Simultaneous determination of six furans in aerosol of heated tobacco products by gas chromatography/mass spectrometry

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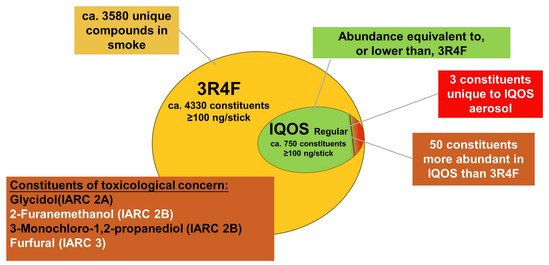
BACKGROUND

- Due to the absence of high-temperature pyrolysis and combustion, the releases of most harmful components from **heated tobacco products** (HTPs) are **much lower than** those from **conventional cigarettes** (CCs)[1].
- However, some harmful components were reported to be released at higher levels than CCs, including furans. Furans, which are **harmful or potentially harmful** to humans, are an important class of **baked aroma components** in cigarette smoke[2].



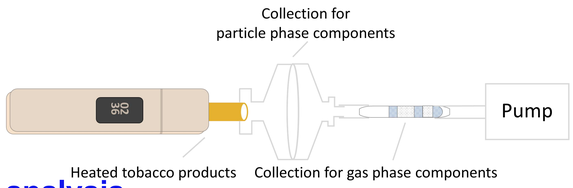
OBJECTIVE

To investigate the release characteristics of **furans** in the aerosol of **HTPs**;
To establish a **gas chromatography/mass spectrometry (GC/MS) method**[3-4].

METHOD

Aerosol collection

For collecting the particle phase and gas phase of aerosol of HTPs and CCs, the Cambridge filter pad (CFP) and a XAD–7 sorbent catridge were used. The XAD–7 sorbent catridge was connected between the CFP and the pump of the linear smoking.



Sample analysis

Both CFP and the XAD-7 sorbent catridge were extracted with 20 mL extraction solution ((50 μg/mL methyl furoate in propan-2-ol), respectively, for 30 min by shaking.
The extraction solution was analysized by GC-MS equipped with a HP–INNOWAX (30 m×0.25 mm×0.25 μm) column.

RESULTS

Tab.1 Linear equation and correlation coefficient, limit of detection and quantitation, matrix effect and recovery

Compound	Linear range (μg/mL)	r^2	LOD/ (μg/cig)	LOQ/ (μg/cig)	matrix effect	Low spiked level Recovery (%)	Low spiked level RSD (%)	Middle spiked level Recovery (%)	Middle spiked level RSD (%)	High spiked level Recovery (%)	High spiked level RSD (%)
Furfural	0.09~18.94	0.9999	0.01	0.04	0.94	96.79	5.41	98.32	4.15	100.67	8.51
2-Acetylfuran	0.03~6.21	0.999 9	0.01	0.02	1.00	105.29	5.33	103.42	3.19	105.59	3.92
5-Methyl-2-furfural	0.05~10.62	0.999 5	0.01	0.03	0.98	99.62	6.4	98.59	4.04	102.58	2.38
2-Furanmethanol	0.09~18.59	0.999 8	0.03	0.09	0.96	101.61	6.23	104.1	3.94	108.66	1.33
5-Methyl-2-furfural	0.04~8.35	0.999 9	0.02	0.06	0.96	100.15	5.23	102.1	3.12	101.7	2.95
5-Hydroxymethyl -furfural	0.36~72.45	0.998 9	0.12	0.39	1.03	95.33	4.78	100.63	6.29	103.35	3.45

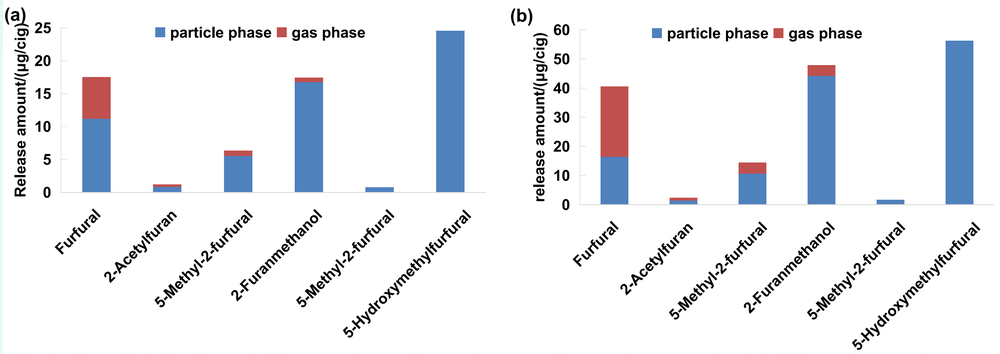


Fig.3 The distribution of 6 furans in particle phase and gas phase under (a) ISO regime and (b) HCI regime

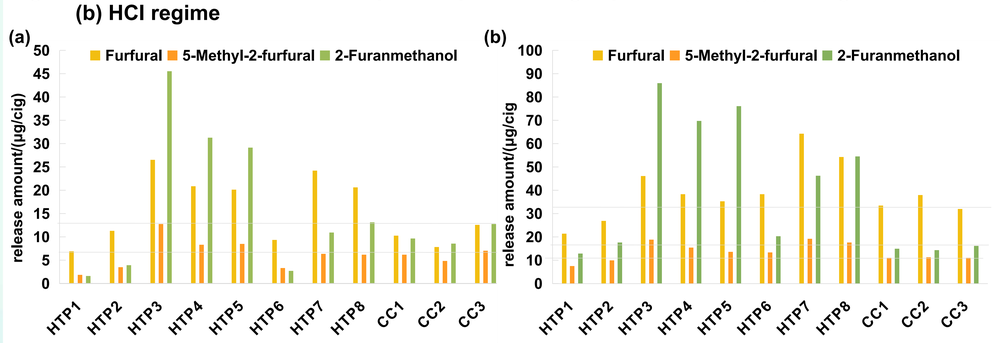


Fig.4 The concentrations of furfural, 5-methyl-2-furfural and 2-furanmethanol detetected in the aerosol of HTPs and CCs under (a) ISO regime and (b) HCI regime

RESULTS

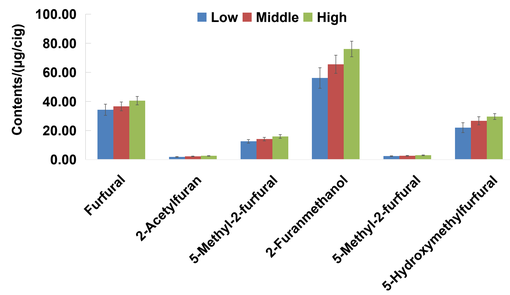


Fig5. Influences of different heating temperature on the release efficiencies of six furans

CONCLUSIONS

Method validation: r^2: 0.9989~0.9999;
LODs: 0.01~0.12 μg/cig, LOQs: 0.02~0.39 μg/cig;
Recoveries: 95.33%~108.66%, RSDs: 1.33% to 8.51%.
Distribution:
Gas phase and particle phase: Furfural, 5-methylfurfural, 2-acetylfuran and 2-furanmethanol;
the proportions in the gas phase under HCI regime was higher than that under ISO regime;
Particle phase: 5-methyl-2-furanmethanol and 5-hydroxymethylfurfural
Release amounts:The release amounts of furanmethanol, furfural, and 5-methylfurfural in aerosol of some HTPs were higher than those of CCs with a ratio between 1.73 to 5.65.
Temperature: Under low-temperature heating conditions, the release amounts of six furans in the aerosol of HTPs increased with heating temperature.

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