भारतीयमानकब्यूरो /BUREAU OF INDIAN STANDARDS
(पूर्वीक्षेत्रीयप्रयोगशाला)/Eastern Regional Laboratory

हमारासंदर्भ/Our Ref: EROL(C)/IS 14625

20/03/2024

विषय/ Subject: Comment on IS 14625:201

इससंबंधमेंप्रस्तावितबदलाव(ओं) परविचारकरनेकेलिएएफ.ए.डीद्वारानिम्नलिखितटिप्पणियोंपरध्यानदियाजाए:

क्र. सं. Sl. No	Clause no of IS 14625	प्रस्तावित बदलाव /Proposed change	वजह/Justification
1.	Cl. 4.1	Replace the existing with - 'The materials used should be of no health hazards to babies and the limit for Bisphenol A (BPA) in the product shall be **'0.05 mg/kg, max'**. Add the following under cl 4.1: Note: Liquid Chromatography technique with Mass Spectrometry methods may be used as an alternate to HPLC method.	As per cl 4.1 of IS 14625 it has been stated that ' The materials used should be of no health hazards to babies and **shall not contain** Bisphenol A (BPA)'. It is informed that all instruments have an intrinsic Limit of Detection (LOD) and Limit of Quantification (LOQ), as such the statement 'shall not contain BPA' is ambiguous and needs more clarity. In similar cases for the parameters 'Mineral Oil' and 'Phenolic compounds' in IS 14543, where previously the requirements were specified as 'Absent', limits have now been specified after issue was raised by ERL The method of tests specified in Amendment 4 to the ISS are ISO 18857-2: 2009 (Water quality — Determination of bisphenol A in solid phase extraction and derivatisation) & EN 13130-13: 2005 [Materials and articles in contact with foodstuffs —Plastics substances subject to limitation — Part 13: Determination of 2,2 bis (4-hydroxyphenyl) propane (Bisphenol A) in food stimulants]. The detection ranges as specified in the test methods given below are: (i) ISO 18857-2:2009; Range - 0.05 µg/l to 0.2 µg/l (Equipment - GC/MS); (ii) EN 13130-13:2005; Range : 0.2 mg/kg to 0.7 mg/kg (Equipment – HPLC with DAD); ERL has undertaken a study using LC/MSMS with a detection capability in the range: 10 ppb to 200 ppb, the detailed report is available at Annex A. A Note may also be included under clause 4.1 allowing use of LC-MSMS methods as an alternate to HPLC method. Committee may also refer Regulation (EU) No. 10/2011 which states that "the new BPA Regulation reduces the Specific migration limet for BPA from 0.6 mg/kg to 0.05 mg/kg and expands the ban on the *use* of BPA in the manufacture of polycarbonate infant feeding bottles to polycarbonate drinking cups or bottles which, due to their spill proof characteristics, are intended for infants and young children." Also according to the U.S. Environmental Protection Agency , the intake limit for BPA is 0.05 mg per kg of body weight (bw) per day. So in line with these guidelines we may set limit as 0.05 mg/kg max.
2.	Col (4) of Sl no i) to viii) of Table 3	Replace the existing with the following: IS 3025(Part-2)/IS 3025(Part-65)	The parameters specified for Specific Migration Limits under Sl no i) to viii) of Table 3 can be tested with an equal accuracy using ICP-MS specified in IS 3025(Part-65). As such the method of test may contain both IS 3025(Part-2) & IS 3025(Part-65).

Submitted for kind consideration of technical committee.

20/3/24

Shampa Ghosh.
LO(Chem Lab.)

20/3/24

OIC(Chemical)

H(ERL)

22/3/24

Annex A

Test for Bisphenol A

F.1 PRINCIPLE

2,2-bis(4-hydroxyphenyl)propane, hereinafter referred to as Bisphenol A, $C_{15}H_{16}O_2$,is a monomer used in the manufacture of certain plastics materials and articles intended to come into contact with foodstuffs. After manufacture residual Bisphenol A can remain in the finished product and may migrate into foodstuffs coming into contact with that product.

This procedure comprises of extraction of BPA from materials and articles in contact with Foodstuff and quantification of its presence by Liquid Chromatography / Ultra high performance liquid chromatography (LC/UHPLC) with Mass spectrometry mass spectrometry triple quadruple (MS/MS TQ) detector.

F.2. APPARATUS

The conditions specified below are recommendation in nature and may vary from equipment to equipment.

F.2. 1 Liquid Chromatography Column, ZORBAX Eclipse plus C18 (2.1 X 50 mm, 1.8 micron)

F.2.2 Liquid Chromatograph, UHPLC coupled with Mass Spectrophotometry-Mass Spectrophotometry detector (QQQ).

Mobile Phase: Methanol: water acidified with 0.1 % acetic acid (70:30), isocratic elution

Column temperature: 30 degree C

Flow rate: 0.3 ml/min

Injection volume: 5ul

F.2.3 Mass Spectrophotometry Detector/Triple Quadruple

F.2.3.1 Electrospray Ionisation Source Parameter,

Gas (N_2) Temperature: 250 degree C

Gas flow: 10 l/min

Nebuliser: 55 psi

Sheath gas temperature: 300 degree C

Sheath gas flow: 10l/min

Capillary voltage: 3500 V (Positive) and 3500V (Negetive)

Nozzle Voltage: 0 V (Positive) and 500V (Negative)

F.2.3.2 Acquisition /MRM parameter,

Precursor Ion	MS1 Res	Product Ion	MS2 Res	Dwell time	Fragmentor Voltage	Collision Energy	Cell Accelerator voltage	Polarity
227.1	wide	212.3	wide	100	150	20	4	Negative
227.1	wide	133.3	wide	100	150	28	4	Negative

F.2.3.4 Solid Phase Extraction System, for extraction of BPA from materials and articles in contact with Foodstuff

F.2.3.5 Vortex, for standard and sample preparation

F.2.3.6 Nitrogen Evaporator, for evaporation of eluent after extraction from C-18 cartridge

F.2.3.7 Micro pipette, 10 µl to 1 000 µl.

F.2.3.8 Test tubes, volume 10 ml, size 10 cm x 1,5 cm

F.2.3.9 Hot Air Oven, capble of maintaining temperature upto 100 degree C.

F.3 REAGENTS

F.3.1 2,2-bis(4-hydroxyphenyl)propane (Bisphenol A or 4,4'-(methylethylidene)-bisphenol or 4,4'-isopropylidenediphenol), C15H16O2, molecular weight: 228,28, purity > 99 %.

F.3.2 C-18 cartridge, for separation and absorption of BPA from materials and articles in contact with Foodstuff

F.3.3 Methanol, Chromatography grade

F.3.4 Water, Chromatography grade

F.3.5 Di-methylene chloride, Chromatography grade

F.3.6 Ethyl Acetate, Chromatography grade

F.4 PROCEDURE

F.4.1 Sample preparation,

Representative sample of Feeding bottle shall be kept either by filling the whole container or by using sheets cut from the container, simulant (ultrapure water) at 70 ± 2 degree C. After keeping two hour of the simulant (ultrapure water), drain the whole simulant through C-18 cartridge in Solid phase extraction system. 3 to 5ml Dichloromethylene, 3 to 5 ml ethyl acetate and 3 to 5 ml methanol passes through C-18 cartridge and collected in test tube. This collected eluent evaporated by Nitrogen Evaporator on temperature 38 to 40 degree C .After drying 1 ml methanol: water mixture (70:30) added, vortex the mixture in test tube and transfer the solution into a vial suitable for LC injections.

F.4.2. Calibration preparation, Weigh standard BPA nearly 10 mg to 10 ml volumetric flask and make up the volume with methanol. This comes to 1000mg/lt stock solution. From this stock solution prepare 10 ppm and then 1 ppm with the help of micro pipette. From this 1 ppm stock standard, 100ppb, 50ppb, 20ppb, 10ppb, 5ppb standards prepare by serial dilution method.

F.4.3 Blank Preparation, Treat the food simulants which have not been contact with packaging material in the same way as describe in F.4.1.

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18/01/24 TA(BG)

18/01/24 LO(SG)

Method validation report of Bis-Phenol A in Plastic Feeding Bottle samples

Agilent Instrument and Software: Agilent Mass Hunter Acquisition and Quantitative Analysis LCMS :1290 Infinity II coupled to 6470B LC-MS/MS TQ system

Preparation of Matrix-match calibration curve:

Level	Level Type	Concentration
Blank	Blank	0
STD-1	Cal	5ppb
STD-2	Cal	10 ppb
STD-3	Cal	20 ppb
STD-4	Cal	50 ppb
STD-5	Cal	100 ppb
LQC	QC	8 ppb
HQC	QC	80 ppb

MS method conditions :

Compound Name	ISTD?	Precursor Ion	MS1 Res	Product Ion	MS2 Res	Dwell	Fragmentor	Collision Energy	Cell Accelerator Voltage	Polarity
BPA	☐	227.1	Wide	212.3	Wide	100	150	20	4	Negative
BPA	☐	227.1	Wide	133.3	Wide	100	150	28	4	Negative

Source Parameters:

Source parameters

Gas Temp:	250	°C			°C
Gas Flow:	10	l/min			
Nebulizer:	55	psi			psi
Sheath Gas Temp:	300	°C			
Sheath Gas Flow:	10	l/min			
	Positive		Negative		
Capillary:	3500	V	3500	V	
Nozzle Voltage:	0	V	500	V	V

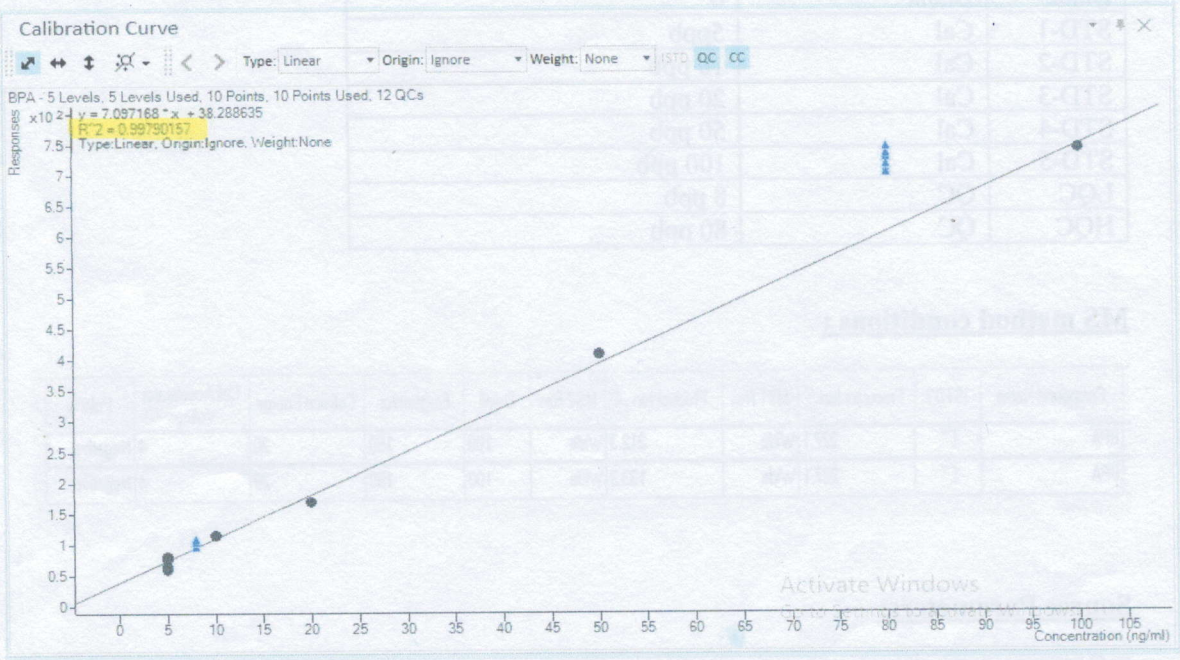
18/01/24

18/01/24

Validation Parameters:

Linearity: (Criteria: R2 value greater than equal to 0.995)

Linearity:



LOQ: (Criteria: S/N Greater than equal to 10, Area RSD less than equal to 20%)

Area RSD=2.85

Average S/N=56.87

Specificity: (Blank area should be less than 20% of LOQ)

Average area at LOQ=72.83

Average area of blank=10.66

Accuracy: (Criteria: 70-130% for all the calibration points)

Sample					BPA Met...	BPA Results						
Name	Data File	Type	Level	Acq. Date-Time	Exp. Conc.	RT	Resp.	Calc. Conc.	Final Conc.	Accuracy	S/N	Area
Method Blank	09012024_Method Blank_..	MatrixBlank		1/9/2024 6:40 PM		0.769	10	0.0000	0.0000		9.84	10
Method Blank	09012024_Method Blank_..	MatrixBlank		1/9/2024 6:46 PM		0.841	12	0.0000	0.0000		26.40	12
Method Blank	09012024_Method Blank_..	MatrixBlank		1/9/2024 6:52 PM		0.824	10	0.0000	0.0000		12.72	10
5 ppb	09012024_5ppb_1.d	Cal	1	1/9/2024 6:58 PM	5.0000	0.793	80	5.9390	5.9390	118.8	47.50	80
5 ppb	09012024_5ppb_2.d	Cal	1	1/9/2024 7:03 PM	5.0000	0.803	79	5.7694	5.7694	115.4	37.41	79
5 ppb	09012024_5ppb_3.d	Cal	1	1/9/2024 7:09 PM	5.0000	0.803	80	5.8914	5.8914	117.8	65.55	80
5 ppb	09012024_5ppb_4.d	Cal	1	1/9/2024 7:15 PM	5.0000	0.790	65	3.7448	3.7448	74.9	81.44	65
5 ppb	09012024_5ppb_5.d	Cal	1	1/9/2024 7:21 PM	5.0000	0.800	76	5.3295	5.3295	106.6	47.64	76
5 ppb	09012024_5ppb_6.d	Cal	1	1/9/2024 7:26 PM	5.0000	0.807	66	3.9746	3.9746	79.5	61.97	66
10 ppb	09012024_10ppb_1.d	Cal	2	1/9/2024 7:32 PM	10.0000	0.800	115	10.8302	10.8302	108.3	60.51	115
20 ppb	09012024_20ppb_1.d	Cal	3	1/9/2024 7:38 PM	20.0000	0.800	169	18.3698	18.3698	91.8	141.81	169
50 ppb	09012024_50ppb_1.d	Cal	4	1/9/2024 7:44 PM	50.0000	0.803	409	52.2912	52.2912	104.6	304.20	409
100 ppb	09012024_100ppb_1.d	Cal	5	1/9/2024 7:49 PM	100.0000	0.803	742	99.1284	99.1284	99.1	566.08	742

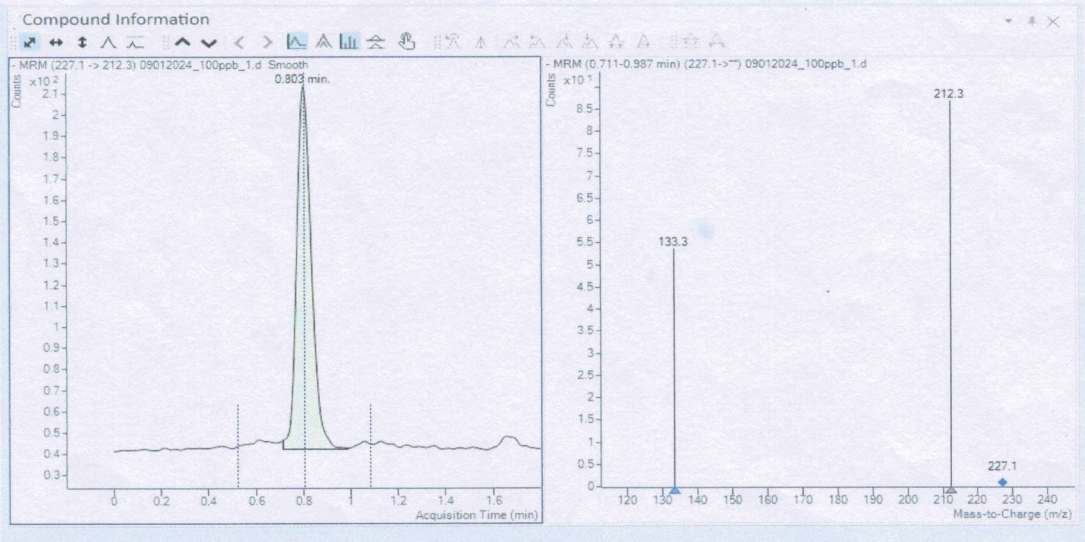
18/01/24

18/01/24

Accuracy at QC level: (Criteria: 70-130% for all the calibration points)

Sample					BPA Met..	BPA Results						
Name	Data File	Type	Level	Acq. Date-Time	Exp. Conc.	RT	Resp.	Calc. Conc.	Final Conc.	Accuracy	S/N	Area
8 ppb(LQC)	09012024_8ppb_1.d	QC	6	1/9/2024 8:12 PM	8.0000	0.813	110	10.0966	10.0966	126.2	75.36	110
8 ppb(LQC)	09012024_8ppb_2.d	QC	6	1/9/2024 8:18 PM	8.0000	0.803	108	9.8695	9.8695	123.4	97.48	108
8 ppb(LQC)	09012024_8ppb_3.d	QC	6	1/9/2024 8:24 PM	8.0000	0.807	96	8.1754	8.1754	102.2	60.29	96
8 ppb(LQC)	09012024_8ppb_4.d	QC	6	1/9/2024 8:29 PM	8.0000	0.800	110	10.1025	10.1025	126.3	63.21	110
8 ppb(LQC)	09012024_8ppb_5.d	QC	6	1/9/2024 8:35 PM	8.0000	0.796	105	9.4591	9.4591	118.2	46.98	105
8 ppb(LQC)	09012024_8ppb_6.d	QC	6	1/9/2024 8:41 PM	8.0000	0.796	108	9.8919	9.8919	123.6	45.25	108
80 ppb(HQC)	09012024_80ppb_1.d	QC	7	1/9/2024 8:46 PM	80.0000	0.803	708	94.3102	94.3102	117.9	554.37	708
80 ppb(HQC)	09012024_80ppb_2.d	QC	7	1/9/2024 8:52 PM	80.0000	0.800	728	97.2049	97.2049	121.5	806.43	728
80 ppb(HQC)	09012024_80ppb_3.d	QC	7	1/9/2024 8:58 PM	80.0000	0.807	734	98.0758	98.0758	122.6	568.89	734
80 ppb(HQC)	09012024_80ppb_4.d	QC	7	1/9/2024 9:04 PM	80.0000	0.803	703	93.6145	93.6145	117.0	617.66	703
80 ppb(HQC)	09012024_80ppb_5.d	QC	7	1/9/2024 9:09 PM	80.0000	0.803	716	95.4349	95.4349	119.3	733.61	716
80 ppb(HQC)	09012024_80ppb_6.d	QC	7	1/9/2024 9:15 PM	80.0000	0.803	746	99.6576	99.6576	124.6	530.49	746

MRM graph of 100 ppb BPA:



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--------Validated by Biswajit Gope & Shampa Ghosh

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