Test Report

Report No.: JC-CPC180103

Date: Oct.30, 2018

Applicant Name: HILIQ CO.,LIMITED

Applicant Add.: Rm.19C, Lockhart Ctr.,301307 Lockhart Rd,. Wan Chai, Hongkong

Test sample(s) was (were) submitted by the applicant, report on the submitted sample(s) said to be:

Sample Name: Nicotine Salt
Strength: 50 mg/ml
Bottle Size: 30 ml
Brand: HILIQ
Refilling Mode: POD

Sample Receiving Date: Oct.17, 2018

Testing Period: Oct.17, 2018 to Oct.25, 2018

Tests conducted: As requested by the applicant, for details refer to attached page(s).

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Test Request:

Test Item	Test Request
Nicotine Consistence, Nicotine, Carbonyls, Impurities in PG and VG, Specific Nitrosamine, Volatile Organic Compounds (VOC), Heavy Metal Elements, Flavour Ingredients, Propylene Glycol and Vegetable Glycerin	Tobacco Product Directive (2014/40/EU)Article 20

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Signed for and on behalf of
Skyte Testing Services Guangdong Co., Ltd.

David Tu/ General Manager

Remark: Please note that every statement made in this report is only valid for the samples tested and reported herein. This report shall not be reproduced except in full, without the written approval of SKYTE. The sample(s)'s information was provided by the applicant, SKYTE has no responsibility for the truth of such information.

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Analytical Method Parameters

Smoking machine condition: Puffing Frequency: 30s±0.1s
Puffing Duration: 3s±0.5s
Puff Volume: 55mL±0.3 mL
Inhalation Profile : Square Wave
Inhalation Flow Rate: 1.10 L/min

Device Power Setting: 40 W
Number of puffs per series: 20
Number of series: 5
Total number of puffs:100
Time between 2 series: 300s
Total vaporization duration:300s

Test Result

1. Nicotine Consistence

Test Item	CAS No.	Test Result (mg/100 puffs)			AVG (mg/100 puffs)	Target values*
		1~20 puffs	41~60 puffs	81~100 puffs		
Nicotine Consistence	54-11-5	11.8	12.0	13.1	12.3	25%
Deviation	——	-4.07%	-2.44%	6.50%	——	

2. Nicotine

Test Item	CAS No.	Test Result (mg/100 puffs)	MDL (mg/100 puffs)
Nicotine	54-11-5	12.3	0.05

3. Impurities in PG and VG

Test Item	CAS No.	Test Result (μg/200 puffs)	MDL (μg/200 puffs)
Ethylene glycol	107-21-1	N.D.	4
Diethylene glycol	111-46-6	N.D.	4

4. Specific Nitrosamine

Test Item	CAS No.	Test Result (ng/200 puffs)	MDL(ng/200 puffs)
NNK	64091-91-4	N.D.	25
NNN	16543-55-8	N.D.	25

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5. Carbonyls

Test Item	CAS No.	Test Result (μg/200 puffs)	MDL (μg/200 puffs)	Target values* (μg/200 puffs)
Formaldehyde	50-00-0	37.5	4.0	200
Acetaldehyde	75-07-0	11.3	4.0	3200
Acrolein	107-02-8	N.D.	4.0	16

6. Volatile Organic Compounds (VOC)

Test Item	CAS No.	Test Result (μg/200 puffs)	MDL (μg/200 puffs)
Benzene	71-43-2	N.D.	4
Toluene	108-88-3	N.D.	4
1,3-Butadiene	106-99-0	N.D.	40
Isoprene	78-79-5	N.D.	4

7. Heavy Metal Elements

Test Item	CAS No.	Test Result (μg/200 puffs)	MDL (μg/200 puffs)	Target values* (μg/200 puffs)
Chromium (Cr)	7440-47-3	N.D.	0.3	3
Cadmium (Cd)	7440-43-9	N.D.	0.2	2
Lead (Pb)	7439-92-1	N.D.	0.5	5
Antimony (Sb)	7440-36-0	N.D.	2.0	20
Nickel (Ni)	7440-02-0	N.D.	0.5	5
Arsenic (As)	7440-38-2	N.D.	0.2	2
Aluminum (Al)	7429-90-5	N.D.	0.5	—
Iron (Fe)	7439-89-6	N.D.	0.5	—
Tin (Sn)	7440-31-5	N.D.	0.5	—
Copper (Cu)	7440-50-8	N.D.	0.5	—

8. Flavour Ingredients

Test Item	CAS No.	Test Result (μg/200 puffs)	MDL (μg/200 puffs)	Target values* (μg/200 puffs)
Diacetyl	431-03-8	N.D.	8	490
2,3- Pentanedione	600-14-6	N.D.	8	—

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9. Propylene glycol and Vegetable glycerin

Test Item	CAS No.	Test Result (mg/200 puffs)	MDL (mg/200 puffs)
Propylene glycol	57-55-6	1175	0.6
Vegetable glycerin	56-81-6	418	0.6

Tested by: Xiangdongdong, Zhaifuqiang, Panrenfeng, Wentonglin Checked by: Yezhirong, Chenyumei

Remark:

(1) N.D. = not detected, less than MDL
(2) MDL = method detection limit
(3) ng/200puffs = nanogram per two hundred puffs.
(4) mg/100puffs = milligrams per one hundred puffs.
(5) mg/200puffs = milligrams per two hundred puffs.
(6) μg/200 puffs = micrograms per two hundred puffs.
(7) g/200 puffs = grams per two hundred puffs.
(8) * = The target value is quoted from AFNOR XP D90-300-3

Test Method

Test Item	Method reference	Reference Title	Test Instrument
Definitions And Standard Conditions	CORESTA RECOMMENDED METHOD N° 81	Routine Analytical Machine For E-Cigarette Aerosol Generation And Collection- Definitions And Standard Conditions (June 2015)	——
Nicotine Consistence	AFNOR XP D90-300-3 Annex A.3	Example of method for measuring nicotine in the emissions	GC-FID
Nicotine			
Ethylene glycol	C-QT-1800-TP	Simultaneous Determination of Alcohols in E-cigarette Emissions by Gas Chromatography-Mass Spectrometry	GC-MS
Diethylene glycol			
Propylene glycol	CORESTA RECOMMENDED METHOD N°84（2017）	Determination of glycerin, propylene glycol, water, and nicotine in the aerosol of e-cigarettes by gas chromatographic analysis	GC-FID
Vegetable glycerin			

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Test Item	Method reference	Reference Title	Test Instrument
Formaldehyde	AFNOR XP D90-300-3 Annex A.5	Example of method for measuring formaldehyde and other aldehydes in the emissions	HPLC
Acetaldehyde			
Acrolein			
Benzene	CORESTA RECOMMENDED METHOD N° 70	Determination of Selected Volatile Organic Compounds in Mainstream Cigarette Smoke By GC-MS	GC-MS
Toluene			
1,3-Butadiene			
Isoprene			
Chromium (Cr)	AFNOR XP D90-300-3 Annex A.6	Example of method for measuring metals and other non-metal elements in the emissions	ICP-OES
Cadmium (Cd)			
Lead (Pb)			
Antimony (Sb)			
Nickel (Ni)			
Arsenic (As)			
Aluminum (Al)			
Iron (Fe)			
Tin (Sn)			
Cuprum (Cu)			
Diacetyl	AFNOR XP D90-300-3 Annex A.4	Example of method for measuring diacetyl in the emissions	GC-MS
2,3- Pentanedione			
NNK	CORESTA	Determination of Tobacco-Specific	

Overview (Emissions – The Determination Of Carbonyl Compounds In Aerosol)

During the vapourisation process, the e-liquid is heated to temperatures often exceeding 300℃.These temperatures are sufficiently high to induce physical changer of e-liquids and chemical reactions between the constituents of e-liquids. Solvents contained in the nicotine formulation may undergo pyrolysis leading to formation of potentially toxic compounds.

Both glycerol and propylene glycol have been shown to thermally decompose at high temperatures generating low molecular weight carbonyl compounds with established toxic properties (e.g., formaldehyde, acetaldehyde and acrolein). The operating conditions of the e-cigarette device plays a pivotal role in determining the rate at which carbonyl compounds during e-cigarette use. In addition, it is also known that the higher the propylene glycol content in the e-liquid, the greater the chance that higher levels of carbonyls will be detected in the vapour.

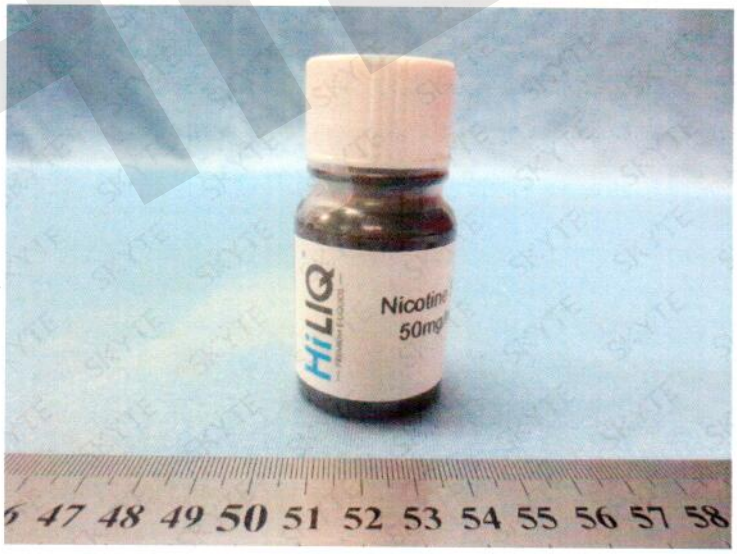
The method is designed to generate a known amount of aerosol under controlled sampling conditions from a specified/ e-cigarette combination, which is then captured in a derivatisation solution. (Derivatisation is a procedural technique that is required to modify the carbonyl compounds functionality in order to enable chromatographic separation and detection). The resulting liquid samples and stabilized and then analysed using high performance liquid chromatography (HPLC).

Method Principles

The materials (e-cigarette devices or e-liquid) under test will be operated under controlled environmental conditions using an automated vaping machine. 100 inhalations from each sample will be generated. The aerosol generated will be collected into an acidified derivatisation solution containing 2,4-dinitrophenylhydeazine. This solution efficiently traps the aerosol and simultaneously converts the carbonyl compounds into a hydrazone species according to the following equation:

$$RR'C{=}O + C_6H_3(NO_2)2NHNH_2 \rightarrow C_6H_3(NO_2)2NHNCRR' + H_2O$$

Sample Photo



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(End of report)

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