

Test Report

No. : KA/2018/30827 Date : 2018/03/19 Page : 1 of 19

ACCURUS SCIENTIFIC CO., LTD
NO.508-51, SECTION 1, WEN-SIEN ROAD, RENDE DISTRICT, TAINAN CITY 717, TAIWAN

The following sample(s) was/were submitted and identified by/on behalf of the client as :

Sample Description : SOLDER BALL
Style/Item No. : SAC405(Sn95.5Ag4Cu0.5)
Sample Receiving Date : 2018/03/08
Testing Period : 2018/03/08 TO 2018/03/19
Sample Submitted By : ACCURUS SCIENTIFIC CO., LTD

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

Test Result(s)

: Please refer to next page(s).

Conclusion

- (1) Based on the performed tests on submitted samples, the test results of Cadmium, Lead, Mercury, Cr(VI), PBBs, PBDEs, DBP, BBP, DEHP, DIBP comply with the limits as set by RoHS and amending Directive (EU) 2015/863.

Ray Chang

Ray Chang Ph.D. | Manager - Techn

Signed for and on behalf of
SGS Taiwan Limited





Chemical Laboratory - Kao., SGS Taiwan Ltd.

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ACCURUS SCIENTIFIC CO., LTD

NO.508-51, SECTION 1, WEN-SIEN ROAD, RENDE DISTRICT, TAINAN CITY 717, TAIWAN

Test Result(s)

PART NAME NO.1 : SILVER SOLDER BALL

Test Item (s):	Unit	Method	MDL	Result	Limit	
				No.1		
Cadmium (Cd)	mg/kg	With reference to IEC 62321-5: 2013 and performed by ICP-AES.	2	n.d.	100	
Lead (Pb)	mg/kg	With reference to IEC 62321-5: 2013 and performed by ICP-AES.	2	62.5	1000	
Mercury (Hg)	mg/kg	With reference to IEC 62321-4: 2013 and performed by ICP-AES.	2	n.d.	1000	
Hexavalent Chromium Cr(VI)(#2)	µg/cm ²	With reference to IEC 62321-7-1:2015 and performed by 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.	1000	
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		With reference to IEC 62321-6:2015 and performed by GC/MS.	-	n.d.	1000
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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台灣檢驗科技股份有限公司

No. 61, Kai-Fa Road, Nanzih Export Processing Zone, Kaohsiung, Taiwan /
t + 886 (07)301 2121

高雄市楠梓加工出口區開發路61號
f + 886 (07)3010867
www.tw.sgs.com

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Test Item (s):	Unit	Method	MDL	Result	Limit
				No.1	
Antimony (Sb)	mg/kg	With reference to US EPA Method 3052 for Antimony Content. Analysis was performed by ICP-AES.	2	42.5	-
Beryllium (Be)	mg/kg	With reference to US EPA Method 3052 for Beryllium Content. Analysis was performed by ICP-AES.	2	n.d.	-
Arsenic (As)	mg/kg	With reference to US EPA Method 3052 for Arsenic Content. Analysis was performed by ICP-AES.	2	14.5	-
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 method. Analysis was performed by GC/MS.	5	n.d.	-
Red phosphorus	**	Analysis was performed by Pyrolyzer-GC/MS.	-	Negative	-
PVC	**	Analysis was performed by FTIR and FLAME Test.	-	Negative	-
Polychlorinated Biphenyls (PCBs)	mg/kg	With reference to US EPA 3550C method. Analysis was performed by GC/MS.	0.5	n.d.	-
Polychlorinated Naphthalene (PCNs)	mg/kg	With reference to US EPA 3550C method. Analysis was performed by GC/MS.	5	n.d.	-
Polychlorinated Terphenyls (PCTs)	mg/kg	With reference to US EPA 3550C method. Analysis was performed by GC/MS.	0.5	n.d.	-
Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) (CAS No.: 085535-84-8)	%	With reference to US EPA 3550C method. Analysis was performed by GC/ECD.	0.01	n.d.	-

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No. 61, Kai-Fa Road, Nanzih Export Processing Zone, Kaohsiung, Taiwan /
t + 886 (07)301 2121

f + 886 (07)3010867

高雄市楠梓加工出口區開發路61號
www.tw.sgs.com

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Test Item (s):	Unit	Method	MDL	Result	Limit
				No.1	
Perfluorooctane sulfonates (PFOS)	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.	-
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		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.	-
Organic-tin compounds					
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.	-
Bis(tributyltin)oxide (TBTO)***(CAS No.: 56-35-9)	mg/kg		-	n.d.	-
Dibutyl Tin (DBT)	mg/kg		0.03	n.d.	-
Diocetyl Tin (DOT)	mg/kg		0.03	n.d.	-

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Test Item (s):	Unit	Method	MDL	Result	Limit
				No.1	
Phthalates					
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.	1000
DBP (Dibutyl phthalate) (CAS No.: 84-74-2)	mg/kg		50	n.d.	1000
DEHP (Di- (2-ethylhexyl) phthalate) (CAS No.: 117-81-7)	mg/kg		50	n.d.	1000
DIBP (Di-isobutyl phthalate) (CAS No.: 84-69-5)	mg/kg		50	n.d.	1000
DIDP (Di-isodecyl phthalate) (CAS No.: 26761-40-0; 68515-49-1)	mg/kg		50	n.d.	-
DINP (Di-isononyl phthalate) (CAS No.: 28553-12-0; 68515-48-0)	mg/kg		50	n.d.	-
DNOP (Di-n-octyl phthalate) (CAS No.: 117-84-0)	mg/kg		50	n.d.	-
DHNUP (1,2-Benzenedicarboxylic acid, di-C7-11-branched and linear alkyl esters) (CAS No.: 68515-42-4)	mg/kg		50	n.d.	-
DIHP (1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich) (CAS No.: 71888- 89-6)	mg/kg		50	n.d.	-
DMEP (Bis (2-methoxyethyl) phthalate) (CAS No.: 117-82-8)	mg/kg		50	n.d.	-
DNHP (Di-n-hexyl phthalate) (CAS No.: 84-75-3)	mg/kg		50	n.d.	-

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Note : 1. mg/kg = ppm ; 0.1wt% = 1000ppm

2. n.d. = Not Detected

3. MDL = Method Detection Limit

4. " - " = Not Regulated

5. (#2) =

a. 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. 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. 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)

7. Negative = Undetectable / Positive = Detectable

8. ***: The substance was calculated by the test results of Tributyl Tin, Triphenyl Tin or element (Ex. Antimony 、Beryllium 、Silicon 、Zinc or Phosphorus respectively). The MDL is evaluated for Tributyl Tin, Triphenyl Tin or element (Ex. Antimony 、Beryllium 、Silicon 、Zinc or Phosphorus respectively.)

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 1 $\mu\text{g}/\text{m}^2$.

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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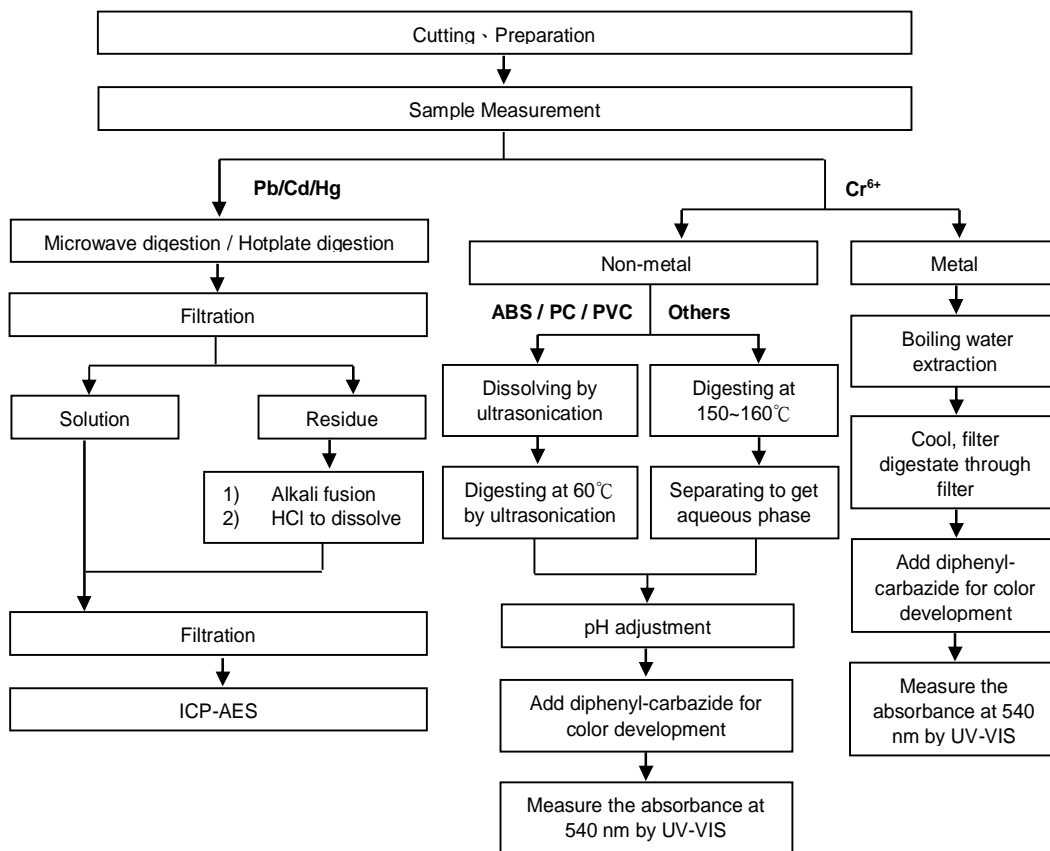
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NO.508-51, SECTION 1, WEN-SIEN ROAD, RENDE DISTRICT, TAINAN CITY 717, TAIWAN

Analytical flow chart of Heavy Metal

These samples were dissolved totally by pre-conditioning method according to below flow chart. (Cr⁶⁺ test method excluded)

- Technician : Jony Liu
- Supervisor: Ray Chang



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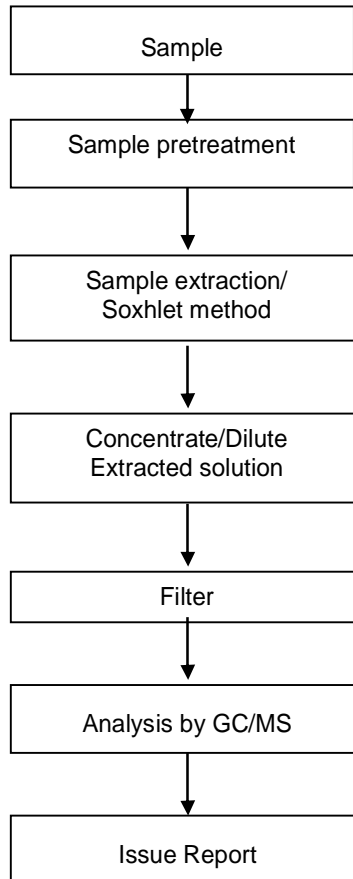
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NO.508-51, SECTION 1, WEN-SIEN ROAD, RENDE DISTRICT, TAINAN CITY 717, TAIWAN

PBB/PBDE analytical FLOW CHART

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang



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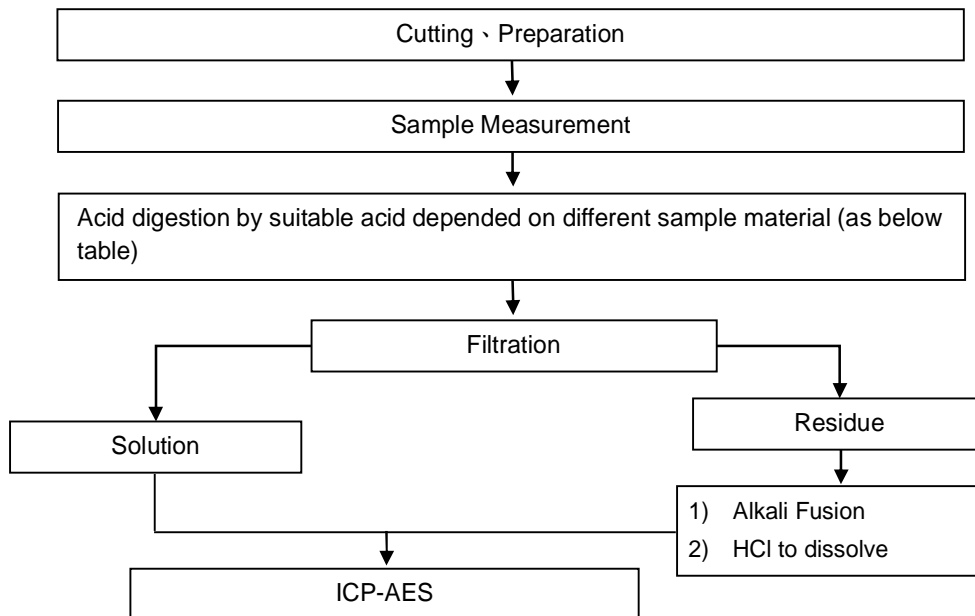
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- 1) These samples were dissolved totally by pre-conditioning method according to below flow chart.
- 2) Name of the person who made measurement: Jony Liu
- 3) Name of the person in charge of measurement: Ray Chang

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



Steel, copper, aluminum, solder	Aqua regia, HNO ₃ , HCl, HF, H ₂ O ₂
Glass	HNO ₃ /HF
Gold, platinum, palladium, ceramic	Aqua regia
Silver	HNO ₃
Plastic	H ₂ SO ₄ , H ₂ O ₂ , HNO ₃ , HCl
Others	Any acid to total digestion

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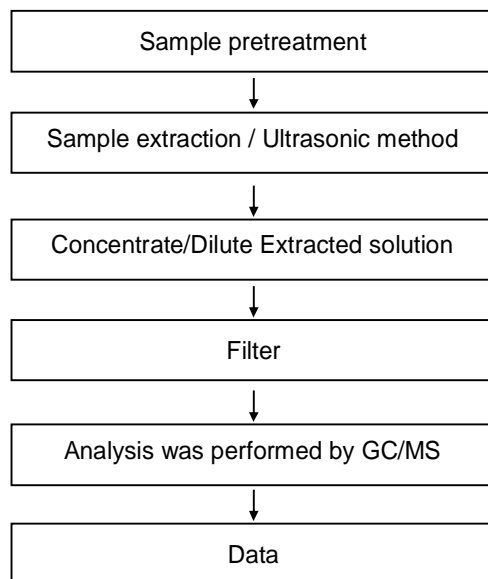
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HBCDD analytical flow chart

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang



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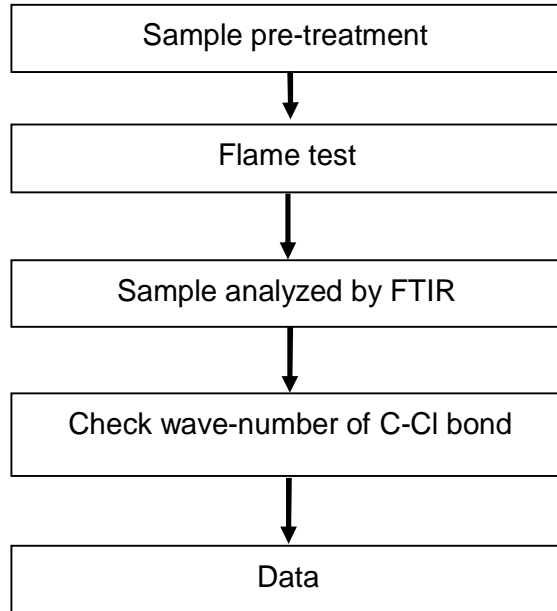
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Analysis flow chart for determination of PVC in polymer material

- 1) Name of the person who made measurement: Hannah Tai
- 2) Name of the person in charge of measurement: Roger Lin



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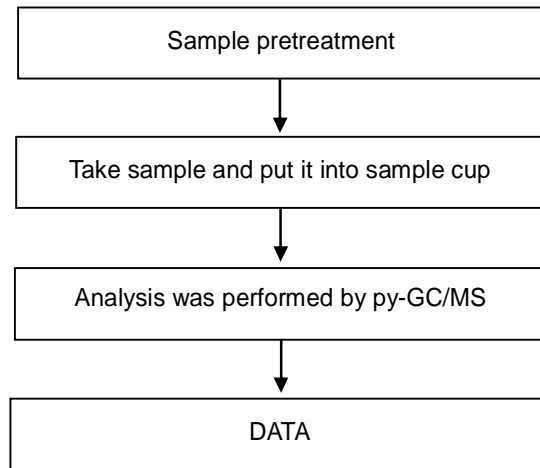
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Analytical flow chart of Red phosphorus

- Name of the person who made measurement: Roy Lin
- Name of the person in charge of measurement: Troy Chang



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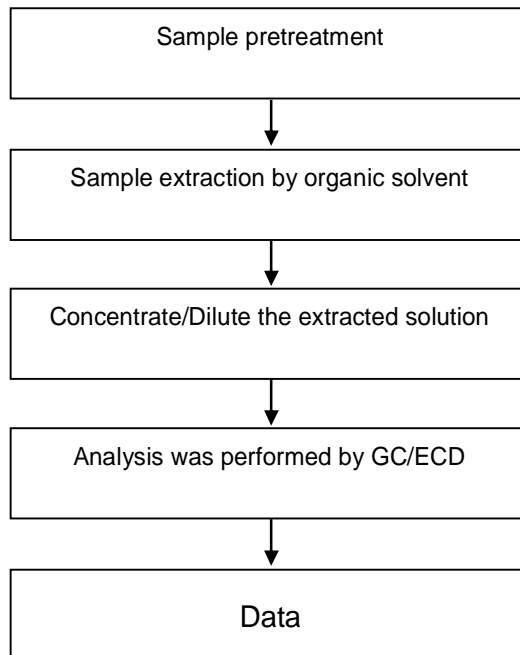
ACCURUS SCIENTIFIC CO., LTD

NO.508-51, SECTION 1, WEN-SIEN ROAD, RENDE DISTRICT, TAINAN CITY 717, TAIWAN

Chlorinated Flame retardant analytical flow chart

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang

- Reference method: US EPA 3550C
- Test Items: PCBs, CP, MCCP



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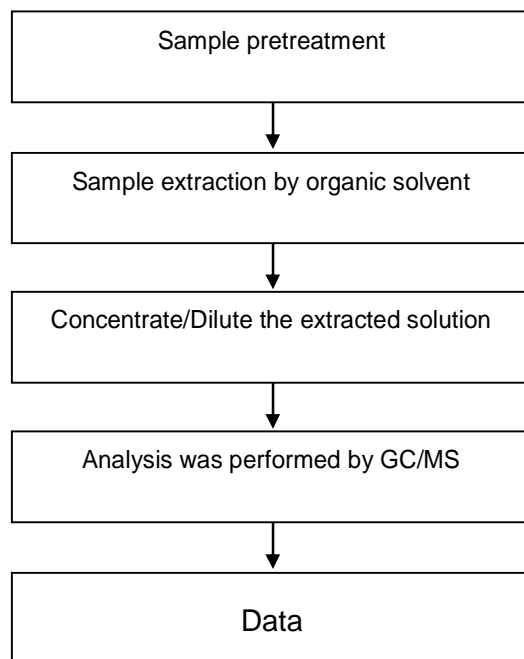
ACCURUS SCIENTIFIC CO., LTD

NO.508-51, SECTION 1, WEN-SIEN ROAD, RENDE DISTRICT, TAINAN CITY 717, TAIWAN

Chlorinated Flame retardant analytical flow chart

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang

- Reference method: US EPA 3550C
- Test Items: PCNs, PCTs, Mirex



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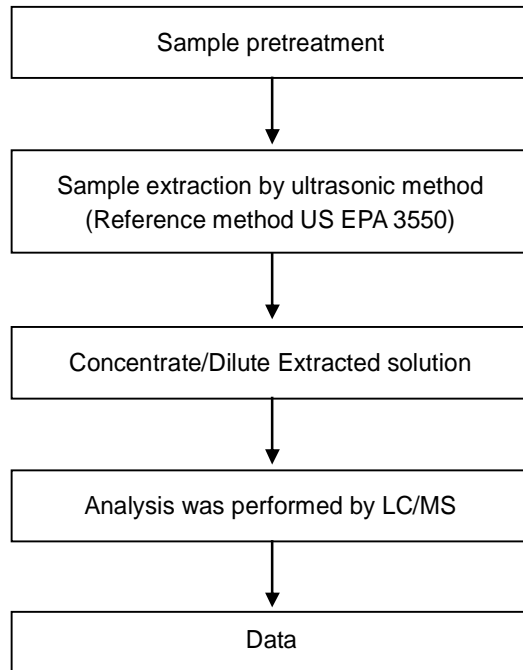
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Analytical flow chart of PFOA/PFOS content

- 1) Name of the person who made measurement: Ginny Huang
- 2) Name of the person in charge of measurement: Ray Chang



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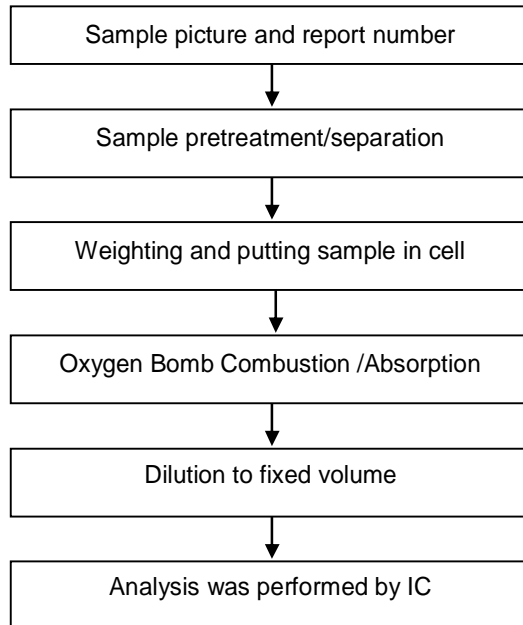
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Analytical flow chart of halogen content

- 1) Name of the person who made measurement: Jean Hung
- 2) Name of the person in charge of measurement: Ray Chang



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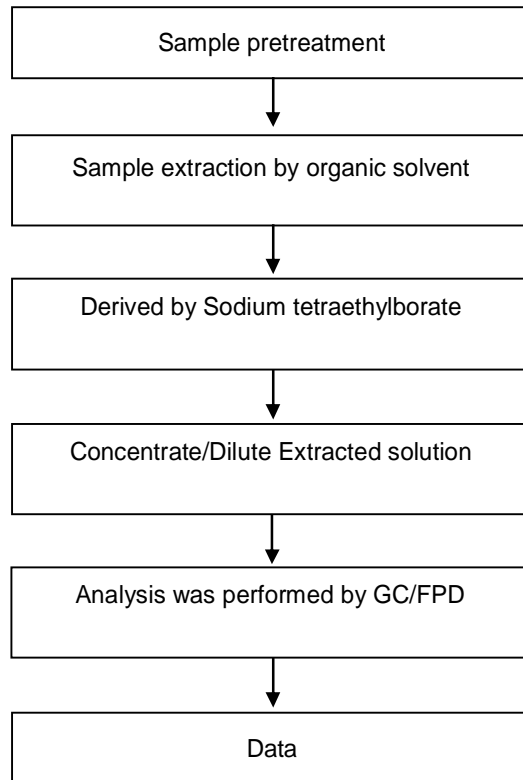
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Analytical flow chart of Organic-Tin content

- 1) Name of the person who made measurement: Dorothy Chen
- 2) Name of the person in charge of measurement: Ray Chang



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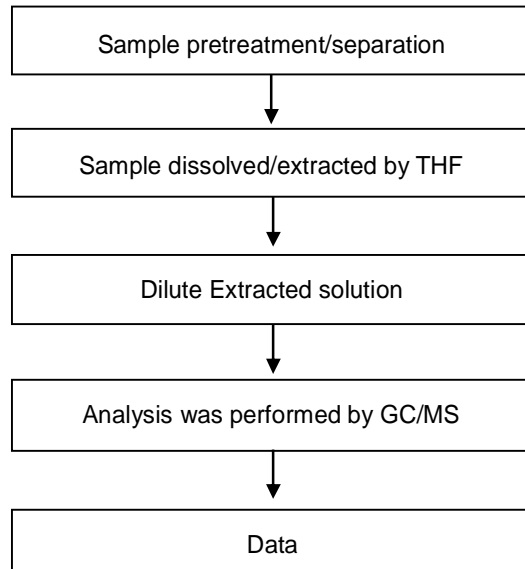
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Analytical flow chart of phthalate content

- Name of the person who made measurement: Dorothy Chen
- Name of the person in charge of measurement: Ray Chang

【Test method: IEC 62321-8】



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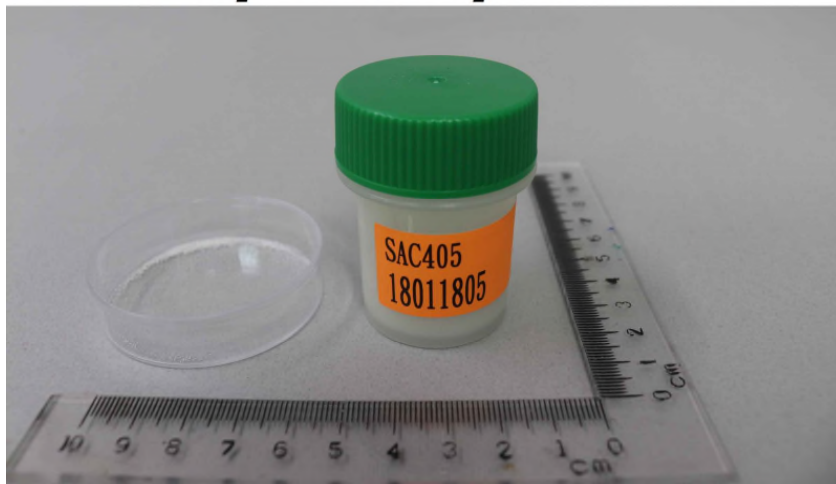
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* The tested sample / part is marked by an arrow if it's shown on the photo. *

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** End of Report **

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