Temperature Logging of Next Generation Heat Not Burn Aerosol

TINDALL.I.F.; COLE A.
Cerulean, Milton Keynes, UK

BACKGROUND

The widespread use of heat not burn products (HNB) is in its infancy and consumer acceptance will involve comparison with existing conventional cigarettes. User perception may be influenced by aerosol delivery temperature and how this is modified by different puffing parameters. The objective of this study was to establish how aerosol temperature varies as a consequence of changing puffing parameters for three commercially available HNB products.

METHOD

The potential change in aerosol temperature was examined using a Cerulean CETI8 vaping machine and a modified CFH with a K type thermocouple added to the holder so that the aerosol stream of the product under test directly impinged on the sensor. Temperature was logged at the valve opening signal of the puff engine at the rate of 4 Hz (250 ms) using a Pico logger.

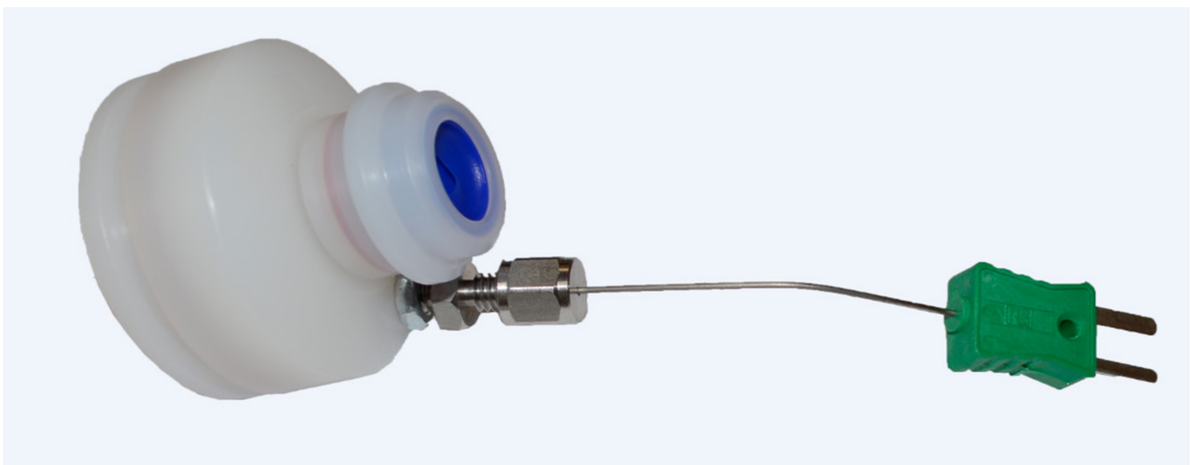

Fig1. Cambridge Filter Holder with thermocouple

Three products were tested, an IQOS Heets stick, a IGLO Neostick regular and a PloomTECH regular. Holders were fully recharged for each test run.

Experimental protocols were based upon changing key parameters such as puff duration, puff interval and puff volume, see table below.

TEST #	PUFF DURATION	PUFF VOLUME	PUFF INTERVAL	PUFF SHAPE
1 (ISO)	2 s	35 ml	60 s	ISO bell
2	3 s	35 ml	30 s	Square
3 (CRM81)	3 s	55 ml	30 s	Square
4	3 s	55 ml	60 s	Square
5	2 s	55 ml	30 s	Square
6	3 s	75 ml	30 s	Square
7	3 s	55 ml	15 s	Square
8	4 s	55 ml	30 s	Square

Fig2. Table of test

RESULTS

As expected for the longest duration experiment the IGLO and IQOS devices both produced aerosol that reduced in temperature once the battery life was exceeded (figure 3)

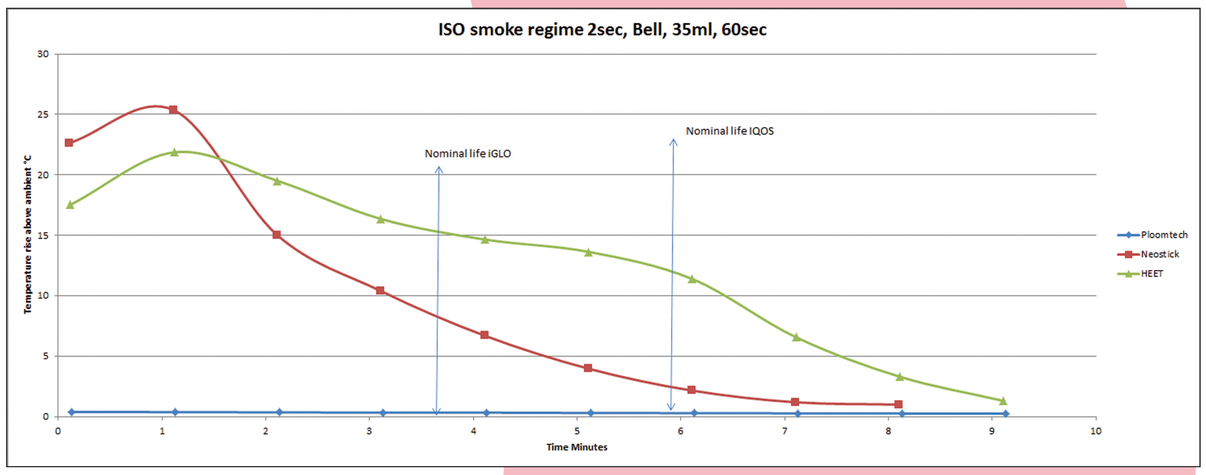

Fig 3. Temperature chart of various products with ISO bell, 35ml, 60s, 2 s duration

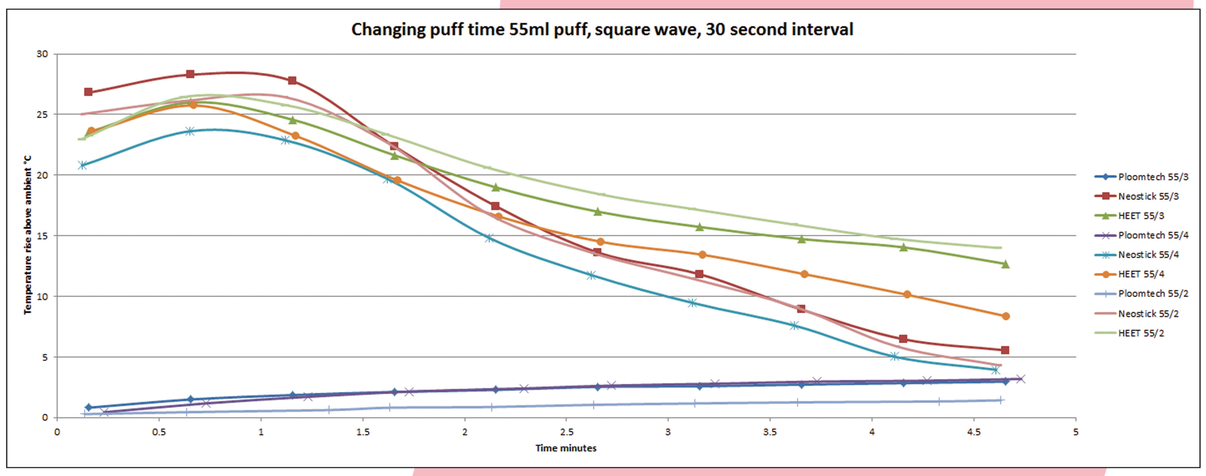

Fig 4. Temperature chart of various products with square wave, 55ml, 30s, various durations

The CORESTA CRM81 method of 55ml puffs, at 30 second interval and 3 second duration is shown (figure 4). It is of note that the PloomTECH devices generally had hotter aerosol the more puffs were taken whilst both the IQOS and IGLO reached a maximum aerosol temperature after 2 puffs and then the temperature began to decline as more puffs were taken.

Changing the puff duration had little impact on the temperature profile of aerosol on the IGLO, PloomTECH and IQOS devices. Increasing the puff volume had no effect on the aerosol temperature of the HEETS devices and a much reduced aerosol temperature for the lower volume puff for the Neosticks. The PloomTECH was again not noticeably affected.

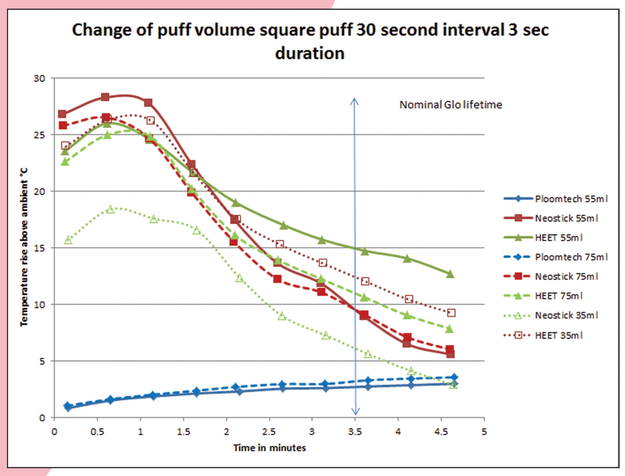

Fig 5. Temperature over time chart of various products with square wave, varying volume, 30s, 3s duration

For similar puff numbers under the different conditions deployed, the IGLO and IQOS produce aerosols of similar temperatures irrespective of the puffing conditions (excluding 35/2/60 where the device limit is engaged at 3.5 and 6 minutes respectively). The 35ml square puff consistently produced a lower temperature aerosol for both devices. A range of temperatures for each puff of the order of 5°C can be seen. Examining more closely, there was not a clearly identifiable regime that created a maximum in aerosol temperature although the shorter puff interval did seem to result in higher aerosol temperatures for the 4th puff onwards.
In contrast the PloomTECH saw consistently higher aerosol temperatures for the more intense regimes in particular the shorter puff interval regime.

CONCLUSIONS

Aerosol temperature for IQOS and IGLO seems independent of the "intensity" of the puffing parameters chosen. It has been found that after the initial two puffs a shorter puff interval yields marginally higher aerosol temperatures. The PloomTECH aerosol temperature increases for more "intense" regimes with shortening puff intervals having the most significant impact.

*IQOS, Heets, iGLO, Neostick and PoomTECH are all registered trade marks.

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