



Investigating re-use of e-cigarette atomisers (coil/wick subassembly) in open systems

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Declarations

- Nerudia works with a variety of pharmaceutical, tobacco, and electronic cigarette companies globally
- The work presented herein was undertaken at the expense of Nerudia without input from any of our clients

Agenda

Background of study

Purpose and study aims

Study design

Results and discussion

Conclusions

Implications and further work

Background

Open e-cig systems: refillable,
replaceable atomizers



Purpose/aims

- A preliminary study to help focus future research
- Explore flavour profile changes and emissions through atomiser life
 - Manufacturers instruction of when to change atomizer

Study design

- One type of device
 - Bottom, dual coil with silica wick material
- Three formulations
 - Burley tobacco
 - Virginia tobacco
 - Unflavoured

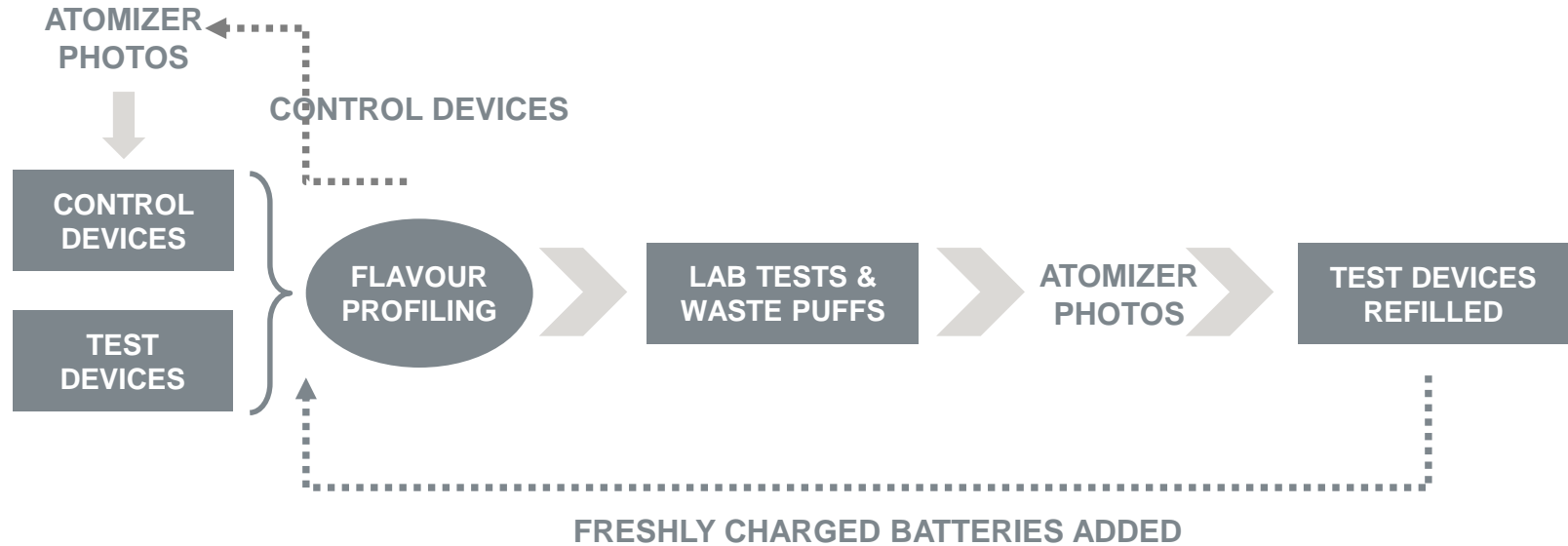


Study design

Laboratory tests

- Atomizer photos
 - Photo of atomizers at start and prior to refilling
 - Aerosol regime:
 - 5 second puff duration
 - 55 ml puff volume
 - 30 second interval
 - Square wave
- 4 seconds
- Farsalinos et al Int. J. Environ. Res. Public Health 2013, 10(6), 2500-2514
- 4.57 seconds
- Dautzenberg et al Int. J Addict Res Ther 6:229

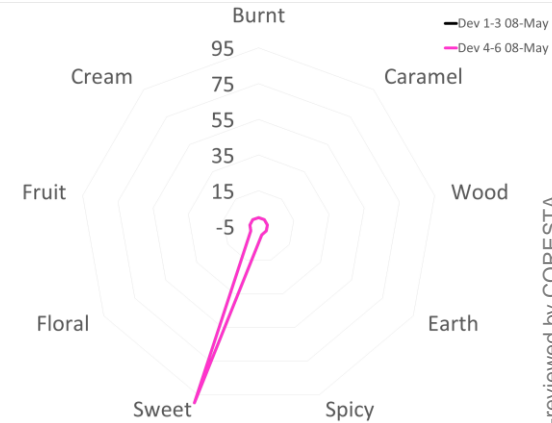
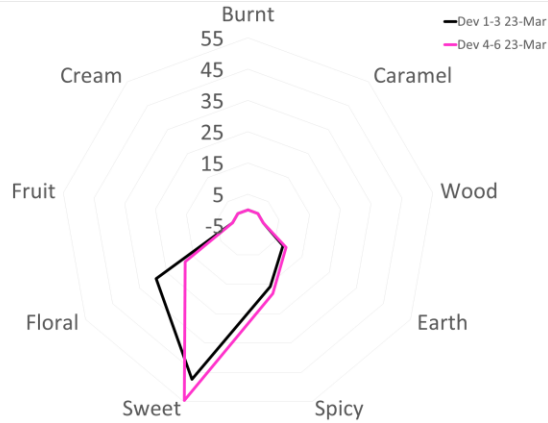
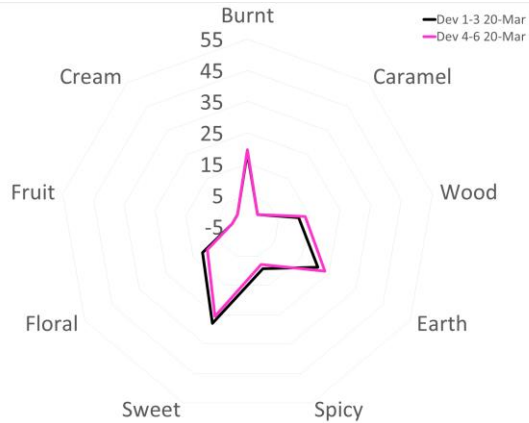
Study design



Flavour profiling

- Panel are trained to taste e-cigarette products:
 - Familiarisation with appropriate flavour wheels
 - Top, mid, base notes to describe how flavour develops
- Specifically for this study:
 - Inclusion of identification of “burnt” tastes

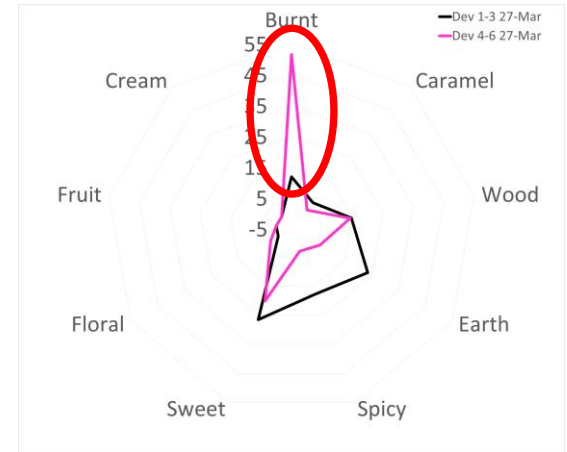
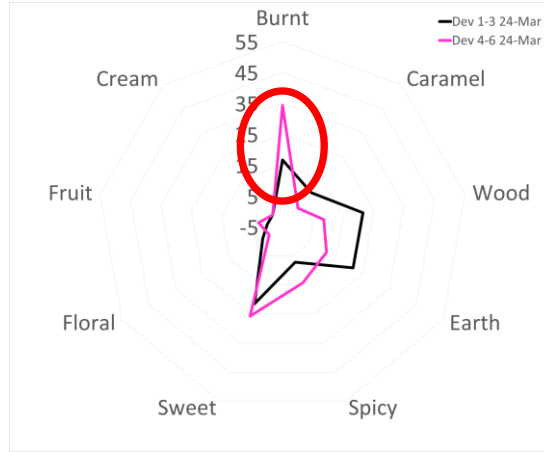
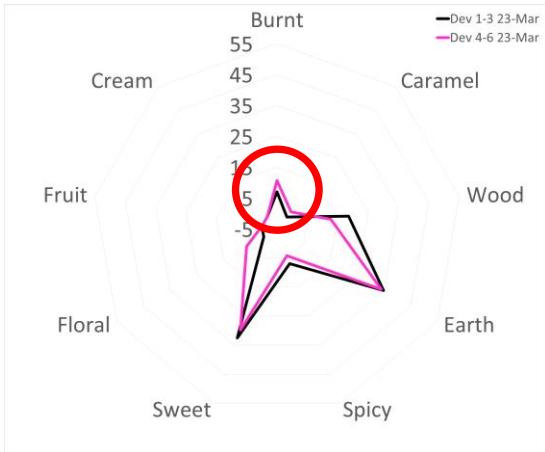
Flavour profiling



- Control devices, always on first fill
- Test devices, taken through laboratory tests and waste puffs

Flavour profiling

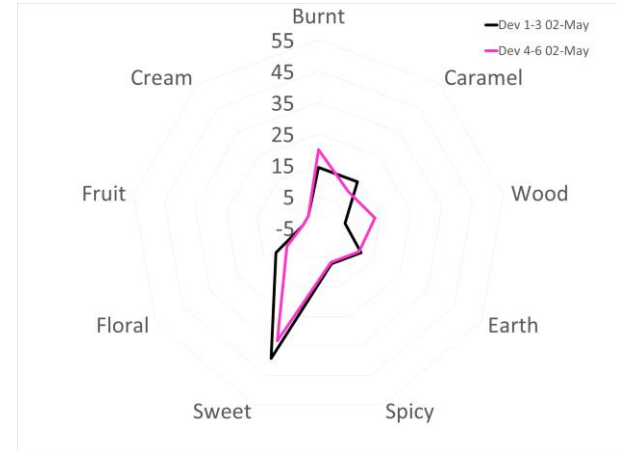
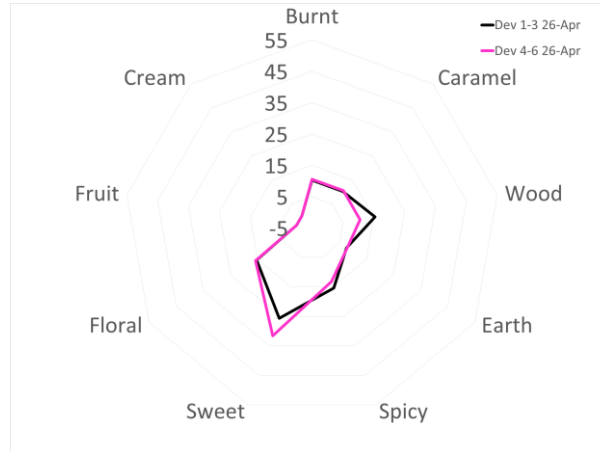
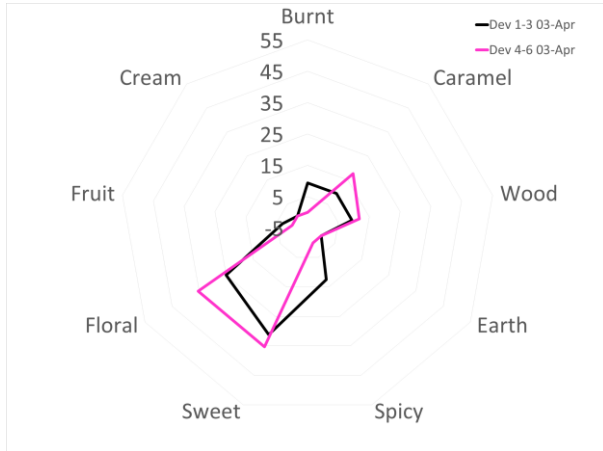
Burley, fills 4 - 6



- Control devices, always on first fill
- Test devices, taken through laboratory tests and waste puffs

Flavour profiling

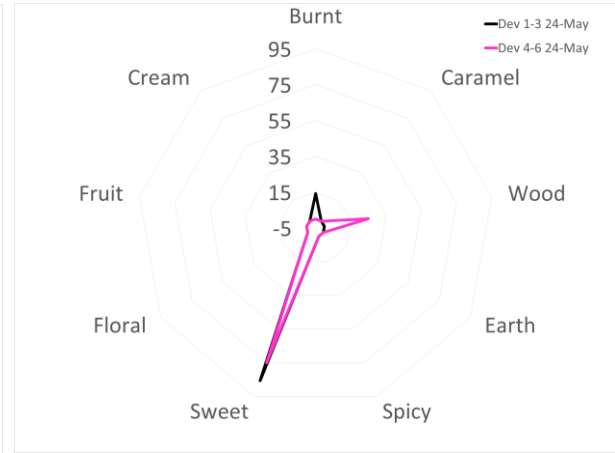
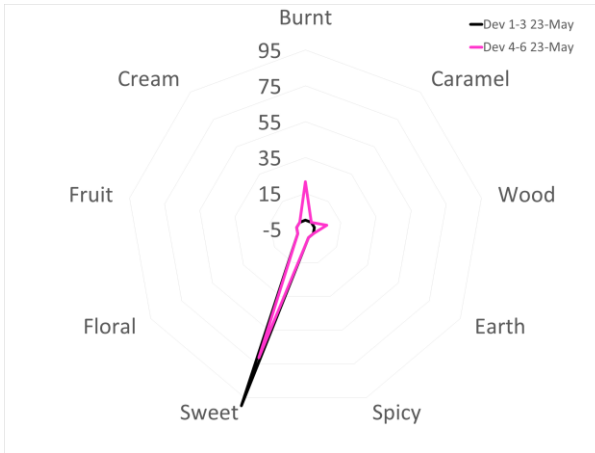
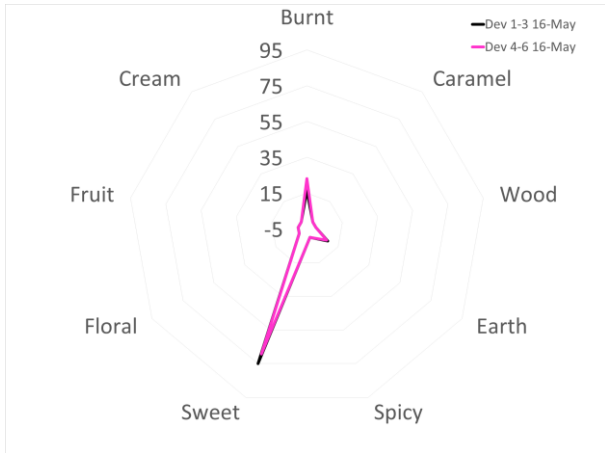
Virginia, fills 6 - 8



- Control devices, always on first fill
- Test devices, taken through laboratory tests and waste puffs

Flavour profiling

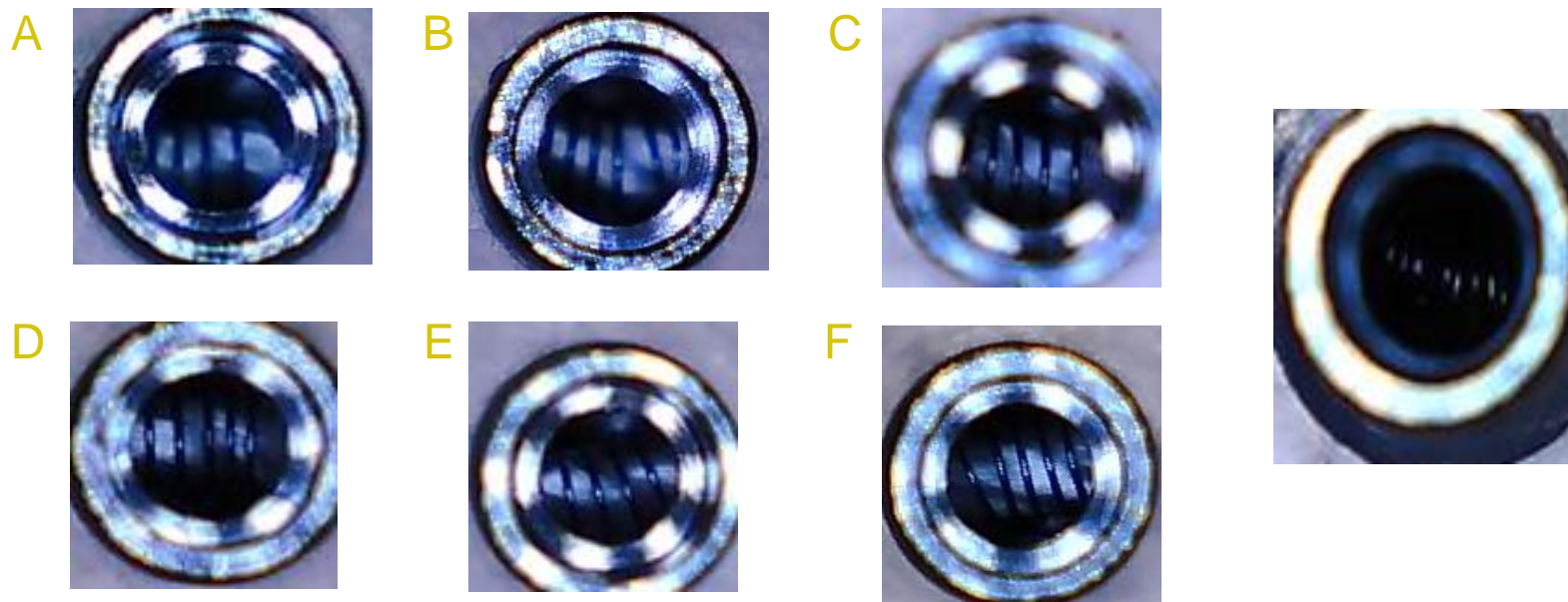
Unflavoured, fills 7 - 9



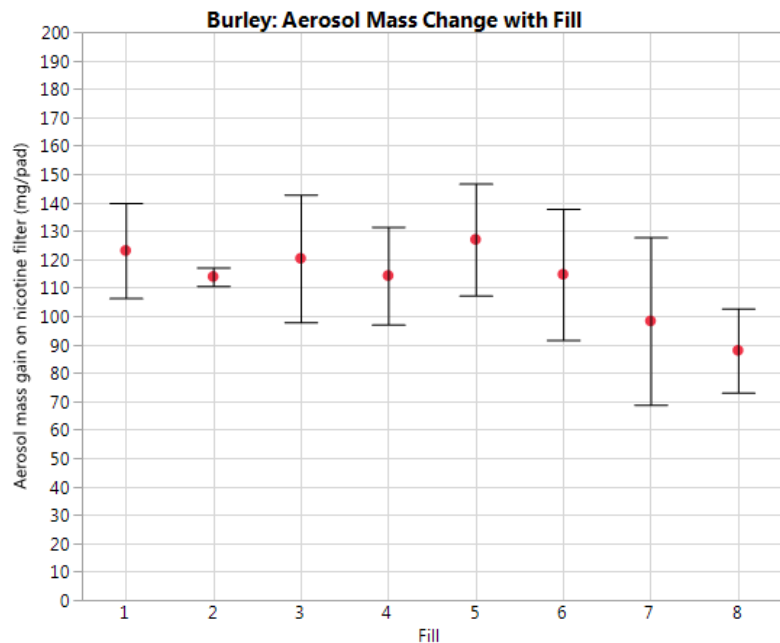
- Control devices, always on first fill
- Test devices, taken through laboratory tests and waste puffs

Atomizer photos

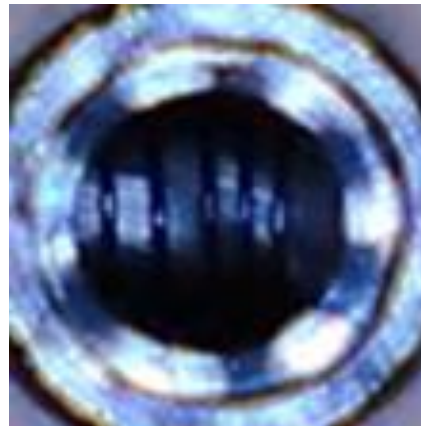
Burley at start of study – individual device atomizers shown:



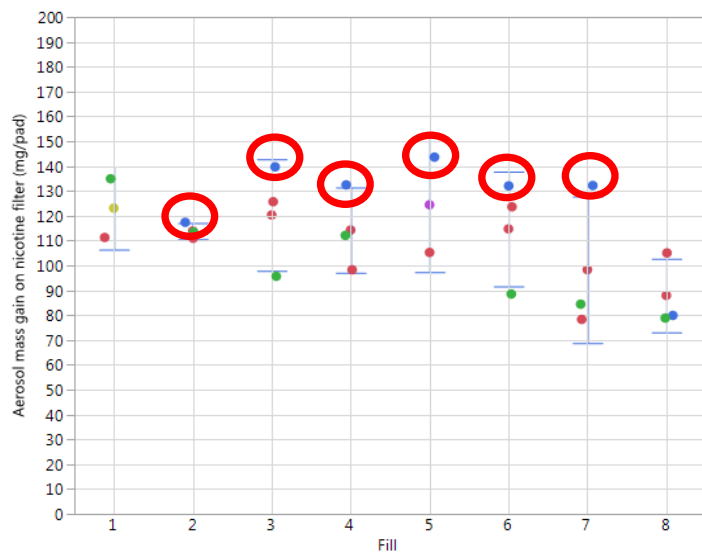
Aerosol mass



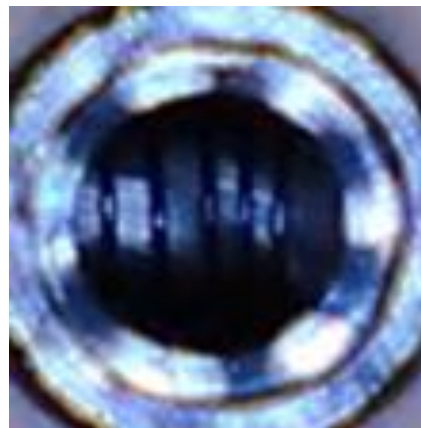
- Variability
- Fill 5 onwards
- Device 'D'



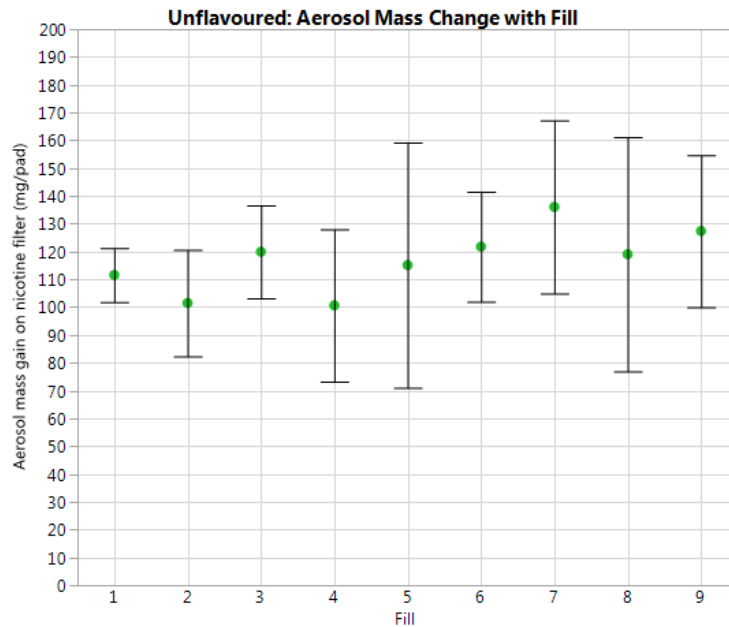
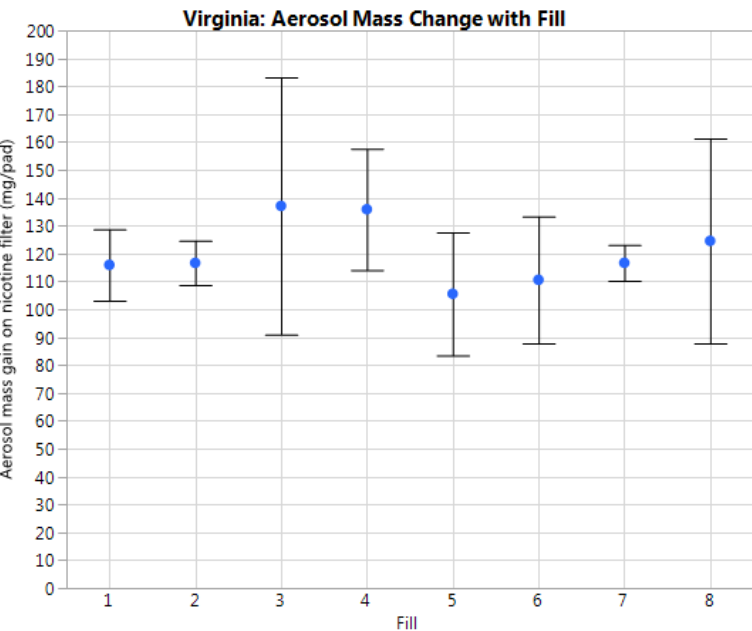
Aerosol mass



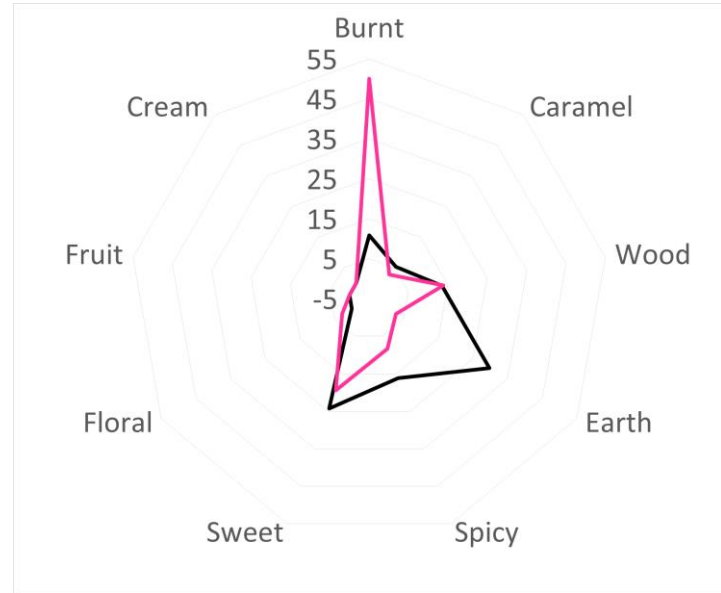
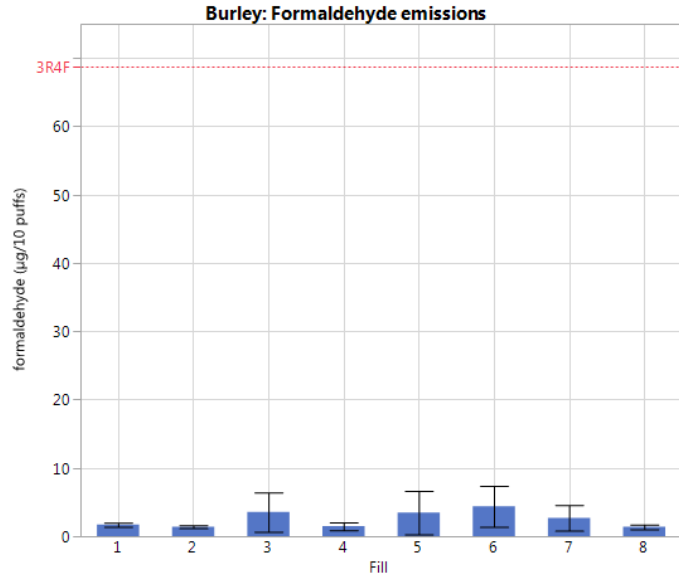
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Aerosol mass

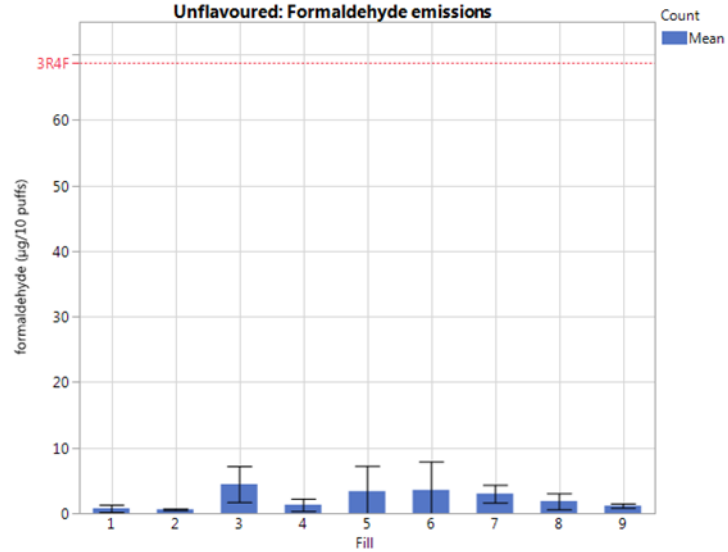
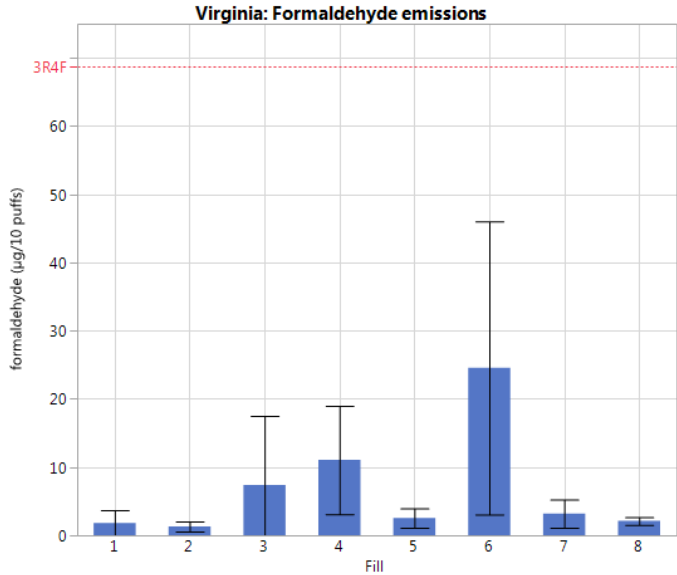


Formaldehyde emissions



Reference cigarette: 3R4F. Schaller et al, Regulatory Toxicology & Pharmacology 81 (2016) S27-S47

Formaldehyde emissions



Reference cigarette: 3R4F. Schaller et al, Regulatory Toxicology & Pharmacology 81 (2016) S27-S47

Other emissions

Formulation	Mean acetaldehyde ($\mu\text{g}/10$ puffs)	Mean acrolein ($\mu\text{g}/10$ puffs)	Mean propionaldehyde ($\mu\text{g}/10$ puffs)
Burley	1.0	0.5	0.1
Virginia	2.3	1.5	1.5
Unflavoured	1.1	-	0.9
Reference cigarette	1555	154	125

Reference cigarette: 3R4F. Schaller et al, Regulatory Toxicology & Pharmacology 81 (2016) S27-S47

Conclusions

- Coil/wick turns black
 - Not linked to change of flavour or emissions
- Some flavour formulations lead to shorter life span of atomizer
 - Burley tasted burnt and unpleasant after fill 5
- Change in flavour profile was not linked to increasing carbonyls
- Device variability is large
 - Coil variability

Implications

- Inter and intra device variability:
 - EU TPD2 requires that emissions are reported
 - CEN developing standards
- Important that variability of devices is accounted for
 - Requirement to test multiple devices
 - Requirement to test at various stages of coil lifespan
- U.S. PMTA requires reporting HPHCs
 - Current guidance takes into account product variability (no. of repeats/batches)
 - Includes coil failure testing, does not detail what this would entail

Further work

- Repeat elements of the study with a more modern e cigarette atomiser design:
 - Cotton wick, vertical coil
 - Statistical analyses:
 - Increase numbers/replicates
 - Improve flavour profiling process
- Understand difference in emissions when flavour profile changes

Any questions?

Thank you.

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