

## Test Report

No. : CE/2019/75434

Date : 2019/08/02

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MK ELECTRON CO., LTD.

405, GEUMEO-RO, POGOK-EUP, CHEOIN-GU, YONGIN-SI, GYEONGGI-DO, KOREA

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

Sample Submitted By : MK ELECTRON CO., LTD.  
Sample Description : COPPER WIRE  
Sample Receiving Date : 2019/07/26  
Testing Period : 2019/07/26 to 2019/08/02

=====  
**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 behalf of  
SGS TAIWAN LTD.  
Chemical Laboratory - Taipei



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## Test Result(s)

PART NAME No.1 : COPPER COLORED METAL WIRE

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	With reference to IEC 62321-5 (2013) and performed by ICP-AES.	2	n.d.
Mercury (Hg)	mg/kg	With reference to IEC 62321-4:2013+AMD1:2017 and performed by ICP-AES.	2	n.d.
Hexavalent Chromium Cr(VI)(#2)	µg/cm <sup>2</sup>	With reference to IEC 62321-7-1 (2015) and performed by UV-VIS.	0.10	n.d.
<b>Sum of PBBs</b>	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.
<b>Sum of PBDEs</b>	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 Terphenyls (PCTs)	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.
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.
Triphenyl Tin (TphT)	mg/kg		0.03	n.d.
Dibutyl Tin (DBT)	mg/kg		0.03	n.d.
Diocetyl Tin (DOT)	mg/kg		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.
<b>Halogen</b>				
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		50	n.d.
Halogen-Bromine (Br) (CAS No.: 10097-32-2)	mg/kg		50	n.d.
Halogen-Iodine (I) (CAS No.: 14362-44-8)	mg/kg		50	n.d.
Antimony (Sb)	mg/kg		With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES.	2
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 CEN/TS 15968 (2010). Analysis was performed by LC/MS.	0.01	n.d.
PFOA (CAS No.: 335-67-1)	mg/kg	With reference to CEN/TS 15968 (2010). Analysis was performed by LC/MS.	0.01	n.d.

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Test Item(s)	Unit	Method	MDL	Result
				No.1
PVC	**	Analysis was performed by FTIR and FLAME Test.	-	Negative
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.
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.
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.
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.
DIDP (Di-isodecyl phthalate) (CAS No.: 26761-40-0; 68515-49-1)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.
DINP (Di-isononyl phthalate) (CAS No.: 28553-12-0; 68515-48-0)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.
DNOP (Di-n-octyl phthalate) (CAS No.: 117-84-0)	mg/kg	With reference to IEC 62321-8 (2017). Analysis was performed by GC/MS.	50	n.d.
DNHP (Di-n-hexyl phthalate) (CAS No.: 84-75-3)	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.
Arsenic (As)	mg/kg	With reference to US EPA 3052 (1996). Analysis was performed by ICP-AES.	2	n.d.
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	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/cm<sup>2</sup>.  
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/cm<sup>2</sup>).  
The coating is considered a non-Cr(VI) based coating
  - c. The result between 0.10 µg/cm<sup>2</sup> and 0.13 µg/cm<sup>2</sup> is considered to be inconclusive - unavoidable coating variations may influence the determination.
8. (▲) : The MDL was evaluated for element / tested substance.

Conversion Formula :  $AX = A \times F$

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

**PFOS Reference Information : POPs - (EU) 2019/1021**

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/m<sup>2</sup>.

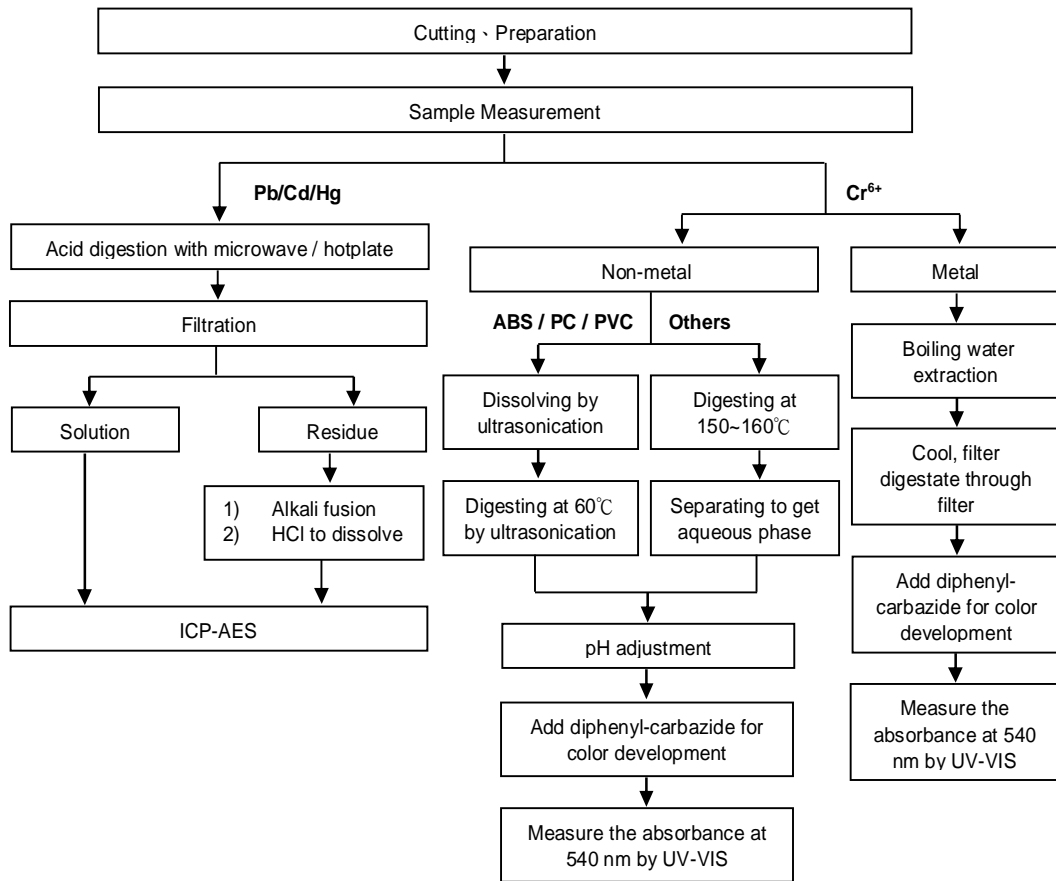
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## Analytical flow chart of Heavy Metal

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

- Technician : Rita Chen
- Supervisor: Troy Chang

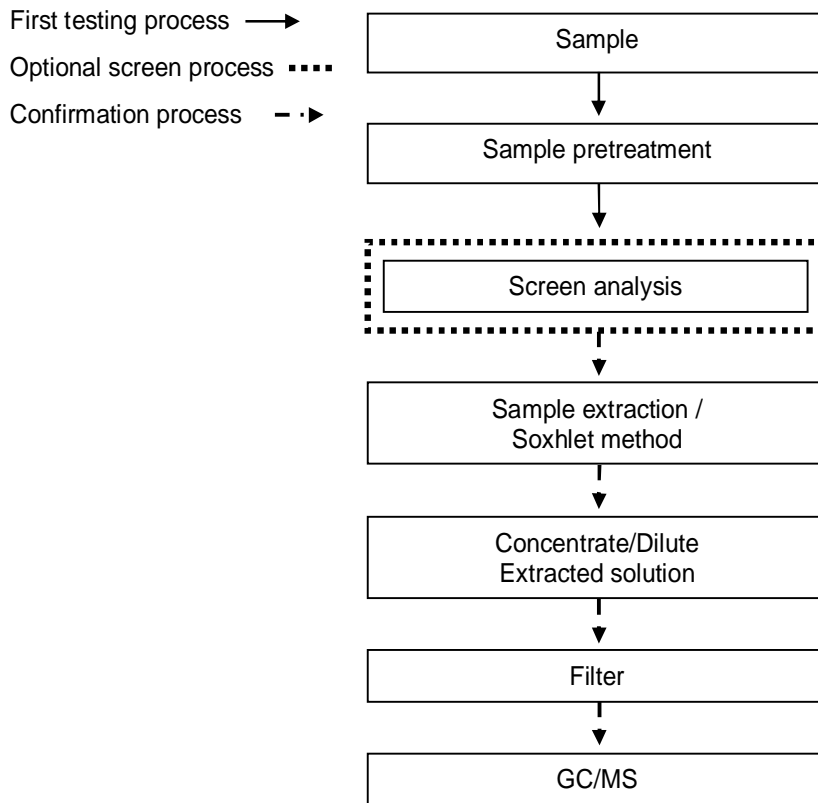


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### Analytical flow chart – PBB / PBDE

- Technician : Yaling Tu
- Supervisor: Troy Chang



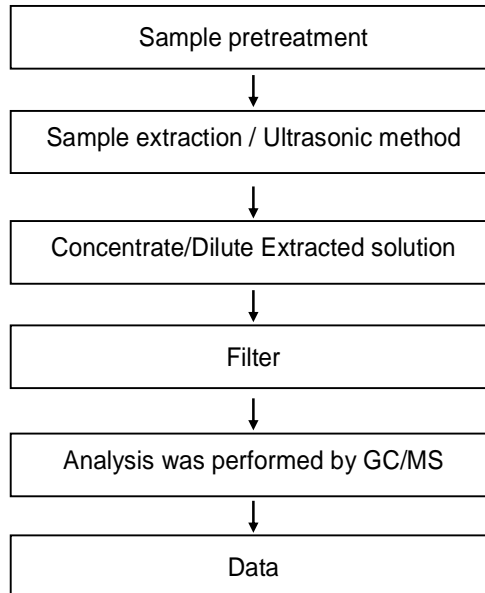
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### Analytical flow chart - PCBs

- Technician: Yaling Tu
- Supervisor: Troy Chang



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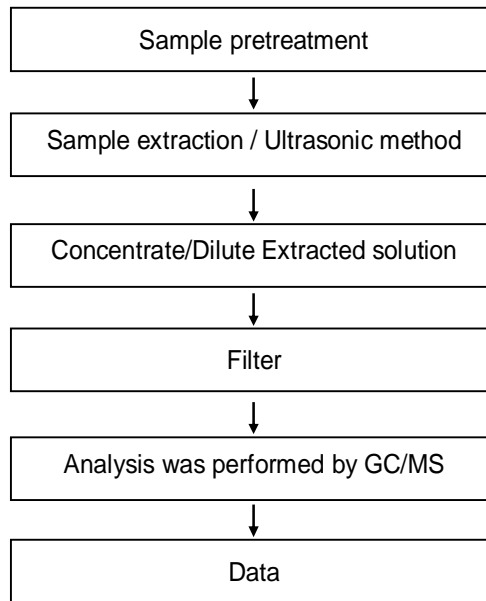


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### Analytical flow chart - PCTs

- Technician: Yaling Tu
- Supervisor: Troy Chang



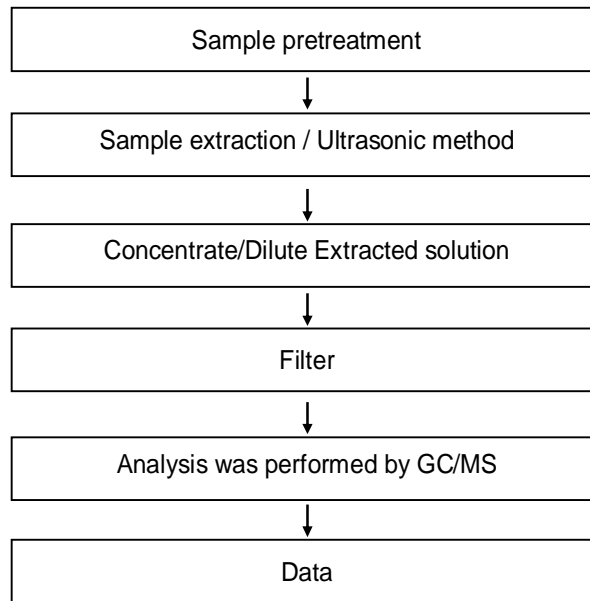
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### Analytical flow chart - PCNs

- Technician: Yaling Tu
- Supervisor: Troy Chang



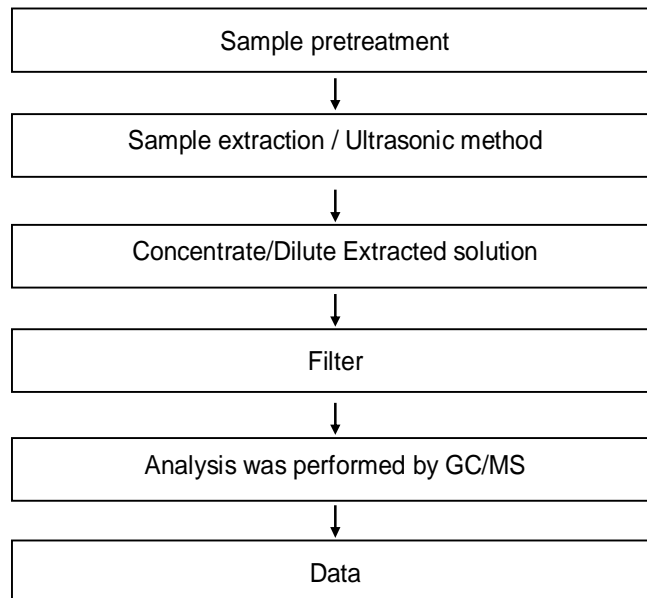
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### Analytical flow chart - Chlorinated Paraffins

- Technician: Yaling Tu
- Supervisor: Troy Chang



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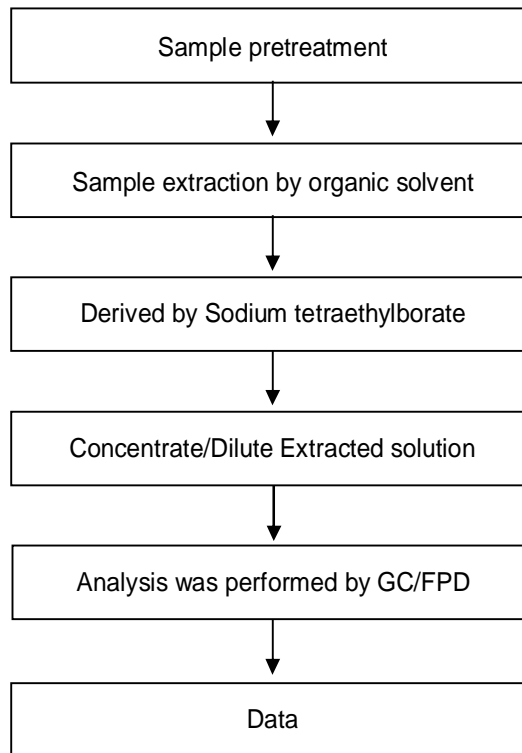
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## Analytical flow chart - Organic-Tin

- Technician: Yaling Tu
- Supervisor: Troy Chang



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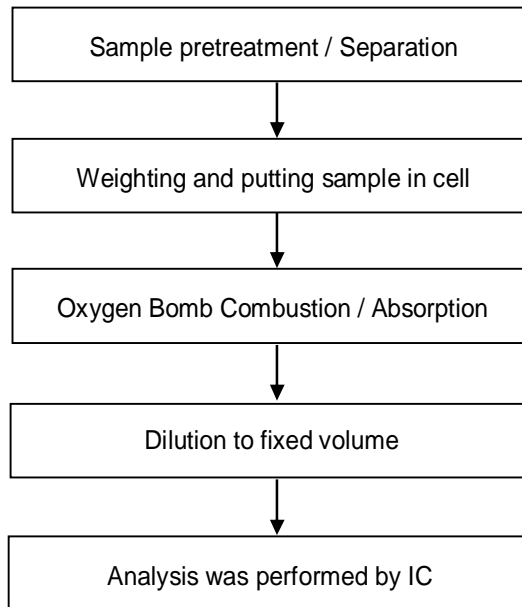
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## Analytical flow chart - Halogen

- Technician: Rita Chen
- Supervisor: Troy Chang



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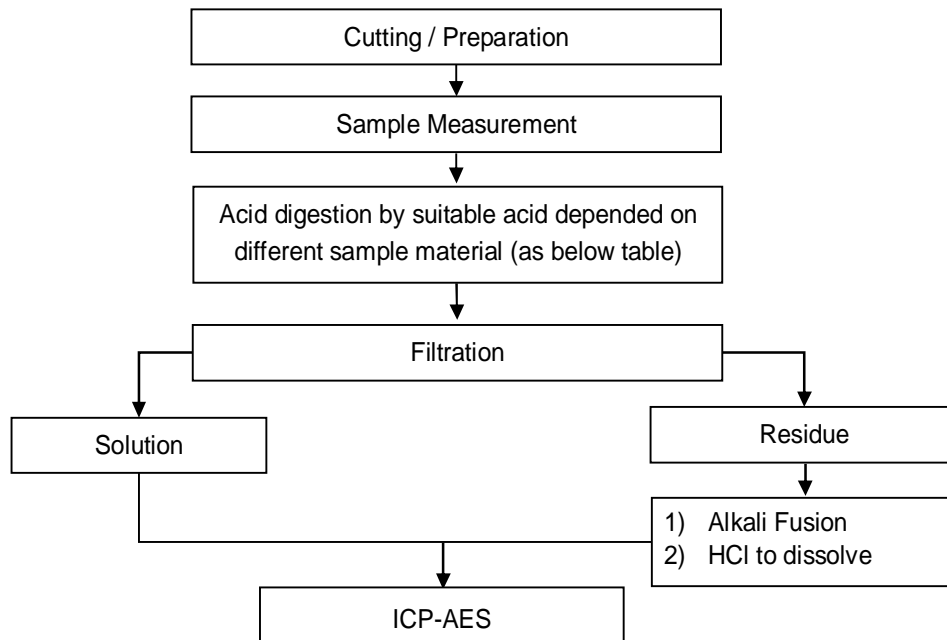
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These samples were dissolved totally by pre-conditioning method according to below flow chart.

- 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 <sub>3</sub> , HCl, HF, H <sub>2</sub> O <sub>2</sub>
Glass	HNO <sub>3</sub> /HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO <sub>3</sub>
Plastic	H <sub>2</sub> SO <sub>4</sub> , H <sub>2</sub> O <sub>2</sub> , HNO <sub>3</sub> , HCl
Others	Added appropriate reagent to total digestion

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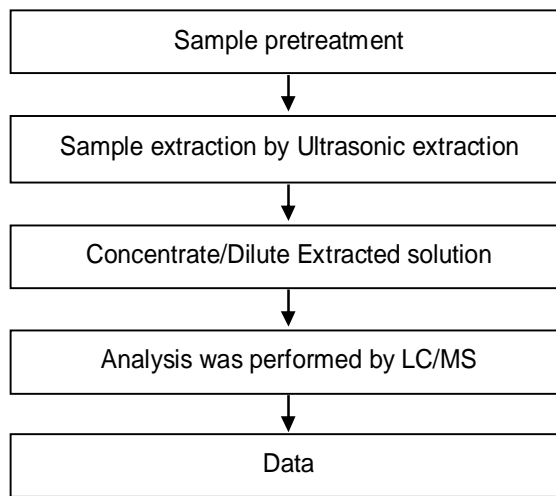
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## Analytical flow chart - PFOA/PFOS

- Technician: Yaling Tu
- Supervisor: Troy Chang



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# Test Report

No. : CE/2019/75434

Date : 2019/08/02

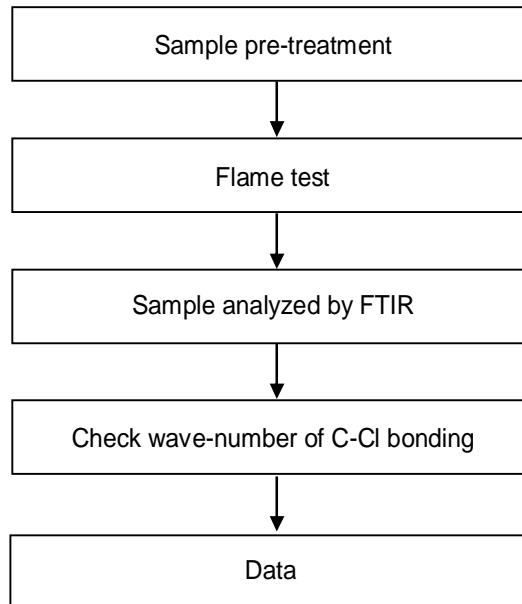
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405, GEUMEO-RO, POGOK-EUP, CHEOIN-GU, YONGIN-SI, GYEONGGI-DO, KOREA

## Analysis flow chart - PVC

- Technician: Yaling Tu
- Supervisor: Troy Chang



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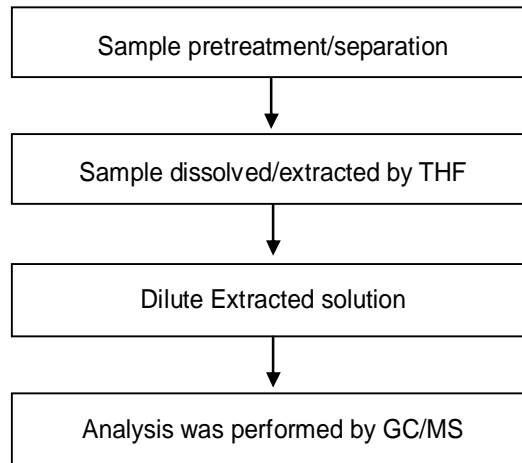
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## Analytical flow chart - Phthalate

- Technician: Yaling Tu
- Supervisor: Troy Chang

**【Test method: IEC 62321-8】**



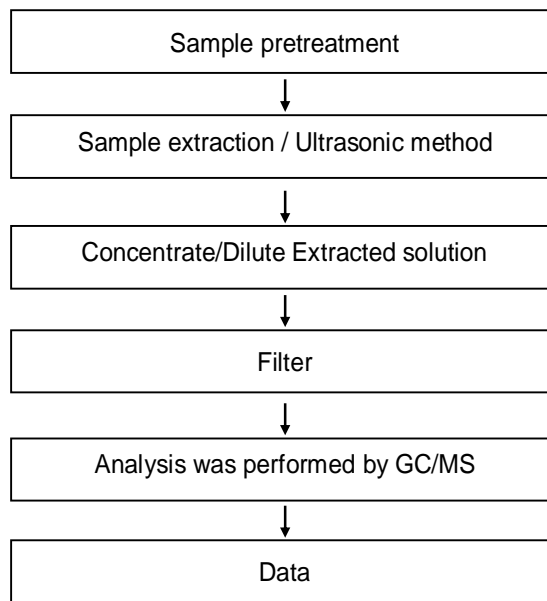
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### Analytical flow chart - HBCDD

- Technician: Yaling Tu
- Supervisor: Troy Chang



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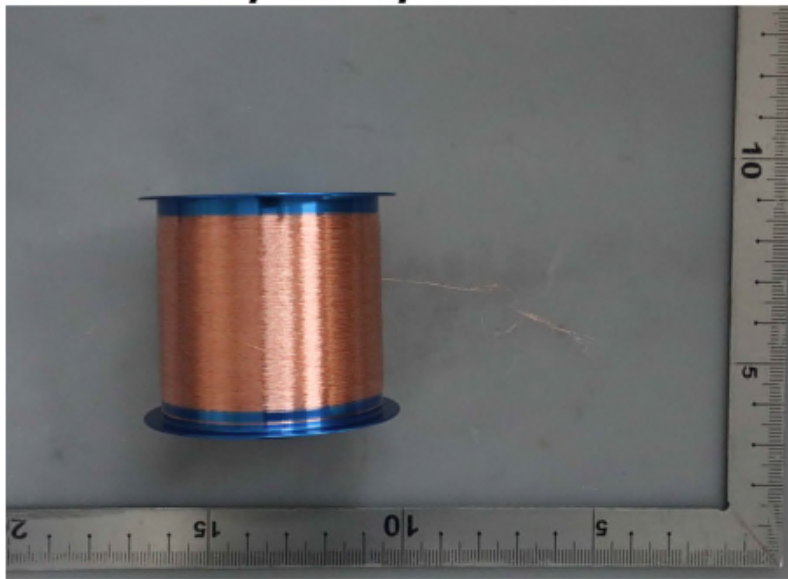
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\* The tested sample / part is marked by an arrow if it's shown on the photo. \*

### CE/2019/75434



\*\* End of Report \*\*