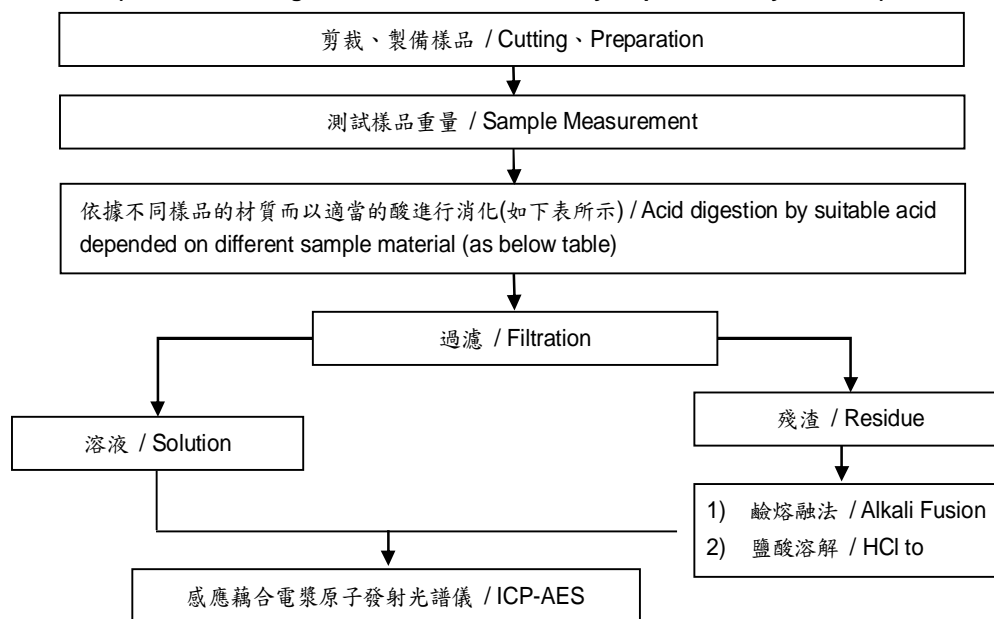
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根據以下的流程圖之條件，樣品已完全溶解。 / These samples were dissolved totally by pre-conditioning method according to below flow chart.

- 測試人員：劉俊宏 / Technician : Jony Liu
- 測試負責人：張伯睿 / Supervisor: Ray Chang

元素以 ICP-AES 分析的消化流程圖  
(Flow Chart of digestion for the elements analysis performed by ICP-AES)



鋼,銅,鋁,焊錫 / Steel, copper, aluminum, solder	王水,硝酸,鹽酸,氫氟酸,雙氧水 / Aqua regia, HNO <sub>3</sub> , HCl, HF, H <sub>2</sub> O <sub>2</sub>
玻璃 / Glass	硝酸,氫氟酸 / HNO <sub>3</sub> /HF
金,鉑,鈀,陶瓷 / Gold, platinum, palladium, ceramic	王水 / Aqua regia
銀 / Silver	硝酸 / HNO <sub>3</sub>
塑膠 / Plastic	硫酸,雙氧水,硝酸,鹽酸 / H <sub>2</sub> SO <sub>4</sub> , H <sub>2</sub> O <sub>2</sub> , HNO <sub>3</sub> , HCl
其他 / Others	加入任何酸至完全溶解 / Any acid to total digestion

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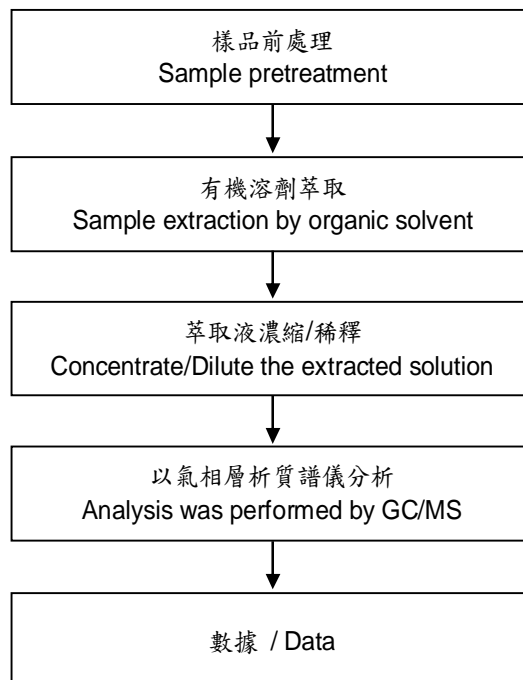
### 含氯阻燃劑分析流程 /

#### Chlorinated Flame retardant analytical flow chart

- 測試人員：陳威錚 / Technician : Dorothy Chen
- 測試負責人：張伯睿 / Supervisor: Ray Chang

【參考方法(Reference method): US EPA 3550C】

【測試項目:多氯聯苯、多氯奈、多氯三聯苯、滅蟻靈 / Test Items: PCBs, PCNs, PCTs, Mirex】



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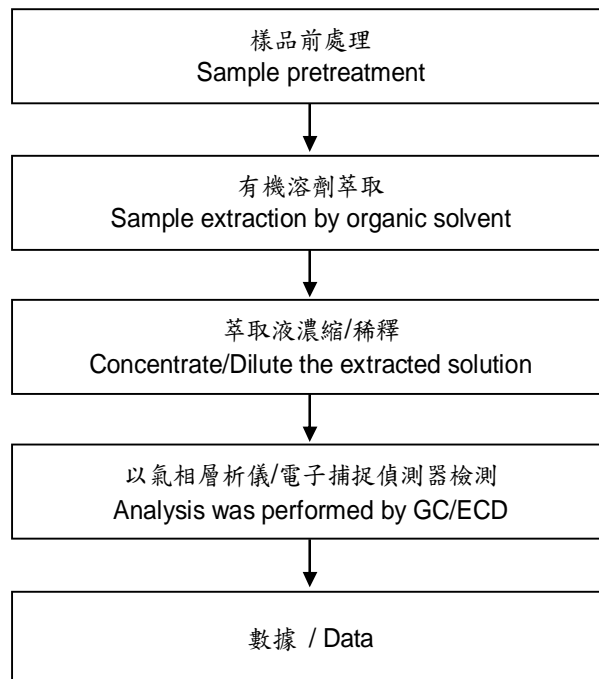
### 含氯阻燃劑分析流程 /

#### Chlorinated Flame retardant analytical flow chart

- 測試人員：陳威錚 / Technician : Dorothy Chen
- 測試負責人：張伯睿 / Supervisor: Ray Chang

【參考方法(Reference method): US EPA 3550C】

測試項目(Test Items): 短鏈氯化石蠟 SCCP、中鏈氯化石蠟 MCCP、  
鏈氯化石蠟 LCCP



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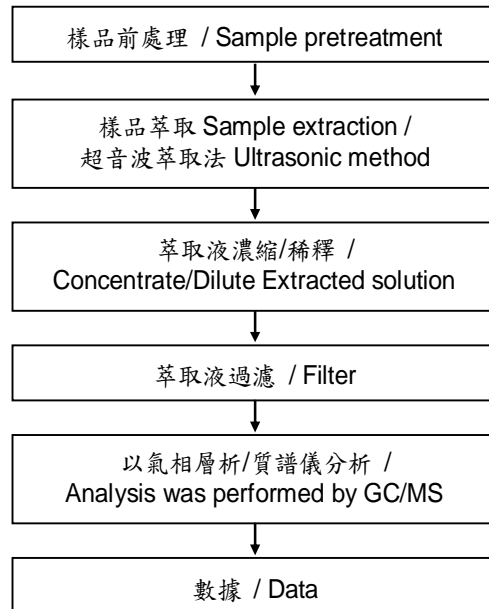
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### 六溴環十二烷分析流程圖 / HBCDD analytical flow chart

- 測試人員：陳威錚 / Technician : Dorothy Chen
- 測試負責人：張伯睿 / Supervisor: Ray Chang



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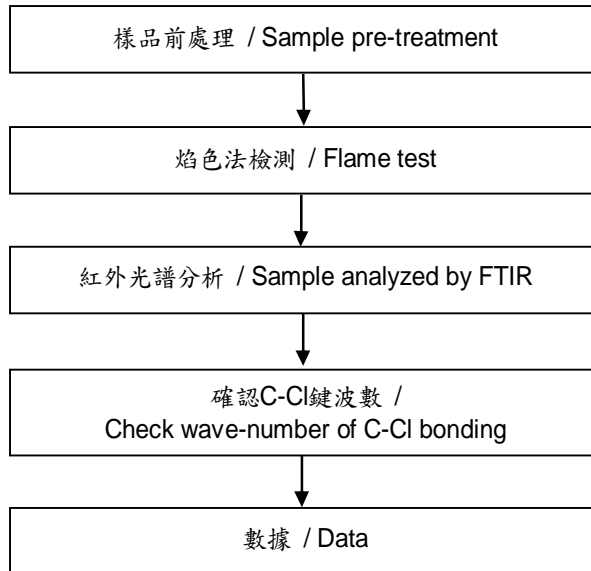
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### 聚氯乙稀物質判定分析流程圖 / Analysis flow chart for determination of PVC in material

- 測試人員：戴秀純 / Technician : Hannah Tai
- 測試負責人：林立翔 / Supervisor: Roger Lin



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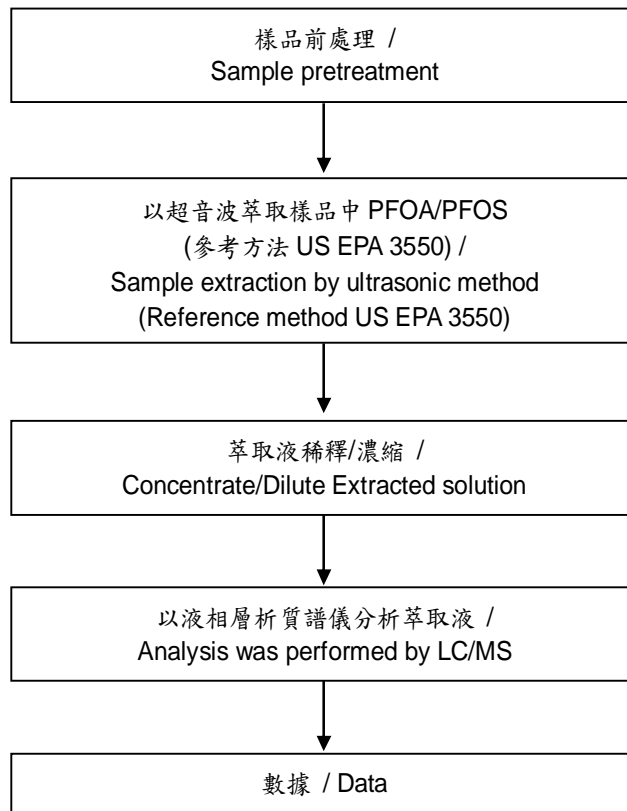
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### 全氟辛酸(銨)/全氟辛酸磺酸分析流程圖 / Analytical flow chart of PFOA/PFOS content

- 測試人員：黃璟璵 / Technician : Ginny Huang
- 測試負責人：張伯睿 / Supervisor: Ray Chang



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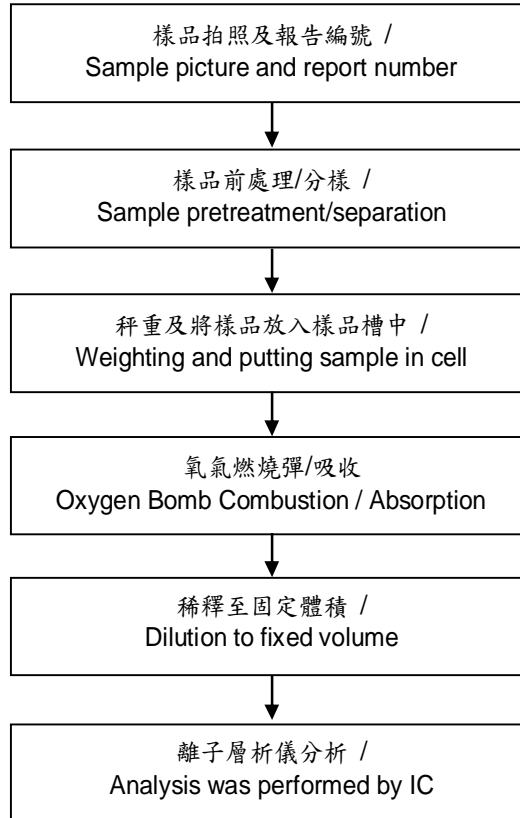
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### 鹵素分析流程圖 / Analytical flow chart of halogen content

- 測試人員：洪秀真 / Technician : Jean Hung
- 測試負責人：張伯睿 / Supervisor: Ray Chang



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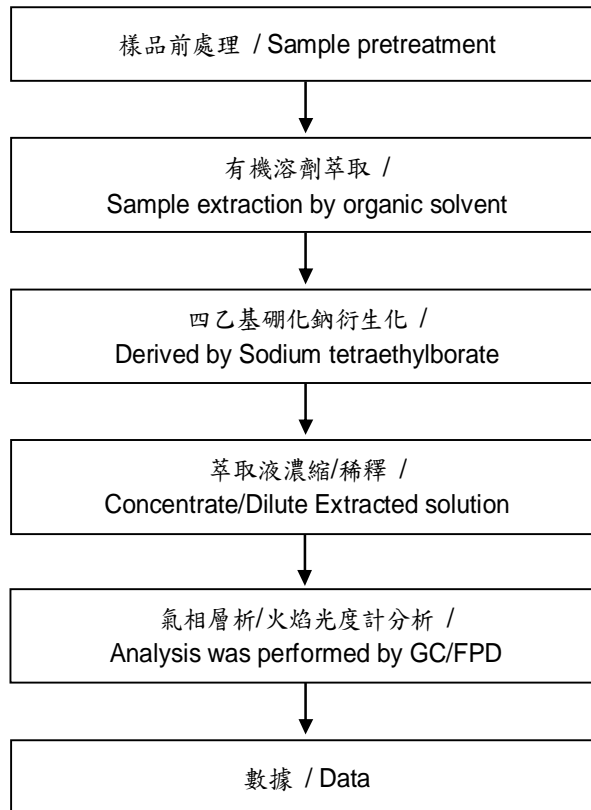
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### 有機錫分析流程圖 / Analytical flow chart of Organic-Tin content

- 測試人員：陳威錚 / Technician : Dorothy Chen
- 測試負責人：張伯睿 / Supervisor: Ray Chang



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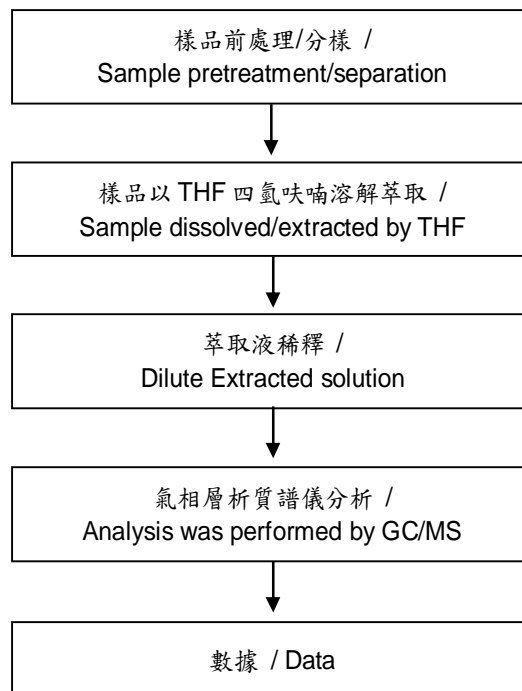
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### 可塑劑分析流程圖 / Analytical flow chart of phthalate content

- 測試人員：陳威錚 / Technician : Dorothy Chen
- 測試負責人：張伯睿 / Supervisor: Ray Chang

#### 【測試方法/Test method: IEC 62321-8】



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