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NATIONAL STANDARDS OF THE PEOPLE'S REPUBLIC OF CHINA

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Electronic cigarette

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Contents

Preface

This document was drafted in accordance with the rules given in GB/T 1.1-2020 *Guidelines for Standardization – Part 1: Structure and Drafting Rules of Standardization Documents*.

Note that some of the contents in this document may involve patents. The issuer of this document does not assume the responsibility for identifying patents.

This document was proposed by the State Tobacco Monopoly Administration which is the focal point for this work.

Electronic Cigarettes

1 Scope

This document defines the terms and definitions of electronic cigarettes, specifies the requirements for e-cigarette design and raw materials and technical requirements, describes the test methodologies, labelling and product instructions.

This document is not applicable for other tobacco products.

2 Normative references

The contents of the following documents constitute essential provisions of this document through the normative references in the text. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document, including any amendments applies.

GB/T 1540-2002 Paper and board - Determination of water absorption - Cobb method

GB/T 2423.7-2018 Environmental test Part 2: Test methodologies test Ec: Shock caused by rough handling (mainly for equipment type samples)

GB/T 4208-2017 Enclosure protection class (IP code)

GB 4343.1 Electromagnetic compatibility requirements for household appliances, power tools and similar apparatus - Part 1: Emission

GB 4706.1 Household and similar electrical appliances - Safety - Part 1: General requirements

GB 4806.1 National Food Safety Standards - General safety requirements for food contact materials and products

GB 4806.3 National Food Safety Standards - Enamel products

GB 4806.4 National Food Safety Standards – Ceramic products

GB 4806.5 National Food Safety Standards – Glassware

GB 4806.6 National Food Safety Standards – Food contact plastics and resin

GB 4806.7 National Food Safety Standards - Food contact plastic materials and products

GB 4806.8 National Food Safety Standards – Food contact paper and cardboard materials and products

GB 4806.9 National Food Safety Standards - Food contact metal materials and products

GB 4806.10 National Food Safety Standards – Food contact paints and coatings

GB 4806.11 National Food Safety Standards – Food contact rubber materials and products

GB 5009.11 National Food Safety Standards - Determination of total and inorganic arsenic in foods

GB 5009.11 – 2014 National Food Safety Standards – Determination of total arsenic and inorganic arsenic

GB 5009.74 National Food Safety Standards - Heavy metal limit test in food additives

GB 5749 Hygienic standards of drinking water

GB/T 6682 Water for analytical laboratory use - Specification and test methods

GB/T 16450 Routine analytical cigarette smoking machine - Definitions and standard conditions

GB/T 26572 Limit requirements for restricted substances in electrical and electronic products

GB 29216 National Food Safety Standards – Additives - Propylene glycol

GB 29950 National Food Safety Standards – Additives – Glycerin

GB/T 41701-2022 E-liquid - Determination of nicotine, propylene glycol and glycerin - Gas chromatography

SJ/T 11364 Marking for the Restriction of Hazardous Substances in Electrical and Electronic Products

SJ/T 11796 General specifications for lithium-ion batteries and battery packs for electronic cigarettes

YC/T 164 Tobacco flavors

YC/T 559 Determination of characteristic components of tobacco – determination of alkaloids - gas chromatography-mass spectrometry joint method and gas chromatography-tandem mass spectrometry

3 Terms and definitions

The following terms and definitions apply to this document:

3.1

Electronic cigarette

Electronic delivery system that produces inhalable aerosols.

Note: It does not include cigarettes.

3.2

E-atomization material

The mixture and auxiliary substances that can be atomized fully or partially into inhalable nicotine-containing aerosols by electronic device.

3.3

E-liquid

E-atomization material in liquid form.

3.4

Electronic cigarette device

Electronic device that atomizes e-atomization material into inhalable aerosols.

3.5

Electronic cigarette modules

An independent module or combination of modules that make up an electronic cigarette.

Note: Any products that form an independent part of e-cigarettes and can be sold independently.

3.6

Cartridge

An electronic cigarette module that contains e-atomization material.

3.7

Atomization agent

Substances in the e-atomization material that can be atomized into the main particulate component of the aerosol.

Note: They are generally glycerin, propylene glycol and water.

3.8

Additive in e-atomization material

Substances added to e-atomization material for the purpose of improving quality, preventing deterioration, and other functions.

3.9

Electronic cigarette material

Materials used in the manufacture of e-cigarettes except the e-atomization material.

3.10

Electronic cigarette emissions

Aerosols from smoking e-cigarettes.

3.11

Emission amount

The amount of a substance or a type of substances in electronic cigarette emissions under standard smoking conditions.

4 Requirements for e-cigarette design and raw materials

4.1 Requirements for design

4.1.1 E-cigarette device

4.1.1.1 The general safety design of e-cigarette device should be in line with GB 4706.1.

4.1.1.2 The electromagnetic compatibility design of e-cigarette device should be in line with GB 4343.1.

4.1.2 Electronic cigarette material

4.1.2.1 Materials in contact with oral cavity, e-atomization material and electronic cigarette emissions should meet the requirements of GB 4806.1, GB 4806.3 - GB 4806.11.

4.1.2.2 Materials that do not come into contact with oral cavity, e-atomization material and electronic cigarette emissions shall comply with the requirements for the limits of restricted substances set out in GB/T 26572.

4.1.3 E-atomization materials

4.1.3.1 They should not be inducive to minors and should not give the product a flavor profile other than that of tobacco.

4.1.3.2 E-atomization materials should contain nicotine.

4.1.3.3 Additives in e-atomization material should be used according to the following principles:

a) The additives shall not increase the health risks under normal or reasonably foreseeable conditions of use.

b) They are technically essential.

c) The use of additives shall be minimized after the expected result is achieved.

d) They should not be used to flavor the product to be attractive to minors.

e) They should not be used to cover up the product's spoilage or other quality defects.

4.1.3.4 Substances that should not be used in e-atomization material include, but are not limited to:

a) substances that are carcinogenic, mutagenic, reproductively toxic, or toxic to the respiratory system;

b) additives and stimulants related to energy and vitality;

c) substances that may give consumers a misconception of health benefits or harm reduction;

substances that are used for dyeing only.

4.2 Requirements for raw materials

4.2.1 Lithium-ion batteries and battery packs

Should be in line with the requirements for labelling and safety set out in SJ/T 11796.

4.2.2 E-atomization material

4.2.2.1 Nicotine, nicotine salt and tobacco extracts

4.2.2.1.1 Nicotine extracted from tobacco should be used with nicotine purity not less than 99% (mass fraction).

4.2.2.1.2 It is permitted to use the benzoate, tartrate, lactate, levulinate, malate and citrate salts of nicotine that are synthesized from nicotine, and the preparation of the above salts of nicotine should meet the requirements set out in 4.2.2.1.1.

4.2.2.1.3 Other tobacco extracts should meet the technical requirements set out in YC/T 164.

4.2.2.2 E-atomization agent

4.2.2.2.1 Propylene glycol should meet the requirements set out in GB 29216.

4.2.2.2.2 Glycerol should meet the requirements set out in GB 29950.

4.2.2.2.3 Water should meet the requirements set out in GB 5749.

4.2.2.3 Additives in e-atomization material

The use of additives in e-atomization material should meet the following requirements:

a) Additives permitted to be used in e-atomization material and their maximum limits are shown in Annex A.

b) The toxicological properties and safety risks of the use of other additives should be assessed to ensure that they do not increase health risks to users. The assessment includes, but is not limited to, the safety of consumption, the safety of inhalation, and the safety under the conditions of use of the e-cigarette.

c) For additives with national food safety standards, the requirements of these standards shall be met; for additives without such standards, provisions on the purity, impurities, and pollutants shall be made by the enterprises.

d) Attention should be paid to the information about any changes in the safety risks of the substances used in order to make timely adjustment.

5 Technical requirements

5.1 Electronic cigarette device

5.1.1 Filling-proof

Electronic cigarette device and cartridges should have a closed structure to prevent manual filling.

5.1.2 Leakage proof

Electronic cigarette device and cartridges using e-liquid should have good sealability and should not leak.

5.1.3 Protection against start-up

Electronic cigarette device should be childproof and have protection against accidental start-up.

5.1.4 Atomization area temperature

It should not be over 350℃.

5.1.5 Waterproof

It should meet the IPX4 protection level requirements in Chapter 6 of GB/T 4208-2017.

5.1.6 Pressure relief safety

When the pressure inside the electronic cigarette device increases due to the failure of the battery, the direction of pressure relief should not be the same as that of suction.

5.1.7 Resilience to fall

An electronic cigarette device should not ignite or explode after falling.

5.2 E-atomization material

5.2.1 Nicotine

Nicotine in e-atomization material should not be over 20 mg/g and the total amount of nicotine not over 200 mg.

5.2.2 Impurities and contaminants

They should meet the requirements in Table 1.

Table 1 Requirements of impurities and contaminants in e-atomization material

mg/kg

Items	Measurements
2,3- butanedione	≤22
Heavy metals (in terms of Pb)	≤10
Arsenic (in terms of As)	≤3

5.3 Electronic cigarette emissions

5.3.1 Nicotine emission

Nicotine emission of each puff should be not over 0.2 mg.

5.3.2 Carbonyl compound emissions

The emission per puff should meet the requirements in Table 2.

Table 2 Requirements of carbonyl compounds in electronic cigarette emissions

μg

Items	Measurements
Formaldehyde	≤7.0
Acetaldehyde	≤30.0
Acrolein	≤5.0
2,3-Butanedione	≤2.5

6 Test methodologies

6.1 Electronic cigarette device

6.1.1 Filling-proof

For e-cigarettes or cartridges filled with e-liquid, visually check if additional substances can be added.

6.1.2 Leakage proof

Place e-cigarettes or cartridges filled with e-liquid in the most unfavorable direction possible on the absorbent paper that meet the GB/T 1540 requirements for at least 6 hours. Visually check if there are traces of e-liquid on the absorbent paper.

6.1.3 Protection against start-up

Check in accordance with the information contained in the instructions and verify if there is protection against start-up and whether it is functioning.

6.1.4 Atomization area temperature

Should be in line with the requirements in Annex B.

6.1.5 Waterproof

Implement the provisions of Item 14.2.4 of GB/T 4208-2017. Visually inspect to determine if there is a fire or explosion.

After the waterproof test, completely discharge the e-cigarette and then fully recharge it. Visually inspect to determine if there is a fire or explosion.

6.1.6 Pressure relief safety

Overcharge the fully charged battery of the electronic cigarette device that has been installed ready for use, with the voltage incrementally added at 0.1V per step for 5 min until n x 6.0 v. Check visually if there is pressure release; if yes, check visually if the direction of pressure release is the same as that of suction.

Note: n refers to the number of batteries or battery packs in series.

6.1.7 Resilience to fall

Have the electronic cigarette assembled into the state ready for use and the battery fully charged; drop it freely in accordance with GB/T 2423.7-2018 5.2 at the height of 1.5 meters. Drop it vertically twice with each end downwards each time and horizontally once. Visually inspect to determine if there is a fire or explosion.

After the drop, completely discharge the e-cigarette and then fully recharge it. Visually inspect to determine if there is a fire or explosion.

6.2 E-atomization material

6.2.1 Nicotine

The nicotine concentration in the e-liquid is measured according to GB/T 41701, and that in the solid e-atomization material is measured according to YC/T 559. The total amount of nicotine is calculated according to the mass of e-atomization material.

6.2.2 2,3-Butanedione

Implement the provisions of Annex C.

6.2.3 Heavy metal (in terms of Pb)

Implement the provisions of GB 5009.74.

6.2.4 Arsenic (in terms of As)

Implement the provisions of Act 1, Chapter 1 of GB 5009.11-2014.

6.3 Electronic cigarette emissions

6.3.1 Nicotine emission

Implement the provisions of Annexes D and E.

6.3.2 Carbonyl compound emissions

Implement the provisions of Annexes D and F.

7 Labelling and product instructions

7.1 Labelling

7.1.1 The following information but not limited to the following information should be labelled on products of electronic cigarettes:

a) List of components of e-atomization material, in descending order of mass fraction, down to 0.1%;

b) Nicotine concentration and total nicotine of e-atomization material, in terms of mg/g and mg respectively;

c) E-liquid volume or mass of solid e-atomization material, in terms of mL and g, respectively;

d) The labelling of restricted use of hazardous substances in electrical and electronic products should be in line with the provisions on the restricted use of hazardous substances and labelling of SJ/T 11364;

e) Health warnings should be in line with the relevant provisions of national regulations.

7.1.2 The following information but not limited to the following information should be labelled on products of electronic cigarette modules:

a) Names and model of the matching modules and the requirements for matching the module with other parts of the electronic cigarette;

b) If electronic cigarette device components are included, information listed in 7.1.1d) and 7.1.1e) should be provided;

c) If it contains e-atomization material, information listed in 7.1.1a), 7.1.1b) and 7.1.1c) should be provided.

7.1.3 In case the labelling cannot be displayed on the product due to the limitation of volume, shape, surface material or functional limitations, it should be marked on the sales package.

7.2 Product instructions

7.2.1 The electronic cigarette product instruction should specify:

a) Precautions in installation, operation and use and information of contraindications, emergency measures, etc;

b) Instructions on product installation, operation and use, if necessary, with illustrations, including instructions on the protection against start-up;

c) Product performance and technical indicators;

d) Information of methods of cleaning, care and maintenance of the product and after-sales service;

e) List of components of e-atomization materials, in descending order of mass fraction, down to 0.1%;

f) Nicotine concentration and total nicotine of e-atomization material, in terms of mg/g and mg respectively;

g) E-liquid volume or mass of solid e-atomization material, in terms of mL and g, respectively;

h) The labelling of restricted use of hazardous substances in electrical and electronic products should be in line with the provisions on the restricted use of hazardous substances and labelling of SJ/T 11364;

i) Health warnings should be in line with the relevant provisions of national regulations.

7.2.2 The electronic cigarette module product instructions should specify:

a) Information listed in 7.2.1a), 7.2.1b) and 7.2.1i);

b) Names and model of the matching modules, requirements for matching the module with other parts of the electronic cigarette and installation method;

c) If electronic cigarette device components are included, information listed in 7.2.1c), 7.2.1d) and 7.2.1h) should be provided;

d) If it contains e-atomization material, information listed in 7.2.1e), 7.2.1f) and 7.2.1g) should be provided.

Annex A

(normative)

Additives permitted to use in e-atomization materials and their maximum usage

Table A.1 provides the list of additives permitted to use in e-atomization materials and their maximum usage.

Table A.1 Additives permitted to use in e-atomization materials and their maximum usage

SN	Chinese names[a]	Engish names	CAS code	Maximal usage (mg/g)
1	2,3-二甲基吡嗪	2,3-DIMETHYL PYRAZINE	5910-89-4	1
2	2,5-二甲基吡嗪	2,5-DIMETHYL PYRAZINE	123-32-0	4
3	2,3,5-三甲基吡嗪	2,3,5-TRIMETHYLPYRAZINE	14667-55-1	5
4	2-乙酰基吡嗪	2-ACETYLPYRAZINE	22047-25-2	25
5	2-乙酰基吡啶	2-ACETYLPYRIDINE	1122-62-9	7
6	2-乙酰基吡咯	2-ACETYLPYRROLE	1072-83-9	5
7	2-乙酰基噻唑	2-ACETYLTHIAZOLE	24295-03-2	1
8	2-乙酰基呋喃	2-ACETYLFURAN	1192-62-7	1
9	α-当归内酯	α-ANGELICA LACTONE	591-12-8	1
10	γ-戊内酯	γ-VALEROLACTONE	108-29-2	10
11	γ-己内酯	γ-HEXALACTONE	695-06-7	5
12	γ-庚内酯	γ-HEPTALACTONE	105-21-5	5
13	γ-辛内酯	γ-OCTALACTONE	104-50-7	10
14	γ-十二内酯	γ-DODECALACTONE	2305-05-7	5
15	二氢猕猴桃内酯	DIHYDROACTINIDIOLIDE	17092-92-1	1
16	3-羟基-4,5-二甲基-2 (5H) 呋喃酮	4,5-DIMETHYL-3-HYDROXY-2,5-DIHYDROFURAN-2-ONE	28664-35-9	10
17	4-羟基-2,5-二甲基-3 (2H) 呋喃酮	2,5-DIMETHYL-4-HYDROXY-3 (2H) -FURANONE	3658-77-3	10
18	2,6,6-三甲基-2-环己烯-1,4-二酮	2,6,6-TRIMETHYLCYCLOHEX-2-ENE-1,4-DIONE	1125-21-9	1
19	α-紫罗兰酮	α-IONONE	127-41-3	3
20	β-突厥酮	β-DAMASCONE	23726-92-3	50
21	β-紫罗兰酮	β-IONONE	79-77-6	3
22	突厥烯酮	DAMASCENONE	23696-85-7	20
23	覆盆子酮	4- (4-HYDROXYPHENYL) -2-BUTANONE; RASPBERRY KETONE	5471-51-2	20
24	甲基环戊烯醇酮	METHYLCYCLOPENTENOLONE	765-70-8	20
25	杨梅醛	ETHYL METHYL PHENYLGLYCIDATE	77-83-8	3
26	对甲氧基苯甲醛	4-METHOXYBENZALDEHYDE	123-11-5	20
27	柠檬醛	CITRAL	5392-40-5	100
28	糠醛	FURFURAL	98-01-1	100
29	乙醇	ETHANOL	64-17-5	5
30	异戊醇	ISOAMYL ALCOHOL	123-51-3	15
31	糠醇	FURFURYL ALCOHOL	98-00-0	10
32	香叶醇	GERANIOL	106-24-1	15
33	叶醇	cis-3-HEXEN-1-OL	928-96-1	5
34	芳樟醇	LINALOOL	78-70-6	15
35	苯甲醇	BENZYL ALCOHOL	100-51-6	50
36	苯乙醇	PHENETHYL ALCOHOL	60-12-8	20
37	D,L-薄荷醇	D,L-MENTHOL	89-78-1	60

Table A.1 Additives permitted to use in e-atomization materials and their maximum usage (Cont'd)

SN	Chinese names[a]	Engish names	CAS code	Maximal amount (mg/g)
38	丁香酚	EUGENOL	97-53-0	50
39	茶多酚	TEA POLYPHENOL	84650-60-2	0. 4
40	麦芽酚	MALTOL	118-71-8	10
41	乙基麦芽酚	ETHYL MALTOL	4940-11-8	60
42	香兰素	VANILLIN	121-33-5	20
43	乙基香兰素	ETHYL VANILLIN	121-32-4	20
44	D,L-酒石酸	D,L-TARTARIC ACID	133-37-9	10
45	乙酸	ACETIC ACID	64-19-7	50
46	丙酸	PROPIONIC ACID	79-09-4	2.5
47	丁酸	BUTYRIC ACID	107-92-6	50
48	2-甲基丁酸	2-METHYLBUTYRIC ACID	116-53-0	50
49	乳酸	LACTIC ACID	50-21-5	20
50	柠檬酸	CITRIC ACID	77-92-9	50
51	苯甲酸	BENZOIC ACID	65-85-0	26
52	乙酰丙酸	4-OXOPENTANOIC ACID	123-76-2	28
53	苹果酸	MALICACID	6915-15-7	24
54	乙酸乙酯	ETHYL ACETATE	141-78-6	60
55	乙酸丁酯	BUTYL ACETATE	123-86-4	20
56	乙酸异丁酯	ISOBUTYL ACETATE	110-19-0	60
57	乙酸异戊酯	ISOAMYL ACETATE	123-92-2	60
58	乙酸庚酯	HEPTYL ACETATE	112-06-1	50
59	乙酸茴香酯	ANISYL ACETATE	104-21-2	20
60	乙酸苄酯	BENZYL ACETATE	140-11-4	50
61	乙酸糠酯	FURFURYL ACETATE	623-17-6	10
62	乙酸香叶酯	GERANYL ACETATE	105-87-3	15
63	乙酸叶醇酯	cis-3-HEXEN-1-YL ACETATE	3681-71-8	50
64	乙酸薄荷酯	MENTHYL ACETATE	16409-45-3	50
65	乙酸苯乙酯	PHENETHYL ACETATE	103-45-7	50
66	丙酸乙酯	ETHYL PROPIONATE	105-37-3	20
67	丁酸丁酯	BUTYL BUTYRATE	109-21-7	50
68	丁酸乙酯	ETHYL BUTYRATE	105-54-4	20
69	丁酸异戊酯	ISOAMYL BUTYRATE	106-27-4	50
70	异戊酸乙酯	ETHYL ISOVALERATE	108-64-5	50
71	异戊酸异戊酯	ISOAMYL ISOVALERATE	659-70-1	50
72	己酸烯丙酯	ALLYLHEXANOATE	123-68-2	3.9
73	壬酸乙酯	ETHYL NONANOATE	123-29-5	20
74	苯甲酸甲酯	METHYL BENZOATE	93-58-3	20
75	苯甲酸乙酯	ETHYL BENZOATE	93-89-0	30
76	苯乙酸乙酯	ETHYL PHENYLACETATE	101-97-3	50
77	二氢茉莉酮酸甲酯	METHYL DIHYDROJASMONATE	24851-98-7	50
78	肉桂酸甲酯	METHYL CINNAMATE	103-26-4	50
79	D-柠檬烯	D-LIMONENE	5989-27-5	50
80	可可提取物	COCOA EXTRACT (*Theobromacacao* Linn.)	84649-99-0	50
81	咖啡提取物	COFFEE EXTRACT (*Coffee* spp.)	93348-12-0	50
82	葫芦巴酊	FENUGREEK EXTRACT (*Trigonella foenum graecum* L.)	84625-40-1	70
83	香荚兰豆酊	VANILLA BEAN TINCTURE (*Vanilla* spp.)	84650-63-5	50
84	山梨酸钾	POTASSIUM SORBATE	24634-61-5	1
85	苯甲酸钠	SODIUM BENZOATE	532-32-1	0.6
86	八角茴香油	ANISE STAR OIL (*Illicium verum* Hook, F.)	8007-70-3	20
87	秘鲁香膏油	BALSAM PERU OIL (*Myroxylon pereirae*	8007-00-9	20

		Klotzsch)		
88	香茅油	CITRONELLA OIL (*Cymbopogon nardus* Rendle)	8000-29-1	50
89	丁香花蕾油	CLOVE BUD OIL (*Eugenia* spp.)	84961-50-2	50
90	丁香叶油	CLOVE LEAF OIL (*Eugenia* spp)	8015-97-2	50
91	芫荽籽油	CORIANDER SEED OIL (*Coriandrum sativum* L.)	8008-52-4	10
92	柠檬油	LEMON OIL (*Citrus limon* (L.) Burm.f.)	8008-56-8	50
93	广藿香油	PATCHOULI OIL (*Pogostemon cablin*)	8014-09-3	10
94	椒样薄荷油	PEPPERMINT OIL (*Mentha piperita* L)	8006-90-4	50
95	迷迭香油	ROSEMARY OIL (*Rosemarinus officinalis* L.)	8000-25-7	10
96	纤维素	CELLULOSE	65996-61-4	Use according to production needs
97	碳酸钙	CALCIUM CARBONATE	471-34-1	Use according to production needs
98	瓜尔胶	GUAR GUM	9000-30-0	Use according to production needs
99	N,2,3-三甲基-2异丙基丁酰胺	N, 2, 3-T RIMETHY-2-ISOPROPY LBUTAMIDE (WS-23)	51115-67-4	10
100	N-乙基-2-异丙基-5-甲基环己烷甲酰胺	N-ETHYL-p-MENTHAN-3-CARBOXAMIDE (WS-3)	39711-79-0	10
101	N-[N-(3,3-二甲基丁基)]-L-a-天门冬氨-L-苯甲氨酸1-甲酯（又名纽甜）	NEOTAME	165450-17-9	10
[a] If the additive in the list is a racemic modification, its levoisomer or dextroisomer should be deemed as permitted for use.				

Annex B

(normative)

Test method for atomization area temperature

B.1 Principles

Thermocouple method is used to measure the surface temperature of the heating unit of the e-cigarette device.

B.2 Device and equipment

B.2.1 Thermocouples

The tolerance of difference of the thermocouple should reach Level 1.

B.2.2 Data collector

The sampling frequency of temperature should not be less than 10 Hz.

B.3 Test conditions

The test should be done in a setting at 20°C±5°C in the environment without forced convective air.

B.4 Steps of the test

B.4.1 Sample preparation

For e-cigarette device using e-liquid, e-liquid should be removed as much as possible before setting up the thermocouple, or e-cigarette device unfilled with e-liquid or a cartridge should be used.

For e-cigarette device using solid e-atomization materials, it should be loaded with solid e-atomization material.

Remove the outer shell of the device or the cartridge and the protective parts near the heating unit to make it easy to install the thermocouple.

Adhere the thermocouple to the hottest area of the heating unit with high temperature resistant glue. Other auxiliary means such as infrared device can be used to locate the location of the hottest area.

After the thermocouple is installed, the e-cigarette device or the cartridge should be restored as much as possible to ensure it functions normally.

B.4.2 Measuring the temperature

Connect the thermocouple with the data collector. For e-cigarette device using e-liquid, use the vaping conditions set out in Annex D to trigger. The trigger duration is (3.0±0.l)s with the interval of (27.0±0.5)s. Continue for 10 vaping cycles. For e-cigarette device using solid e-atomization materials, trigger in accordance with the information in the product instruction and the duration is one working cycle.

Record the temperature of the e-cigarette device during the working period.

B.5 Test data processing

For e-cigarette device using e-liquid, use the highest temperature of the e-cigarette device during the working period as the test result, accurate to 0.1°C.

For e-cigarette device using solid e-atomization materials, use the highest temperature of the e-cigarette device during the period from the 31.0 second after working to the end of the first working cycle as the result, accurate to 0.1°C.

B.6 Test report

The test report should include the following:

- All the information needed to identify the sample;
- Location of the

- The test method, as described in this Annex;
- The test results;
- Differences from the analytical procedures specified in this method;
- Abnormal findings during the test;
- Date of test;
- Tester.

Annex C

(normative)

Determination of 2,3-butanedione in e-atomization material

C.1 Principles

2,3-butanedione in e-atomization material is derivatized with 2,4-dinitrophenylhydrazine (DNPH) solution. The amount of derivative is determined by using high-performance liquid chromatography.

C.2 Device and equipment

C.2.1 Analytical balance with a sensitivity of 0.1 mg.

C.2.2 High-performance liquid chromatography device with UV or diode array detector.

C.2.3 Vortex oscillator.

C.3 Reagents and materials

C.3.1 Water, GB/T 6682, Grade 1.

C.3.2 Acetonitrile, chromatographically pure.

C.3.3 Phosphoric acid, purity ≥ 85%.

C.3.4 Pyridine, ≥ 99% purity.

C.3.5 Tetrahydrofuran, chromatographically pure.

C.3.6 Isopropanol, chromatographically pure.

C.3.7 2,4-Dinitrophenylhydrazine hydrochloride (DNPH-HCl), purity no less than 98%.

C.3.8 2,3-butanedione, purity no less than 98%.

C.3.9 Aqueous solution of phosphoric acid.

Measure 60 mL of phosphoric acid (C.3.3) into a 1L beaker and add slowly 440 mL of water (C.3.1) while stirring to the scale. Mix well and store in the reagent bottle. The stable period is 3 months.

C.3.10 Derivatization reagent

Weigh 1.00 g of DNPH-HCl (C.3.7) into a 2-L beaker; add 500 mL of acetonitrile (C.3.2) and 40 mL aqueous solution of phosphoric acid (C.3.9). Dissolve and add 500 mL of water (C.3.1). Mix well. The prepared solution shall be stored in a brown reagent bottle and kept away from sunlight. It will be stable for 1 week.

C.3.11 Standard solutions

C.3.11.1 2,3-butanedione solution

Weigh 0.10 g of 2,3-butanedione (C.3.8) into a 10-mLbrown volumetric flask with an accuracy to 0.1 mg. Dilute with acetonitrile (C.3.2) to volume. The solution is stored at -18°C in darkness and will be stable for 3 months.

C.3.11.2 Standard stock solution of DNPH derivative

Pipette 0.1 mL of 2,3-butanedione solution (C.3.11.1) into a 25-mL brown volumetric flask; add 20 mL of derivatization reagent (C.3.10). Shake the flask well to enable reaction at room temperature for 20 min. Add 1 mL of pyridine (C.3.4) and then dilute with acetonitrile (C.3. 2) to volume. The solution is stored at -18°C in darkness and will be stable for 3 months.

C.3.11.3 Standard working solution

Make gradient dilution of standard stock solutions of DNPH derivatives (C.3.11.2) with acetonitrile to prepare at least 5 standard working solutions with mass concentrations ranging from 0.1 μg/mL to 4 μg/mL respectively. The solution should be used immediately after preparation.

C.3.12 Polytetrafluoroethylene (PTFE) filter membrane, 0.45 μm.

C.4 Steps of analysis

C.4.1 Sample pre-treatment

C.4.1.1 E-liquid

Weigh 0.5 g of sample in a 10-mL brown volumetric flask with accuracy to 0.1 mg; add 5 mL of derivatization reagent (C.3.10); shake well and react for 20 min at room temperature; add 0.25 mL of pyridine (C.3.4) and dilute to volume with acetonitrile (C.3.2); filter through PTFE membrane (C.3.12) and place in a brown chromatography vial for measurement.

C.4.1.2 Solid e-atomization materials

Weigh accurately 0.5 g of sample into a 15-mL centrifuge tube with accuracy to 0.1 mg; add 10 mL of derivatization reagent (C.3.10), keep away from light and vortex shake for reaction for 20 min, filter through PTFE membrane (C.3.12) and then take 5 mL into a 10-mL brown volumetric flask. Add 0.25 mL of pyridine (C.3.4), dilute with acetonitrile (C.3.2) to the scale, filter through PTFE membrane (C.3.12) and place in a brown chromatography vial for measurement.

C.4.2 Conditions for high performance liquid chromatography

The following analytical conditions are available for reference. The applicability should be verified before other conditions are used.

- Chromatographic column: C18 column, [150 mm (length) × 2.1 mm (inner diameter), 2.7 μm (particle size)] or equivalent column;

- Mobile phase A: water-acetonitrile-tetrahydrofuran-isopropanol (63-27-9-1);
- Mobile phase B: water-acetonitrile-tetrahydrofuran-isopropanol (40-58-1-1);
- Mobile phase C: acetonitrile;
- Column temperature: 30℃;
- Flow rate: 0.3 mL/min;
- Injection volume: 2 μL;
- Gradient: see Table C.1;
- Detector: UV or diode array detector, sensitive to 365-nm light.

Table C.1 Gradient elution during high-performance liquid chromatography

Time (min)	Mobile phase A	Mobile phase B	Mobile phase C
0.0	95	0	5
1.0	95	0	5
5	70	30	0
6	40	60	0
10	40	60	0
12	0	100	0
13	0	0	100
14	0	0	100
14.1	95	0	5
18	95	0	5

C.4.3 Drawing of standard working curves

The standard working solution (C.3.11.3) is determined by using the conditions of high-performance liquid chromatography (C.4.2). The standard working curve is established based on the peak area of the target compound and its concentration.

After every 20 samples are measured, a standard working solution with medium concentration should be added; if the measured value differs from the original value by more than 5%, the whole standard working curve should be re-created.

C.4.4 Sample determination

The sample solution (C.4.1) is tested using the conditions of the high-performance liquid chromatographic analysis (C.4.2).

Each sample shall be measured twice in parallel.

C.5 Calculation and presentation of the results

The concentration of 2,3-butanedione in e-atomization material is calculated using the following equation (C.1):

$$X = \frac{C \times V \times d}{m} \quad \text{(C.1)}$$

where

X: the concentration of 2,3-butanedione in e-atomization material (mg/kg);

C: the mass concentration of 2,3-butanedione in sample solution (μg/mL);

V: constant volume of sample solution (mL);

d: dilution multiplier (e-liquid is 1; solid e-atomization material is 2);

m: mass of e-atomization material (g).

The arithmetic mean of two parallel measurements is used as the final result, accurate to 0.01 mg/kg. The relative average deviation of the two parallel measurements should be no more than 10%.

C.6 Recovery, detection limit, and quantification limit

The recovery, detection limit, and quantification limit of this method are listed in Table C.2.

Table C.2 Recovery, detection limit, and quantification limit of this method

Material	Compound	Recovery %	Detection limit mg/kg	Quantification limit mg/kg
E-liquid	2,3-butanedione	96.1-102.4	0. 3	1.1
Solid e-atomization material		95.6-105.1	0. 6	2.1

C.7 Reporting of the tests

The report should include:

— All the information needed to identify the sample;
— The test method, as described in this Annex;
— The test results;
— Date of test;
— Tester.

Annex D

(normative)

Standard conditions for electronic cigarette vaping

D.1 Puff duration

The duration of each puff is (3.0 ± 0.1) seconds.

D.2 Puff volume

The tested puff volume is (55.0 ± 0.3) mL with a pressuring drop device of (1000 ± 50) Pa.

D.3 Puff frequency

The frequency is one puff every (30.0 ± 0.5) seconds.

D.4 Puff profile

The puff profile of the vaping machine is rectangular. During the measurement, ensure that the puff volume meets the requirements of D.2 when a pressure drop device of (1000±50) Pa is connected in series in the gas path between the port of the vaping machine and the measuring device. A typical puff profile without E-cigarette samples is shown in Figure D.1. In Figure D.1, the area of V1+V3 enclosed by the curves when the gas flow rate rises (t0 – t1) and falls (t2 - t3) should not exceed 10% of the total puff volume in graphs V1+V2+V3. The maximum gas flow rate should be maintained between 16.5 and 20.1 mL/s.

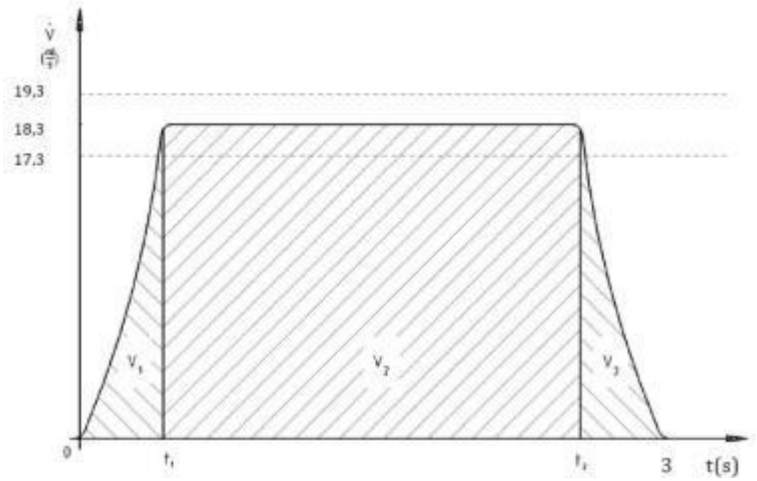


Fig D.1 A typical puff profile without e-cigarette samples

D.5 Trigger interval

If the e-cigarette requires additional triggering during vaping to produce aerosols properly, the trigger duration should be synchronized with the vaping duration, with no more than 0.1 second difference between the start trigger time and the start vaping time, and no more than 0.1 second difference between the end trigger time and the end vaping time.

D.6 Atmosphere during test

The following criteria should be met for atmosphere test:

- Temperature: (22 ± 2)°C.
- Relative humidity: (60 ± 5)%.

Annex E

(normative)

Determination of nicotine released in electronic cigarette emissions

E.1 Principles

The e-cigarette emissions are trapped on glass fiber filter, which is extracted with isopropanol solution that contains an internal standard. The nicotine content of the extract is determined by gas chromatography.

E.2 Device and equipment

E.2.1 Electronic cigarette smoking machine.

E.2.2 Analytical balance, sensitive to 0.1 mg.

E.2.3 Oscillator.

E.2.4 Conical flasks with stopper, 50mL.

E.2.5 Gas chromatography equipment with a hydrogen flame ionization detector.

E.3 Reagents and materials

E.3.1 Isopropanol, chromatographically pure.

E.3.2 Internal standard: n-heptadecane or 2-methylquinoline, purity not less than 99%.

Note: Other substances can be used as internal standards if their purity meets the requirements and they do not elute simultaneously with other released components. Nicotine.

E.3.3 Extraction solution

Isopropanol (E.3.1) solution containing the appropriate concentration of internal standard (E.3.2), typically 0.2 mg/mL − 0.5 mg/mL.

E.3.4 Standard solutions

E.3.4.1 Standard stock solution

Dissolve nicotine (E.3.3) in isopropanol (E.3.1) solution to prepare a standard stock solution of nicotine, typically 5.0 mg/mL. The solution is stored at 4°C in darkness and will be stable for 6 months.

E.3.4.2 Standard working solution

Add different volumes of nicotine standard stock solution (E.3.5.1) into 20 mL of extraction solution (E.3.4) respectively to prepare at least 5 levels of standard working solutions, with their mass concentration ranging from 0.01 mg/mL to 0.5 mg/mL. The solutions should be used immediately after preparation.

E.3.5 Glass fiber filter paper, in line with the requirements of GB/T 16450.

E.4 Steps of analysis

E.4.1 Preparation of samples

The cartridge should be in sealed package and left for at least 12 hours in the test atmosphere for temperature balance. Rechargeable e-cigarettes should have their batteries fully charged prior to testing.

If the gas inlet is adjustable, open it fully. For e-cigarette samples with adjustable power, use the maximum power of the e-cigarette.

E.4.2 Emission trapping and treatment

E.4.2.1 E-cigarettes using e-liquid

Vape 20 puffs in line with the requirements set out in Annex D. Remove the glass fiber filter (E.3.6) upon the completion of vaping. Wipe the internal wall of the trap with a new glass fiber filter (E.3.6) and place both filters in a 50-mL conical flask with stopper (E.2.4). Add 20 mL of extraction solution (E.3.4). Shake for 30 min before the extract is harvested and put into a chromatography vial for further tests.

E.4.2.2 E-cigarettes using solid e-atomization materials

Vape in line with the requirements set out in Annex D after the e-cigarette device is preheated. Vape 4 cartridges. The number of puffs per cartridge is determined according to the heating time of the e-cigarette (the time between the completion of the warm-up and the cessation of heating) and calculated using the following equation (E.1):

$$n=\frac{t-3}{30}+1 \qquad \text{(E.1)}$$

Where

n – number of puffs in integer values from the calculation; t – heating time in seconds (s).

Remove the glass fiber filter (E.3.6) upon the completion of vaping. Wipe the internal wall of the trap with a new glass fiber filter (E.3.6) and place both filters in a 50-mL conical flask with stopper (E.2.4). Add 20 mL of extraction solution (E.3.4). Shake for 30 min before the extract is harvested and put into a chromatography vial for further tests.

E.4.3 Conditions of gas chromatography

The following analytical conditions are available for reference. The applicability should be verified before other conditions are used.

— Chromatographic column: It is recommended to use flexible quartz capillary column with a stationary phase of 6% cyanopropylphenyl and 94% dimethyl polysiloxane [30 m (length) × 0.32 mm (inner diameter) × 1.8 μm (film thickness)]; or equivalent column;

— GC oven temperature program: initial temperature of 100°C with a 1 min hold followed by a 15°C/min ramp up to 220°C with a 6 min hold;

— Inlet temperature: 250°C;

— Detector temperature: 275°C;

— Injection volume: 1μl; split ratio: 20:1;

— Carrier gas: helium, 1.8 mL/min;

— Makeup gas: 20 mL/min;

— Air: 450 mL/min;

— Hydrogen: 40 mL/min

E.4.4 Drawing of standard working curves

The standard working solutions of nicotine (E.3.5.2) is determined by using the conditions of gas chromatography (E.4.3). The standard working solution is developed using the ratio of the peak area of nicotine to the peak area of the internal standard and their amount.

After every 20 samples are measured, a working standard solution with medium concentration should be added; if the measured value differs from the original value by more than 5%, the whole standard working curve should be re-created.

E.4.5 Sample determination

Determine the concentration of nicotine in the sample extract solution (E.4.2) according to the conditions of the gas chromatography (E.4.3).

Each sample shall be measured three times in parallel.

E.5 Calculation and presentation of the results

The amount of nicotine released in electronic cigarette emissions is calculated using the following equation (E.2):

$$X_i = m/N \qquad \text{..... (E.2)}$$

Where

X_i: the amount of nicotine released in each puff of the electronic cigarette emissions (mg);

m: total amount of nicotine in the extraction solution (mg);

N: total number of puffs.

The arithmetic mean of three parallel measurements is used as the final result, accurate to 0.01 mg.

E.6 Recovery, detection limit, and quantification limit

The recovery, detection limit, and quantification limit of this method are listed in Table E.1.

Table E.1 Recovery, detection limit, and quantification limit of this method

Compound	Recovery %	Detection limit (mg)	Quantification limit (mg)
Nicotine	92.2-102.4	0.001	0.004

E.7 Reporting of the tests

Description of the test should include:

— All the information needed to identify the sample;
— This test method is used;
— The test results;
— Date of test;
— Tester.

Annex F

(normative)

Determination of formaldehyde, acetaldehyde, acrolein, and 2,3-buranedione released in electronic cigarette emissions

F.1 Principles

Formaldehyde, acetaldehyde, acrolein, and 2,3-butanedione in electronic cigarette emissions are trapped and derivatized with 2,4-dinitrophenylhydrazine (DNPH) solution. The amounts of derived compounds are determined by using high-performance liquid chromatography.

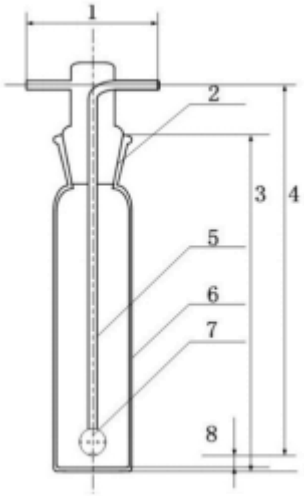
F.2 Device and equipment

F.2.1 Electronic cigarette smoking machine.

F.2.2 Analytical balance with 0.1 milligram readability.

F.2.3 High-performance liquid chromatography device with UV or diode array detector.

F.2.4 Trap. See Figure F.1 for schematic diagram.



1- Distance 70 mm;

2- Vacuum grinding mouth 24#;

3- Height 200 mm;

4- Height 216 mm;

5- Outside diameter of the tube 8 mm;

6- Outside diameter of the tube 30 mm;

7- Outside diameter of the bulb 18 mm, six round holes of 2 mm diameter evenly distributed on the horizontal maximum circumference, and the round hole at the bottom is 4 mm in diameter;

8- The bottom of the bulb is 4 mm away from the bottom of the bottle.

Fig F.1 Schematic diagram of the shape and size of the trap

F.3 Reagents and materials

F.3.1 Water, GB/T 6682, Grade 1

F.3.2 Acetonitrile, chromatographically pure

F.3.3 Phosphoric acid, purity ≥ 85%.

F.3.4 Pyridine, ≥ 99% purity.

F.3.5 Tetrahydrofuran, chromatographically pure

F.3.6 Isopropanol, chromatographically pure

F.3.7 2,4-Dinitrophenylhydrazine hydrochloride (DNPH-HCl), purity ≥98%.

F.3.8 DNPH derivatives of formaldehyde, acetaldehyde, and acrolein, purity ≥ 97%.

F.3.9 2,3-butanedione, purity ≥ 98%.

F.3.10 Aqueous solution of phosphoric acid

Pipette 60 mL of phosphoric acid (F.3.3) into a 1-L beaker and add 440 mL water (F.3.1) slowly. Mix well and transfer to a reagent bottle. The stable period is 3 months.

F.3.11 Derivatization reagents

Weigh 1.0 g of DNPH (F.3.7) and dissolve it in 500 mL of acetonitrile (F.3.2) and 40 mL of aqueous solution of phosphoric acid (F.3.10) in a 2L brown volumetric flask. Add 500 mL of water (F.3.1) and mix well. Transfer to a brown reagent bottle and stored in darkness away from light. It will be stable for 1 week.

F.3.12 Standard solutions

F.3.12.1 Standard stock solutions of DNPH derivatives of formaldehyde, acetaldehyde, and acrolein

Weigh accurately 0.050 g of DNPH derivatives of formaldehyde and acrolein and 0.10 g of DNPH derivatives of acetaldehyde (F.3.8) into 50-mL brown volumetric flask, accurate to 0.1mg. Dilute with acetonitrile (F.3.2) to volume. The solution is stored at -18°C in darkness and will be stable for 3 months.

F.3.12.2 2,3-butanedione solution

Weigh 0.10 g of 2,3-butanedione (F.3.9) into a 10-mL brown volumetric flask, precise to 0.1 mg, and dilute with acetonitrile (F.3.2) to volume. The solution is stored at -18°C in darkness and will be stable for 3 months.

F.3.12.3 Standard stock solution of DNPH derivatives of 2,3-butanedione

Pipette accurately 0.1 mL of 2,3-butanedione solution (F.3.12.2) into a 25-mL brown volumetric flask and add 20 mL of derivatization reagent (F.3.11). Shake the flask well to enable reaction at room temperature for 20 min. Add 1.0 mL of pyridine (F.3.4) and then dilute with acetonitrile (F.3.2) to volume. The stock solution is stored at -18°C in darkness and will be stable for 3 months.

F.3.12.4 Mixed standard stock solution

Pipette 5 mL of standard stock solutions of the DNPH derivatives of formaldehyde, acetaldehyde, and acrolein (F.3.12.1) and 10 mL of standard stock solutions of the DNPH derivative of 2,3-butanedione (F.3.12.3) into 25-mL brown volumetric flasks respectively and dilute with acetonitrile (F.3.2) to volume. The stock solution is stored at -18°C in darkness and will be stable for 3 months.

F.3.12.5 Mixed standard working solutions

Pipette different volumes of the mixed standard stock solution (F.3.12.4) into 6 brown volumetric flasks of 10-ml respectively. Dilute with acetonitrile (F.3.2) to volume. Prepare at least 5 different mixed standard working solutions. The recommended mass concentrations are: formaldehyde, 0.07 ug/ml – 14 ug/ml; acetaldehyde, 0.20 ug/ml – 40 ug/ml; acrolein, 0.12 ug/ml – 24 ug/ml; and 2,3-butanedione, 0.04 ug/ml – 8 ug/ml. These solutions should be used immediately after preparation.

F.3.13 Polytetrafluoroethylene (PTFE) filter membrane, 0.45 μm.

F.4 Steps of analysis

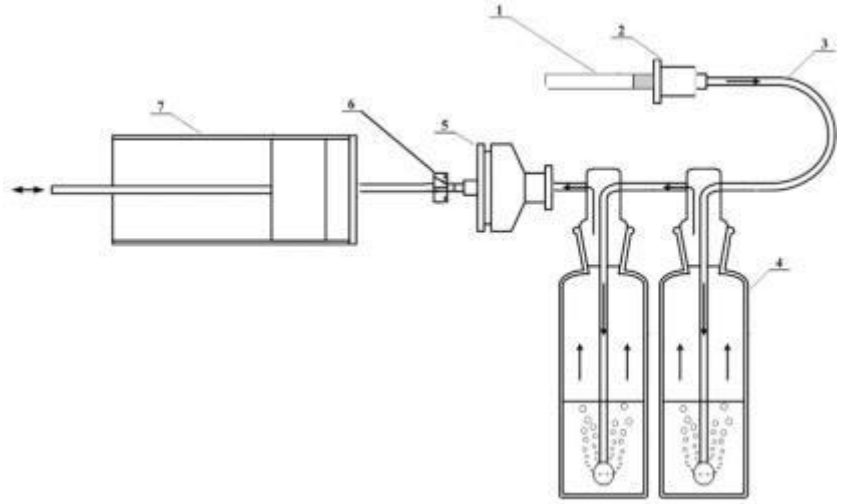
F.4.1 Preparation of samples

The cartridge should be in sealed package and left for at least 12 hours in the test atmosphere for temperature balance. Rechargeable e-cigarettes should have their batteries fully charged prior to testing.

If the gas inlet is adjustable, open it fully. For e-cigarette samples with adjustable power, use the maximum power of the e-cigarette.

F.4.2 Preparation for emission trapping

Pipette 25.0 mL of derivatization reagent (F.3.11) into each trap (F.2.4). Connect two traps (F.2.4) in series between the e-cigarette holder and the trapping device (see Fig F.2 for the connection method). The vaping machine is set up in accordance with the requirements set out in Annex D and check out for leaks and verify vaping volume, then insert the samples into the e-cigarette holder.



1- Electronic cigarettes;

2- E-cigarette holder;

3- Connection tubes;

4- Traps;

5- Trapping device;

6- Vaping unit.

Fig F.2 Schematic diagram of vaping connections of e-cigarettes

F.4.3 Emission trapping and treatment

F.4.3.1 E-cigarettes using e-liquid

Vape 50 puffs. After vaping, remove the trap (F.2.4) and let it stand for 20 min. Pipette 5 mL of the trapping solution from each trap (F.2.4) to a 20 mL brown flask; add 0.5 mL of pyridine (F.3.4); dilute with acetonitrile (F.3.2) to the scale and shake well; have it filtered on a PTFE membrane (F.3.13) and place it in a chromatography vial for measurement.

F.4.3.2 E-cigarettes using solid e-atomization materials

The vaping process begins after the warm-up is complete. Vape 4 cartridges. The number of puffs per

cartridge is determined according to the heating time of the e-cigarette (the time between the completion of the warm-up and the cessation of heating) and calculated using the following equation (F.1):

$$n = \frac{t-3}{30} + 1 \quad \text{..... (F.1)}$$

where,

n – number of puffs in integer values from the calculation;

t – heating time in seconds (s).

After vaping, remove the trap (F.2.4) and let it stand for 20 min. Pipette 5 mL of the trapping solution from each trap (F.2.4) to a 20 mL brown flask; add 0.5 mL of pyridine (F.3.4); dilute with acetonitrile (F.3.2) to the scale and shake well; have it filtered on a PTFE membrane (F.3.13) and place it in a chromatography vial for measurement.

F.4.4 Blank test

Repeat the steps of F.4.3 without adding samples to perform the blank test. For each batch of samples, one blank sample should be prepared.

F.4.5 Conditions of high-performance liquid chromatography

The following analytical conditions are available for reference. The applicability should be verified before other conditions are used.

- Chromatographic column: C18 column, [150 mm (length) × 2.1 mm (inner diameter), 2.7 μm (particle size)] or equivalent;
- Mobile phase A: water-acetonitrile-tetrahydrofuran-isopropanol (63-27-9-1);
- Mobile phase B: water-acetonitrile-tetrahydrofuran-isopropanol (40-58-1-1);
- Mobile phase C: acetonitrile;
- Column temperature: 30℃;
- Flow rate: 0.3 mL/min;
- Injection volume: 2 μL;
- Gradient: see Table F.1;
- Detector: UV or diode array detector, sensitive to 365-nm light.

Table F.1 Elution gradient during high-performance liquid chromatography

Time (min)	Mobile phase A (%)	Mobile phase B (%)	Mobile phase C (%)
0.0	95	0	5
1.0	95	0	5
5	70	30	0
6	40	60	0
10	40	60	0
12	0	100	0
13	0	0	100
14	0	0	100

14.1	95	0	5
18	95	0	5

F.4.6 Drawing of standard working curves

The mixed standard working solutions (F.3.12.5) are determined by using the conditions of high-performance liquid chromatography (F.4.5). The standard working curve is developed based on the peak area of the target compound and its concentration.

After every 20 samples are measured, a standard working solution with medium concentration should be added; if the measured value differs from the original value by more than 5%, the whole standard working curve should be re-created.

F.4.7 Sample determination

Sample solutions (F.4.3) are determined by using the conditions of the high-performance liquid chromatographic analysis (F.4.5).

Each sample should be tested 3 times in parallel.

F.5 Calculation and presentation of the results

The amount of formaldehyde, acetaldehyde, acrolein, and 2,3-buranedione in e-cigarette emissions are calculated using the following equation (F.2):

$$X = \frac{(C - C_0) \times V \times 5}{N} \qquad \text{……} \quad (F.2)$$

where

X: the amount of target compound released in each puff of electronic cigarette emissions (μg);

C: the determined mass concentration of the target compound in sample solution (μg/mL);

C_0: the determined mass concentration of the target compound in the blank test (μg/mL) ;

V: constant volume of the sample solution (mL);

N: total number of puffs.

The arithmetic mean of three parallel measurements is used as the final result, accurate to 0.01 μg.

F.6 Recovery, detection limit, and quantification limit

The recovery, detection limit, and quantification limit of this method are listed in Table F.2.

Table F.2 Recovery, detection limit, and quantification limit of this method

Compound	Recovery %	Detection limit μg	Quantification limit μg
Formaldehyde	92.7-103.0	0.004	0.012
Acetaldehyde	95.5-101.5	0.008	0.027
Acrolein	95.6-106.8	0.006	0.021
2,3-Butanedione	93.9-98.9	0.006	0.021

F.7 Reporting of the tests

The report should include:

— All the information needed to identify the sample;

— The test method, as described in this Annex;

— The test results;

— Date of test;

— Tester