

Detection of Toxic and Harmful Elements in AOCI Polycarbonate Sheets and Packaging Materials

Report 1: Test Report for AOCI Polycarbonate Sheets

1. Test Items

Based on the detection of samples, the test items are as follows:

- Total lead (Pb) content in materials in accordance with the US Consumer Product Safety Improvement Act (CPSIA)
- Toxic element content in materials in accordance with the Canada Hazardous Products Act (CHPA)
- Phthalate content in accordance with the US Consumer Product Safety Improvement Act (CPSIA)
- Customer-required items - Phthalate content (including n-hexyl phthalate, dimethyl phthalate, diethyl phthalate, diisodecyl phthalate, di-n-octyl phthalate, diisononyl phthalate, bis(2-ethylhexyl) phthalate, dibutyl phthalate, benzyl butyl phthalate, diisobutyl phthalate)
- Customer-required items - Organotin compound detection
- Alkylphenol ethoxylates (APEO) content detection in accordance with Annex XVII to EU REACH Regulation

2. Test Conclusions

Test Item	Result
Total lead (Pb) content in materials (CPSIA)	PASS

Toxic element content in materials (CHPA)	PASS
Phthalate content (CPSIA)	PASS
Customer-required phthalate content (10 items including n-hexyl phthalate)	PASS
Customer-required organotin compound detection	PASS
APEO content detection (Annex XVII to EU REACH Regulation)	PASS

3. Detailed Test Results

3.1 Total Lead (Pb) Content in Materials

Test method: In accordance with the Consumer Product Safety Improvement Act of 2008 (H.R.4040), with reference to the CPSC-CH-E1002-08.3 standard, the total lead content was determined using an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES).

Material No.	Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
1	Total Lead (Pb)	100	10	Not Detected (N.D.)

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit.

3.2 Toxic Element Content in Materials

Test method: In accordance with customer requirements and with reference to the Canada Hazardous Products Act, the toxic element content was determined using acid digestion and acid extraction methods with an Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES).

Test Item	Recommended Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1	-	-	-
Total Lead (Pb)	100	10	N.D.
Total Mercury (Hg)	▲	5	N.D.
Soluble Cadmium (Cd)	1000	5	N.D.
Soluble Barium (Ba)	1000	5	N.D.
Soluble Arsenic (As)	1000	5	N.D.
Soluble Antimony (Sb)	1000	5	N.D.
Soluble Selenium (Se)	1000	5	N.D.

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit; 4. "▲" = Prohibited from detection, or the test result is lower than the method detection limit.

3.3 Phthalate Content Detection (I)

Test method: In accordance with the Consumer Product Safety Improvement Act of 2008 (CPSIA) (H.R.4040), with reference to the CPSC-CH-C1001-09.4 standard, the phthalate content was determined using ultrasonic extraction with a Gas Chromatography-Mass Spectrometer (GC-MS).

(Applicable to plasticized materials in toys and children's care products)

Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1	-	-	-
Bis(2-ethylhexyl) phthalate (DEHP)	1000	50	N.D.
Dibutyl phthalate (DBP)	1000	50	N.D.
Benzyl butyl phthalate (BBP)	1000	50	N.D.
Diisononyl phthalate (DINP)	1000	50	N.D.
Diisobutyl phthalate (DIBP)	1000	50	N.D.
Dicyclohexyl phthalate (DCHP)	1000	50	N.D.
Di-n-pentyl phthalate (DPENP)	1000	50	N.D.
Di-n-hexyl phthalate (DHEXP)	1000	50	N.D.

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit.

3.4 Phthalate Content Detection (II)

Test method: In accordance with customer requirements, with reference to the Standard Operating Procedure for Phthalate Determination (CPSC-CH-C1001-09.4, revised April 1, 2010), the phthalate content was determined using ultrasonic extraction with a Gas Chromatography-Mass Spectrometer (GC-MS).

Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1	-	-	-
Bis(2-ethylhexyl) phthalate (DEHP)	1000	50	N.D.
Dibutyl phthalate (DBP)	1000	50	N.D.
Benzyl butyl phthalate (BBP)	1000	50	N.D.
Diisononyl phthalate (DINP)	1000	50	N.D.
Di-n-octyl phthalate (DNOP)	1000	50	N.D.
Diisodecyl phthalate (DIDP)	1000	50	N.D.
Diisobutyl phthalate (DIBP)	1000	50	N.D.
n-Hexyl phthalate (DnHP)	1000	50	N.D.
Dimethyl phthalate (DMP)	1000	50	N.D.
Diethyl phthalate	1000	50	N.D.

(DEP)			
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Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit.

3.5 Organotin Compound Detection

Test method: In accordance with Annex XVII to EU REACH Regulation (EC 1907/2006) and its revisions, with reference to the ISO 17353:2004 standard, the organotin compound content was determined using organic solvent extraction with a Gas Chromatography-Mass Spectrometer (GC-MS).

Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1	-	-	-
Tributyltin (TBT)	1000	10	N.D.
Triphenyltin (TPhT)	1000	10	N.D.
Dibutyltin (DBT)	1000	10	N.D.
Diocetyl tin (DOT)	1000	10	N.D.

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit.

3.6 Alkylphenol Ethoxylates (APEO) Content Detection

Test method: In accordance with Annex XVII to EU Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Regulation (EC 1907/2006) and its revisions, the APEO content was determined using organic solvent extraction with a Liquid Chromatography-Mass Spectrometer (LC-MS).

Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1	-	-	-
Nonylphenol ethoxylates (NPEO)	1000	10	N.D.
Octylphenol ethoxylates (OPEO)	Not Applicable (--)	10	N.D.

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit; 4. "Not Applicable (--)" = no relevant limit requirement.

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Report 2: Test Report for AOCI Polycarbonate Sheet Packaging Materials

1. Test Items

Based on the detection of specified materials or submitted samples, the test items are as follows:

- Total lead, cadmium, mercury and hexavalent chromium content in accordance with the US Toxic Packaging Clearinghouse (TPCH) Regulation
- Phthalate content in accordance with the US TPCH Regulation
- Per- and polyfluoroalkyl substances (PFAS) total fluorine screening content in accordance with the US TPCH Regulation

2. Test Conclusions

Test Item	Result
Total lead, cadmium, mercury and hexavalent chromium content (TPCH)	PASS
Phthalate content (TPCH)	PASS
PFAS total fluorine screening content (TPCH)	PASS

3. Detailed Test Results

3.1 Total Lead, Cadmium, Mercury and Hexavalent Chromium Content (TPCH Standard)

Test methods:

- Lead (Pb)/Cadmium (Cd)/Mercury (Hg): Determined using Flame Atomic

Absorption Spectroscopy (AAS) or Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES) in accordance with the US EPA 3052:1996 standard.

- Hexavalent Chromium (Cr⁶⁺): Determined using Ultraviolet-Visible Spectrophotometry (UV-Vis) in accordance with the US EPA 3060A:1996 standard.

Test Item	Chemical Abstracts Service (CAS) No.	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1, Sample 2, Sample 3, Sample 4, Sample 5	-	-	-	-
Lead (Pb)	7439-92-1	10	10	N.D.
Cadmium (Cd)	7440-43-9	10	10	N.D.
Mercury (Hg)	7439-97-6	Not Applicable (--)	10	N.D.
Hexavalent Chromium (Cr ⁶⁺)	18540-29-9	10	10	N.D.
Total Content (Pb+Cd+Hg+Cr ⁶⁺)	-	100	Not Applicable (--)	N.D.
Conclusion	-	-	-	PASS

Test Item	CAS No.	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 6, Sample 7, Sample 8,	-	-	-	-

Sample 9				
Lead (Pb)	7439-92-1	Not Applicable (--)	10	N.D.
Cadmium (Cd)	7440-43-9	Not Applicable (--)	10	N.D.
Mercury (Hg)	7439-97-6	Not Applicable (--)	10	N.D.
Hexavalent Chromium (Cr ⁶⁺)	18540-29-9	10	10	N.D.
Total Content (Pb+Cd+Hg+ Cr ⁶⁺)	-	100	Not Applicable (--)	N.D.
Conclusion	-	-	-	PASS

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit; 4. "Not Applicable (--)" = no relevant limit requirement; 5. 19 states in the US (including California, Connecticut, Florida, etc.) have enacted TPCH regulations regarding total lead, cadmium, mercury and hexavalent chromium.

3.2 Phthalate Content (TPCH Standard)

Test method: Determined using a Gas Chromatography-Mass Spectrometer (GC-MS) with reference to the CPSC-CH-C1001-09.4 standard.

Test Item	CAS No.	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 1, Sample 2, Sample 3, Sample 4,	-	-	-	-

Sample 5				
Dibutyl phthalate (DBP)	84-74-2	Not Applicable (--)	10	N.D.
Bis(2-ethylhexyl) phthalate (DEHP)	117-81-7	Not Applicable (--)	10	N.D.
Benzyl butyl phthalate (BBP)	85-68-7	Not Applicable (--)	10	N.D.
Diisononyl phthalate (DINP)	28553-12-0/68515-48-0	Not Applicable (--)	10	N.D.
Diisobutyl phthalate (DIBP)	84-69-5	Not Applicable (--)	10	N.D.
Di-n-pentyl phthalate (DPENP/DnP P)	131-18-0	Not Applicable (--)	10	N.D.
Di-n-hexyl phthalate (DHEXP/DnH P)	84-75-3	Not Applicable (--)	10	N.D.
Dicyclohexyl phthalate (DCHP)	84-61-7	Not Applicable (--)	10	N.D.
Di-n-octyl phthalate (DNOP)	117-84-0	Not Applicable (--)	10	N.D.
Diisodecyl phthalate (DIDP)	26761-40-0/68515-49-1	Not Applicable (--)	10	N.D.

Dimethyl phthalate (DMP)	131-11-3	Not Applicable (--)	10	N.D.
Diethyl phthalate (DEP)	84-66-2	Not Applicable (--)	10	N.D.
Dipropyl phthalate (DPrP)	131-16-8	Not Applicable (--)	10	N.D.
Diisooctyl phthalate (DIOP)	27554-26-3	Not Applicable (--)	10	N.D.
Bis(2-methoxyethyl) phthalate (DMEP)	117-82-8	Not Applicable (--)	10	N.D.
Diisopentyl phthalate (DIPP)	605-50-5	Not Applicable (--)	10	N.D.
n-Pentyl isopentyl phthalate (nPIPP)	776297-69-9	Not Applicable (--)	10	N.D.
Di-C6-8 branched alkyl phthalate (C7-enriched) (DIHP)	71888-89-6	Not Applicable (--)	10	N.D.
Di-C7-11 branched and linear alkyl phthalate (DHNUP)	68515-42-4	Not Applicable (--)	10	N.D.
Dipentyl phthalate	84777-06-0	Not	10	N.D.

(branched and linear) (DPP)		Applicable (--)		
Dihexyl phthalate (branched and linear) (DHP)	68515-50-4	Not Applicable (--)	10	N.D.
Diisohexyl phthalate (DIHxP)	71850-09-4	Not Applicable (--)	10	N.D.
Di-C6-10 alkyl phthalate; Decyl hexyl octyl mixed diesters of phthalic acid (containing $\geq 0.3\%$ dihexyl phthalate)	68515-51-5/68648-93-1	Not Applicable (--)	10	N.D.
Total Phthalates	-	100	Not Applicable (--)	N.D.
Conclusion	-	-	-	PASS

Test Item	CAS No.	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 6, Sample 7, Sample 8, Sample 9	-	-	-	-
Dibutyl phthalate (DBP)	84-74-2	Not Applicable (--)	10	57

Bis(2-ethylhexyl) phthalate (DEHP)	117-81-7	Not Applicable (--)	10	N.D.
Benzyl butyl phthalate (BBP)	85-68-7	Not Applicable (--)	10	N.D.
Diisononyl phthalate (DINP)	28553-12-0/68515-48-0	Not Applicable (--)	10	N.D.
Diisobutyl phthalate (DIBP)	84-69-5	Not Applicable (--)	10	N.D.
Di-n-pentyl phthalate (DPENP/DnP P)	131-18-0	Not Applicable (--)	10	N.D.
Di-n-hexyl phthalate (DHEXP/DnH P)	84-75-3	Not Applicable (--)	10	N.D.
Dicyclohexyl phthalate (DCHP)	84-61-7	Not Applicable (--)	10	N.D.
Di-n-octyl phthalate (DNOP)	117-84-0	Not Applicable (--)	10	N.D.
Diisodecyl phthalate (DIDP)	26761-40-0/68515-49-1	Not Applicable (--)	10	N.D.
Dimethyl phthalate (DMP)	131-11-3	Not Applicable (--)	10	N.D.

Diethyl phthalate (DEP)	84-66-2	Not Applicable (--)	10	N.D.
Dipropyl phthalate (DPrP)	131-16-8	Not Applicable (--)	10	N.D.
Diisooctyl phthalate (DIOP)	27554-26-3	Not Applicable (--)	10	N.D.
Bis(2-methoxyethyl) phthalate (DMEP)	117-82-8	Not Applicable (--)	10	N.D.
Diisopentyl phthalate (DIPP)	605-50-5	Not Applicable (--)	10	N.D.
n-Pentyl isopentyl phthalate (nPIPP)	776297-69-9	Not Applicable (--)	10	N.D.
Di-C6-8 branched alkyl phthalate (C7-enriched) (DIHP)	71888-89-6	Not Applicable (--)	10	N.D.
Di-C7-11 branched and linear alkyl phthalate (DHNUP)	68515-42-4	Not Applicable (--)	10	N.D.
Dipentyl phthalate (branched and linear) (DPP)	84777-06-0	Not Applicable (--)	10	N.D.

Dihexyl phthalate (branched and linear) (DHP)	68515-50-4	Not Applicable (--)	10	N.D.
Diisohexyl phthalate (DIHxP)	71850-09-4	Not Applicable (--)	10	N.D.
Di-C6-10 alkyl phthalate; Decyl hexyl octyl mixed diesters of phthalic acid (containing ≥0.3% dihexyl phthalate)	68515-51-5/68648-93-1	Not Applicable (--)	10	N.D.
Total Phthalates	-	100	Not Applicable (--)	57
Conclusion	-	-	-	PASS

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit; 4. "Not Applicable (--)" = no relevant limit requirement; 5. TPCH defines phthalates as a class of chemical substances, and there is currently no official explicit list. The conclusion is based on the 26 phthalate substances tested.

3.3 Per- and Polyfluoroalkyl Substances (PFAS) Total Fluorine Screening Content (TPCH Standard)

Test method: Determined using a Liquid Chromatography-Mass Spectrometer (LC-MS) with reference to the EN 14582:2016 standard.

Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
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Sample 1, Sample 2, Sample 3, Sample 4	-	-	-
PFAS (as fluorine)	▲	0.0025	N.D.
Conclusion	-	-	PASS

Test Item	Limit (mg/kg)	Reporting Limit (RL) (mg/kg)	Result (mg/kg)
Sample 6, Sample 7, Sample 8, Sample 9	-	-	-
PFAS (as fluorine)	▲	0.0025	N.D.
Conclusion	-	-	PASS

Notes: 1. mg/kg = milligrams per kilogram; 2. Reporting Limit (RL) = the minimum detectable concentration of the test report; 3. Not Detected (N.D.) = the test result is lower than the reporting limit; 4. "▲" = Prohibited from detection, or the test result is lower than the method detection limit; 5. TPCH defines per- and polyfluoroalkyl substances (PFAS) as a class of chemical substances, and there is currently no official explicit list. The conclusion is based on the total fluorine test result.

Summary Table of Core Test Results of the Two Reports

Sample Information	Core Test Items	Reference Standard/Requirement	Key Limit	Core Test Result	Test Conclusion
Sample 1: Transparent plastic (material for components such as ventilation panels and roof panels)	Total lead (Pb) content in materials	CPSIA (H.R.4040), CPSC- CH-E1002-08.3	100 mg/kg, RL 10 mg/kg	N.D.	PASS
	Toxic element content (Pb, Hg, Cd, etc.)	Canada Hazardous Products Act (CHPA)	Total lead 100 mg/kg, mercury prohibited from detection, other soluble elements 1000 mg/kg	All elements N.D.	
	Phthalate content (DEHP, DBP, etc.)	CPSIA (H.R.4040), CPSC- CH-C1001-09.4; Customer requirements	Each item 1000 mg/kg	All tested items N.D.	
	Organotin	Annex XVII to EU REACH	Each item	All tested items	

Sample Information	Core Test Items	Reference Standard/Requirement	Key Limit	Core Test Result	Test Conclusion
	compound detection (TBT, TPhT, etc.)	Regulation, ISO 17353:2004	1000 mg/kg	N.D.	
	APEO content	Annex XVII to EU REACH Regulation	NPEO 1000 mg/kg, OPEO no relevant limit	All tested items N.D.	
	Customer-specified phthalate content (10 items)	Customer requirements, CPSC-CH-C1001-09.4	Each item 1000 mg/kg	All tested items N.D.	
Samples 1-9: Packaging materials such as transparent plastic, blue plastic, transparent tape, printed transparent plastic, etc.	Total lead, cadmium, mercury and hexavalent chromium content	US TPCH Regulation	Lead, cadmium, hexavalent chromium each 10 mg/kg, total 100 mg/kg	All samples N.D., total content not exceeding the limit	PASS
	Phthalate content (26 types)	US TPCH Regulation, CPSC-CH-C1001-09.4	Total 100 mg/kg, no explicit limit for individual items	Only DBP 57 mg/kg detected in Sample 6, total content not exceeding the	

Sample Information	Core Test Items	Reference Standard/Requirement	Key Limit	Core Test Result	Test Conclusion
				limit, others N.D.	
	PFAS total fluorine screening	US TPCH Regulation, EN 14582:2016	Prohibited from detection, RL 0.0025 mg/kg	All samples N.D.	

Note: 1. Not Detected (N.D.) means the result is lower than the reporting limit; 2. mg/kg is the test unit; 3. Report 1 only tested 1 sample, Report 2 tested 9 packaging material samples, and all samples passed the test.

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