# Test Report

No. : CE/2019/11458 Date : 2019/01/14 

HAESUNGDS CO., LTD.
(SEONGJU-DONG) 726, UNGNAM-RO, SEONGSAN-GU, CHANG-WON-SI, GYEONGSANGNAM-DO, KOREA

**The following samples was/were submitted and identified by/on behalf of the applicant as :**

| | | |
|---|---|---|
| Sample Submitted By | : | HAESUNGDS CO., LTD. |
| Sample Description | : | LEAD FRAME |
| SGS Korea File No. | : | AYGU19-00898 |
| Style/Item No. | : | C194-uPPF |
| Sample Material | : | METAL ALLOY |
| Sample Receiving Date | : | 2019/01/07 |
| Testing Period | : | 2019/01/07 to 2019/01/14 |

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**Test Requested** :

(1) 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).

(2) Please refer to next pages for the other item(s).

**Test Result(s)** : Please refer to following pages.

Troy Chang / Manager - Tech
Signed for and on behalf of
SGS TAIWAN LTD.
Chemical Laboratory - Taipei

HAESUNGDS CO., LTD.
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**Test Result(s)**

PART NAME No.1 : SILVER COLORED METAL SHEET (EXCLUDING THE FRAME)

| Test Item(s) | Unit | Method | MDL | Result |
|---|---|---|---|---|
| | | | | No.1 |
| Cadmium (Cd) | mg/kg | With reference to IEC 62321-5 (2013) and performed by ICP-AES. | 2 | n.d. |
| Lead (Pb) | mg/kg | | 2 | 48.1 |
| Mercury (Hg) | mg/kg | With reference to IEC 62321-4 (2013) and performed by ICP-AES. | 2 | n.d. |
| Hexavalent Chromium Cr(VI)(#2) | µg/cm² | With reference to IEC 62321-7-1 (2015) and performed by UV-VIS. | 0.10 | n.d. |
| **Sum of PBBs** | mg/kg | With reference to IEC 62321-6 (2015) and performed by GC/MS. | - | n.d. |
| Monobromobiphenyl | mg/kg | | 5 | n.d. |
| Dibromobiphenyl | mg/kg | | 5 | n.d. |
| Tribromobiphenyl | mg/kg | | 5 | n.d. |
| Tetrabromobiphenyl | mg/kg | | 5 | n.d. |
| Pentabromobiphenyl | mg/kg | | 5 | n.d. |
| Hexabromobiphenyl | mg/kg | | 5 | n.d. |
| Heptabromobiphenyl | mg/kg | | 5 | n.d. |
| Octabromobiphenyl | mg/kg | | 5 | n.d. |
| Nonabromobiphenyl | mg/kg | | 5 | n.d. |
| Decabromobiphenyl | mg/kg | | 5 | n.d. |
| **Sum of PBDEs** | mg/kg | | - | n.d. |
| Monobromodiphenyl ether | mg/kg | | 5 | n.d. |
| Dibromodiphenyl ether | mg/kg | | 5 | n.d. |
| Tribromodiphenyl ether | mg/kg | | 5 | n.d. |
| Tetrabromodiphenyl ether | mg/kg | | 5 | n.d. |
| Pentabromodiphenyl ether | mg/kg | | 5 | n.d. |
| Hexabromodiphenyl ether | mg/kg | | 5 | n.d. |
| Heptabromodiphenyl ether | mg/kg | | 5 | n.d. |
| Octabromodiphenyl ether | mg/kg | | 5 | n.d. |
| Nonabromodiphenyl ether | mg/kg | | 5 | n.d. |
| Decabromodiphenyl ether | mg/kg | | 5 | n.d. |

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| Test Item(s) | Unit | Method | MDL | Result |
|---|---|---|---|---|
| | | | | No.1 |
| Polychlorinated Biphenyls (PCBs) (CAS No.: 1336-36-3) | mg/kg | With reference to US EPA 3550C (2007). Analysis was performed by GC/MS. | 0.5 | n.d. |
| Polychlorinated Naphthalene (PCNs) | mg/kg | With reference to US EPA 3550C (2007). Analysis was performed by GC/MS. | 5 | n.d. |
| Polychlorinated Terphenyls (PCTs) | mg/kg | With reference to US EPA 3550C (2007). Analysis was performed by GC/MS. | 0.5 | n.d. |
| Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) (CAS No.: 85535-84-8) | mg/kg | With reference to US EPA 3550C (2007). Analysis was performed by GC/MS. | 100 | n.d. |
| Tributyl Tin (TBT) | mg/kg | With reference to ISO 17353 (2004). Analysis was performed by GC/FPD. | 0.03 | n.d. |
| Bis(tributyltin)oxide (TBTO) (CAS No.: 56-35-9) | mg/kg | With reference to ISO 17353 (2004). Analysis was performed by GC/FPD. Calculated from the result of Tributyl Tin (TBT). | 0.03 (▲) | n.d. |
| Triphenyl Tin (TphT) | mg/kg | With reference to ISO 17353 (2004). Analysis was performed by GC/FPD. | 0.03 | n.d. |
| Dibutyl Tin (DBT) | mg/kg | With reference to ISO 17353 (2004). Analysis was performed by GC/FPD. | 0.03 | n.d. |
| Dioctyl Tin (DOT) | mg/kg | With reference to ISO 17353 (2004). Analysis was performed by GC/FPD. | 0.03 | n.d. |
| **Halogen** | | | | |
| Halogen-Fluorine (F) (CAS No.: 14762-94-8) | mg/kg | With reference to BS EN 14582 (2016). Analysis was performed by IC. | 50 | n.d. |
| Halogen-Chlorine (Cl) (CAS No.: 22537-15-1) | mg/kg | With reference to BS EN 14582 (2016). Analysis was performed by IC. | 50 | n.d. |
| Halogen-Bromine (Br) (CAS No.: 10097-32-2) | mg/kg | With reference to BS EN 14582 (2016). Analysis was performed by IC. | 50 | n.d. |
| Halogen-Iodine (I) (CAS No.: 14362-44-8) | mg/kg | With reference to BS EN 14582 (2016). Analysis was performed by IC. | 50 | n.d. |
| Antimony (Sb) | mg/kg | With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES. | 2 | n.d. |
| Arsenic (As) | mg/kg | With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES. | 2 | n.d. |

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| Test Item(s) | Unit | Method | MDL | Result |
|---|---|---|---|---|
| | | | | No.1 |
| Beryllium (Be) | mg/kg | With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES. | 2 | n.d. |
| Perfluorooctane sulfonates (PFOS-Acid, Metal Salt, Amide) | mg/kg | With reference to US EPA 3550C (2007). Analysis was performed by LC/MS. | 10 | n.d. |
| PFOA (CAS No.: 335-67-1) | mg/kg | With reference to US EPA 3550C (2007). Analysis was performed by LC/MS. | 10 | n.d. |
| PVC | ** | Analysis was performed by FTIR and FLAME Test. | - | Negative |
| DBP (Dibutyl phthalate) (CAS No.: 84-74-2) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| BBP (Butyl Benzyl phthalate) (CAS No.: 85-68-7) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| DIBP (Di-isobutyl phthalate) (CAS No.: 84-69-5) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| DIHP (1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich) (CAS No.: 71888-89-6) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| DHNUP (1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters) (CAS No.: 68515-42-4) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| DMEP (Bis (2-methoxyethyl) phthalate) (CAS No.: 117-82-8) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| DNPP (Di-n-pentyl phthalate) (CAS No.: 131-18-0) | mg/kg | With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS. | 50 | n.d. |
| Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified (α-HBCDD, β- HBCDD, γ- HBCDD) (CAS No.: 25637-99-4 and 3194-55-6 (134237-51-7, 134237-50-6, 134237-52-8)) | mg/kg | With reference to IEC 62321 (2008). Analysis was performed by GC/MS. | 5 | n.d. |

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**Note :**

1. mg/kg = ppm ; 0.1wt% = 1000ppm
2. MDL = Method Detection Limit
3. n.d. = Not Detected = less than MDL
4. " - " = Not Regulated
5. ** = Qualitative analysis (No Unit)
6. Negative = Undetectable / Positive = Detectable
7. (#2) =
   a. The sample is positive for Cr(VI) if the Cr(VI) concentration is greater than 0.13 μg/cm². The sample coating is considered to contain Cr(VI)
   b. The sample is negative for Cr(VI) if Cr(VI) is n.d. (concentration less than 0.10 μg/cm²). The coating is considered a non-Cr(VI) based coating
   c. The result between 0.10 μg/cm² and 0.13 μg/cm² is considered to be inconclusive - unavoidable coating variations may influence the determination.
8. (▲) : The MDL was evaluated for element / tested substance.
   Conversion Formula : AX = A × F

| AX | A | F |
|---|---|---|
| Bis(tributyltin)oxide (TBTO) | Tributyl Tin (TBT) | 1.024 |

**PFOS Reference Information : POPs - (EU) 757/2010**

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 1μg/m².

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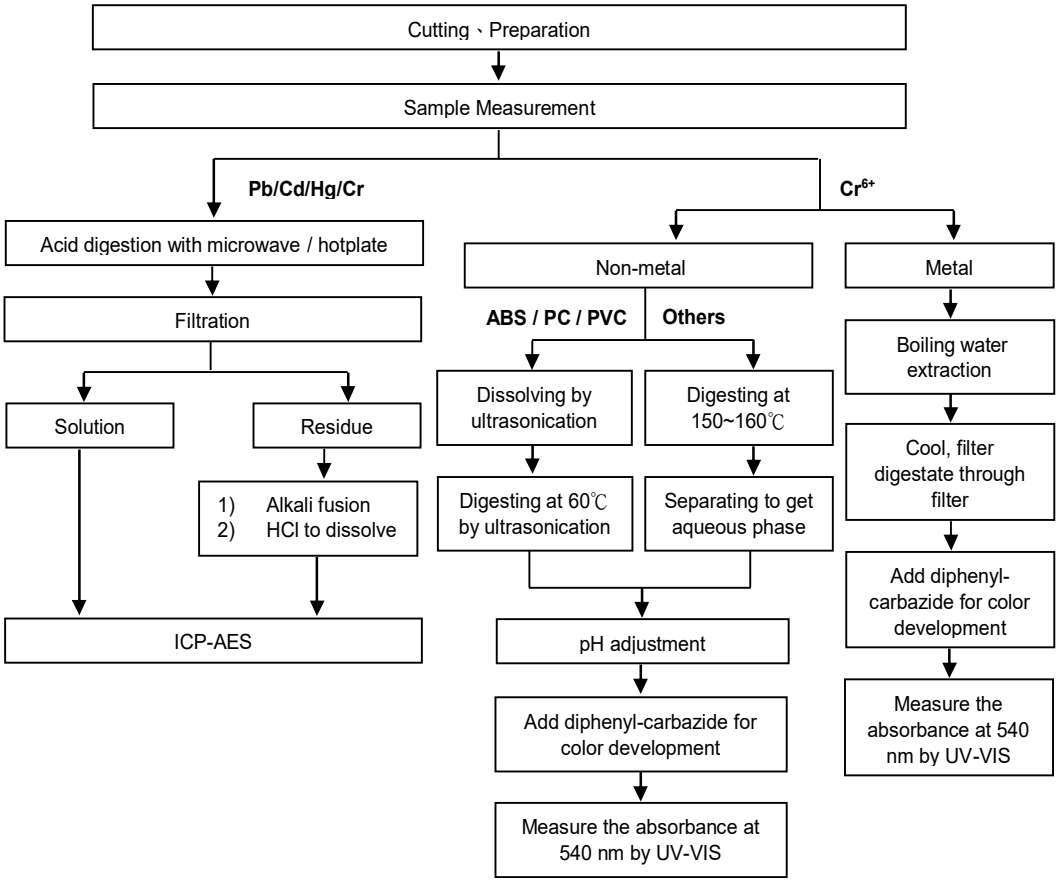
## Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart. （$Cr^{6+}$ test method excluded）

- Technician : Rita Chen
- Supervisor: Troy Chang



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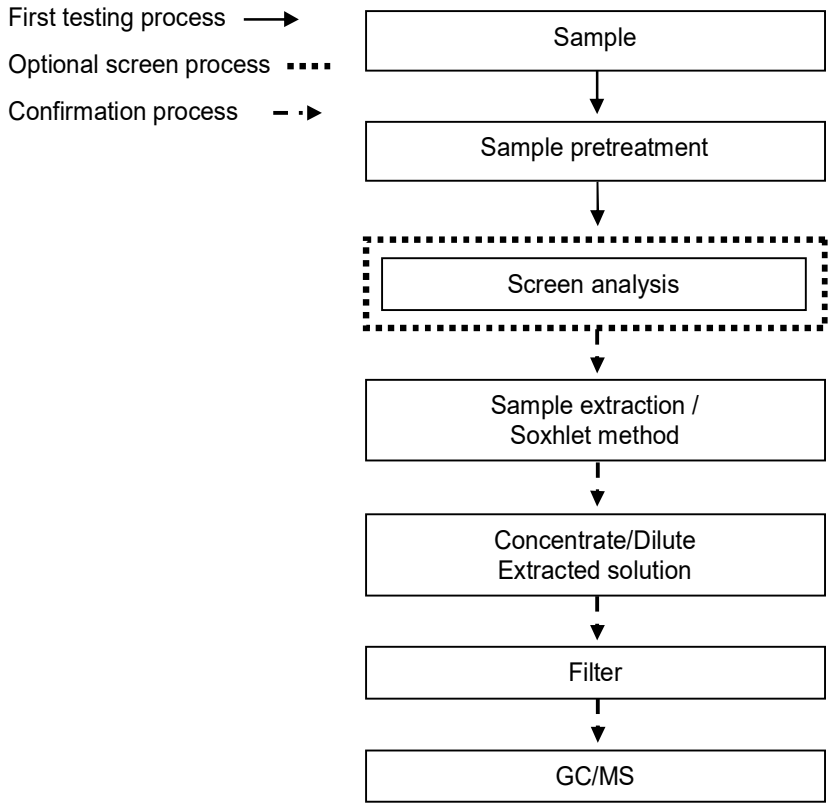
**Analytical flow chart – PBB / PBDE**

- Technician : Yaling Tu
- Supervisor: Troy Chang



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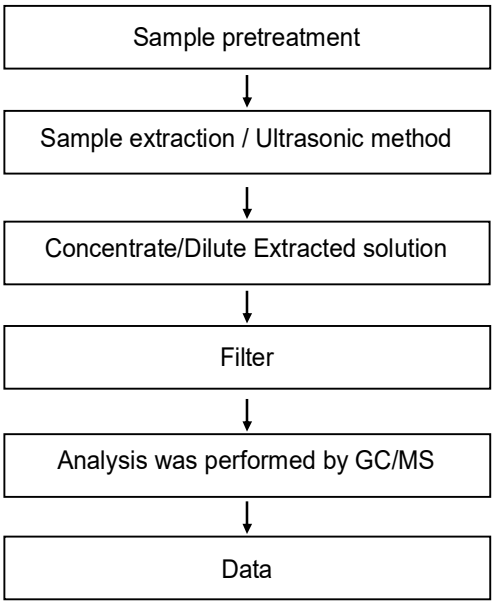
**Analytical flow chart - PCBs**

- Technician: Yaling Tu
- Supervisor: Troy Chang



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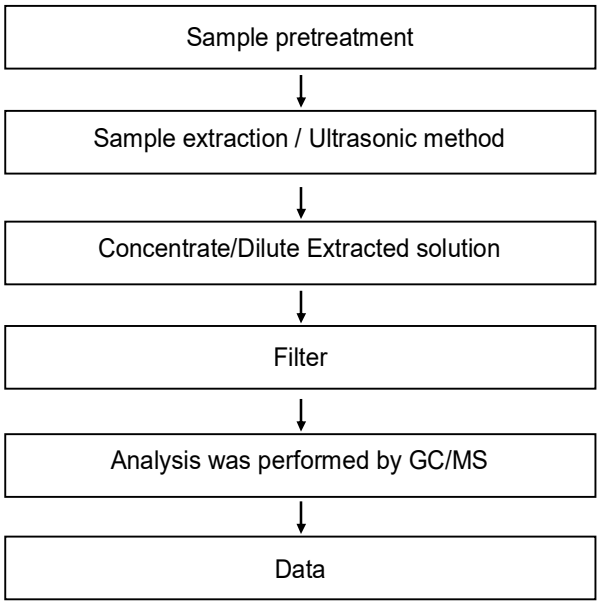
## Analytical flow chart - PCNs

- Technician: Yaling Tu
- Supervisor: Troy Chang



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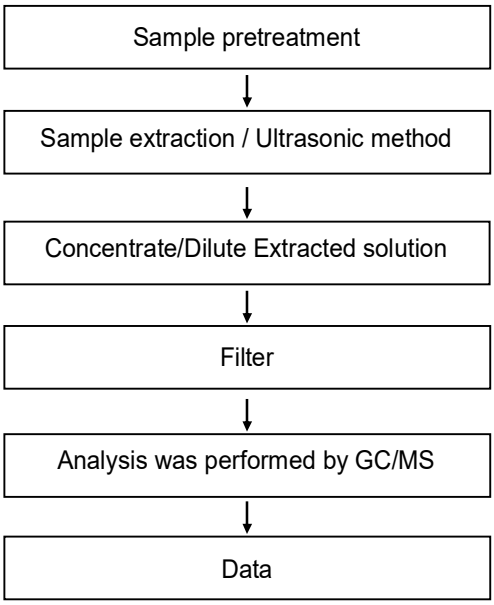
**Analytical flow chart - PCTs**

- Technician: Barry Tseng
- Supervisor: Troy Chang



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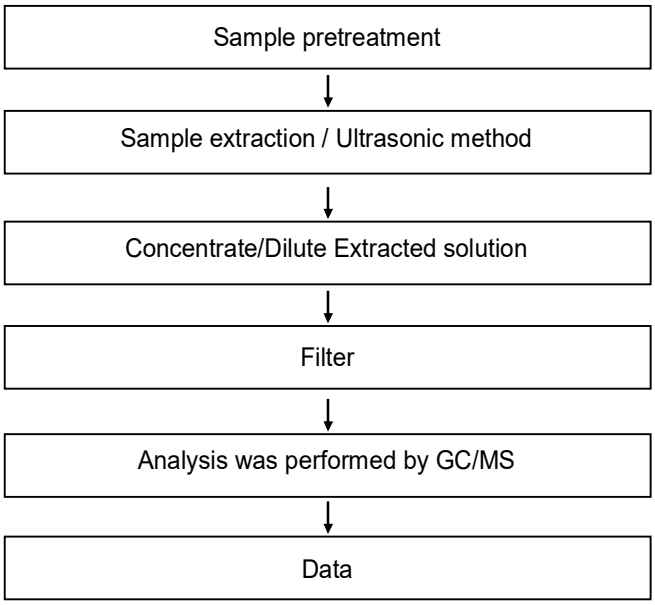
**Analytical flow chart - Chlorinated Paraffins**

- Technician: Yaling Tu
- Supervisor: Troy Chang



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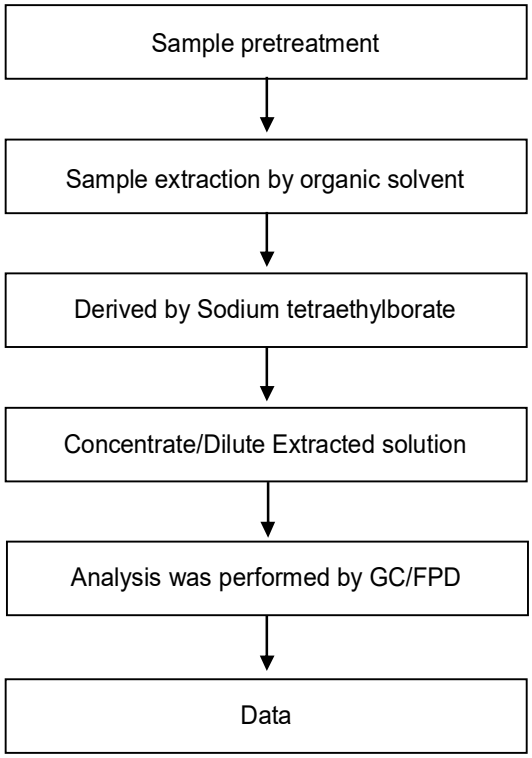
## Analytical flow chart - Organic-Tin

- Technician: Yaling Tu
- Supervisor: Troy Chang



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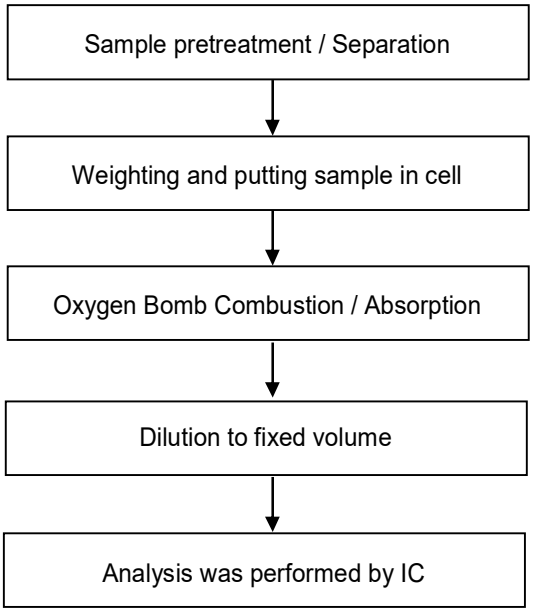
## Analytical flow chart - Halogen

- Technician: Rita Chen
- Supervisor: Troy Chang



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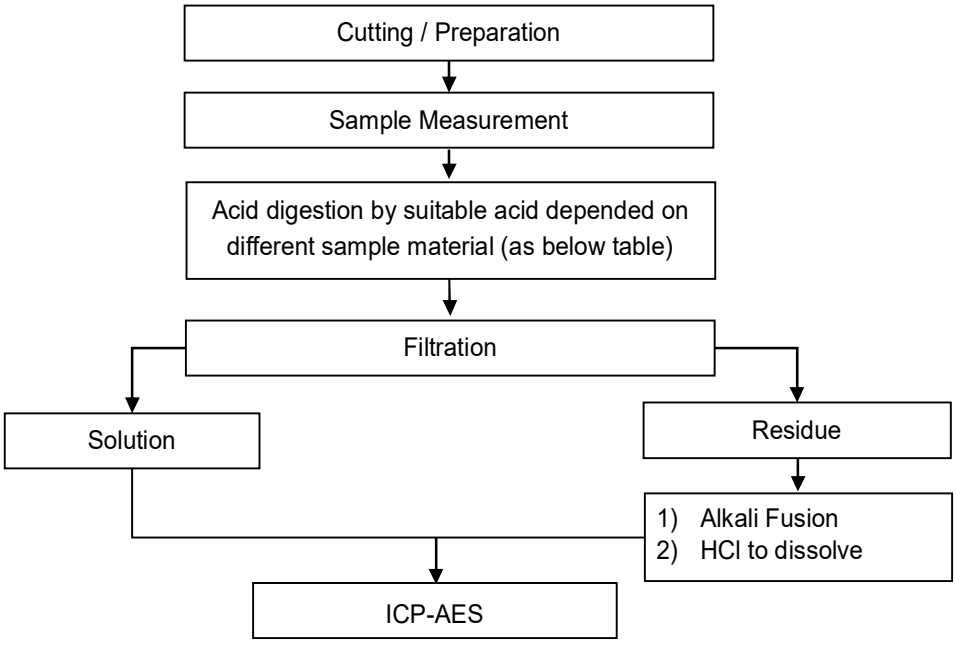
These samples were dissolved totally by pre-conditioning method according to below flow chart.

- Technician: Rita Chen
- Supervisor: Troy Chang

**Flow Chart of digestion for the elements analysis performed by ICP-AES**




| | |
|---|---|
| Steel, copper, aluminum, solder | Aqua regia, $HNO_3$, HCl, HF, $H_2O_2$ |
| Glass | $HNO_3$/HF |
| Gold, platinum, palladium, ceramic | Aqua regia |
| Silver | $HNO_3$ |
| Plastic | $H_2SO_4$, $H_2O_2$, $HNO_3$, HCl |
| Others | Added appropriate reagent to total digestion |

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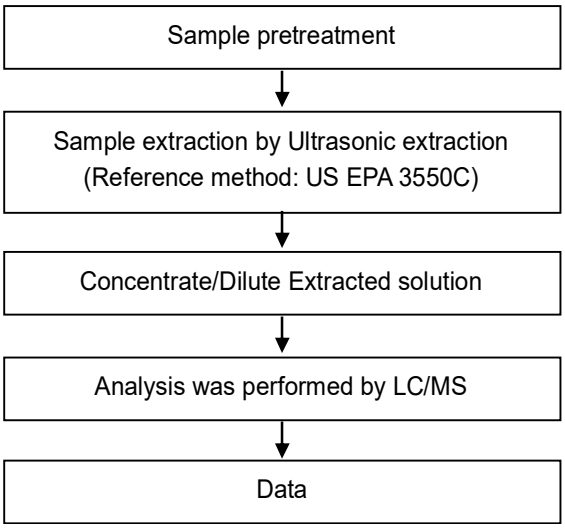
## Analytical flow chart - PFOA/PFOS

- Technician: Yaling Tu
- Supervisor: Troy Chang



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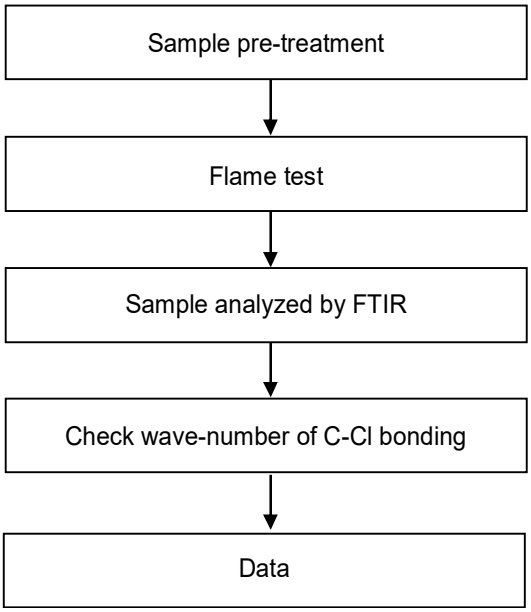
## Analysis flow chart - PVC

- Technician: Yaling Tu
- Supervisor: Troy Chang



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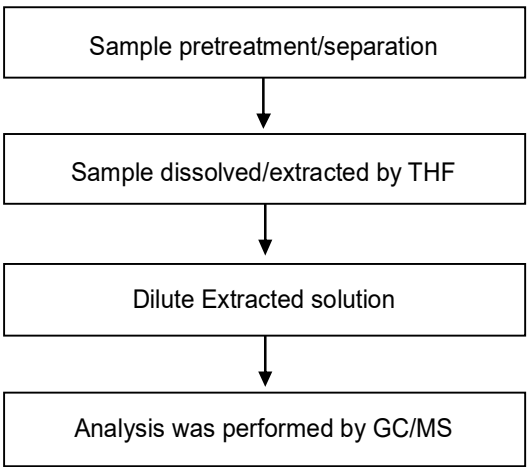
**Analytical flow chart - Phthalate**

- Technician: Yaling Tu
- Supervisor: Troy Chang

**【Test method: IEC 62321-8】**



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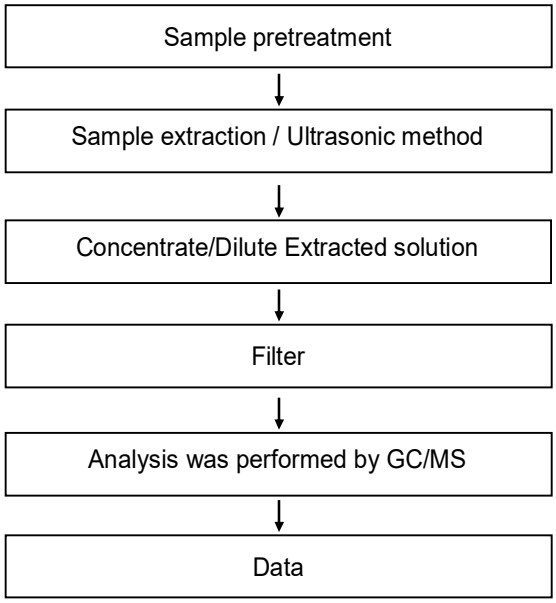
## Analytical flow chart - HBCDD

- Technician: Yaling Tu
- Supervisor: Troy Chang



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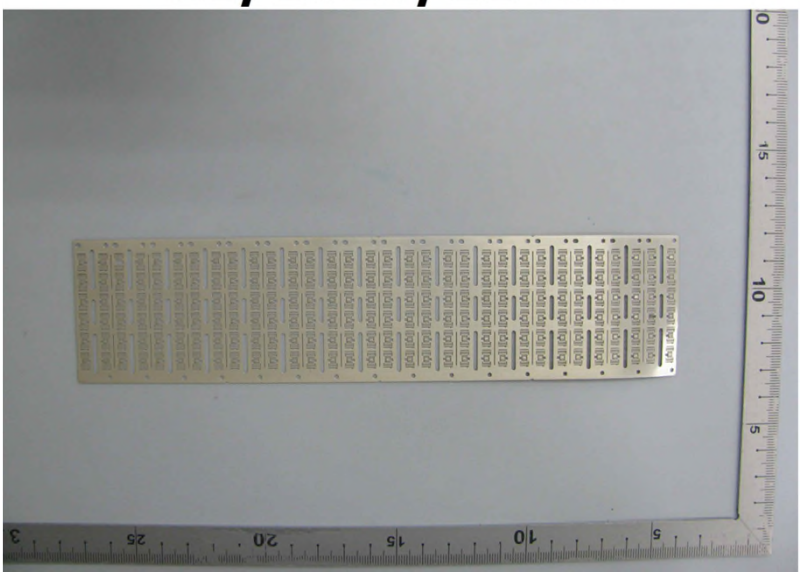
*** The tested sample / part is marked by an arrow if it's shown on the photo. ***

**CE/2019/11458**



** End of Report **