

Juul Labs Science

Formation of Selected HPHCs in Non-Commercial JUUL2 Devices as Function of Temperature

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Background

- A major factor influencing formation of Harmful and Potentially Harmful Chemicals (HPHC) is temperature
 - When an e-cigarette is heated, the e-liquid undergoes vaporization, creating an aerosol that is inhaled by the user
 - The temperature at which this vaporization occurs can impact the composition of the aerosol and the formation of HPHCs
- Temperature regulated devices play a crucial role in limiting the formation of HPHCs
- Importance of temperature regulation
 - Reduces the risk of overheating
 - Reduces the thermal degradation of e-liquid which leads to formation of higher levels of HPHCs
 - Ensures a more consistent and controlled aerosolization process

Goals

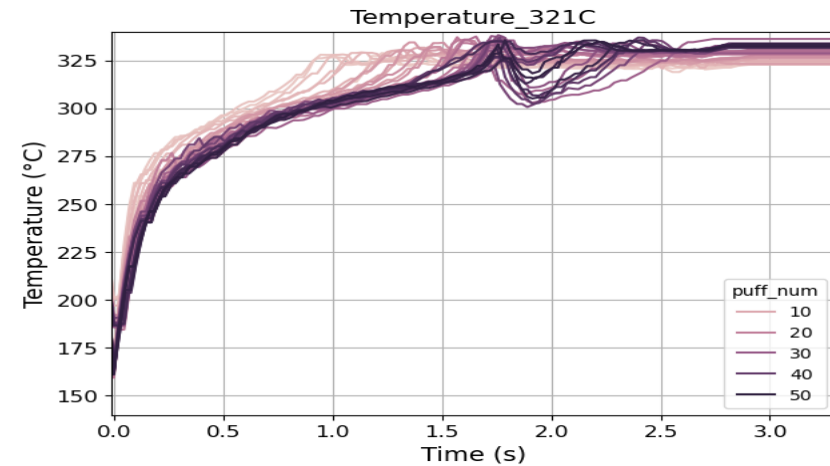
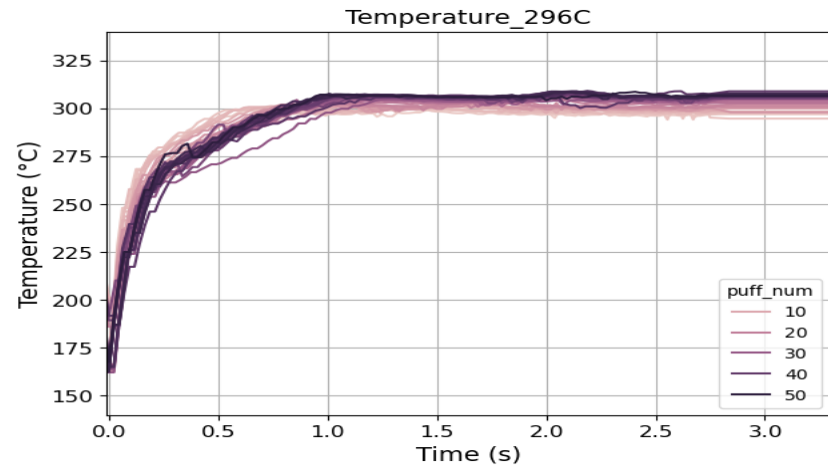
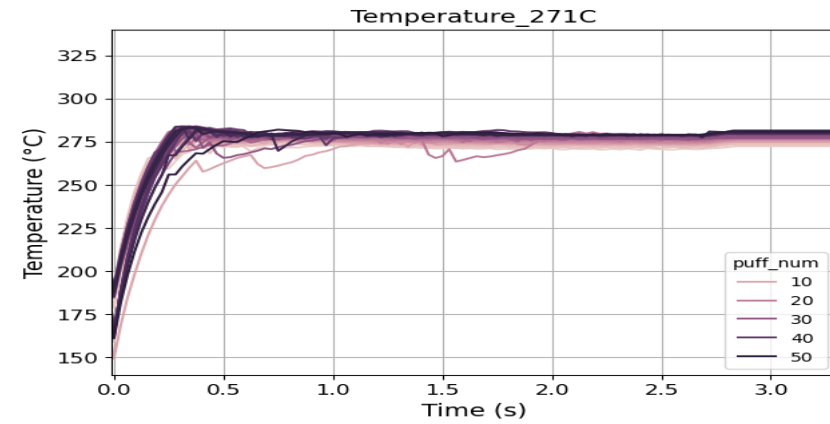
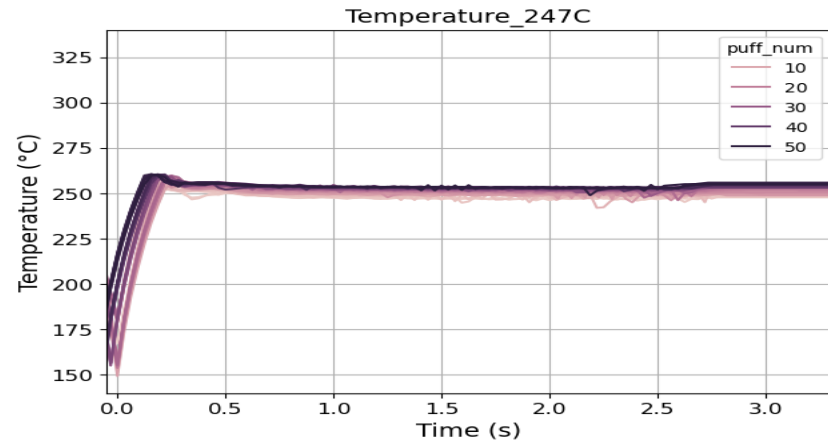
Assess the performance of non-commercial JUUL2 devices in terms of:

- Device temperature regulation
- Impact of temperature regulation on limiting the formation of Harmful and Potentially Harmful Constituents (HPHCs)
- Controlled aerosolization process and delivery

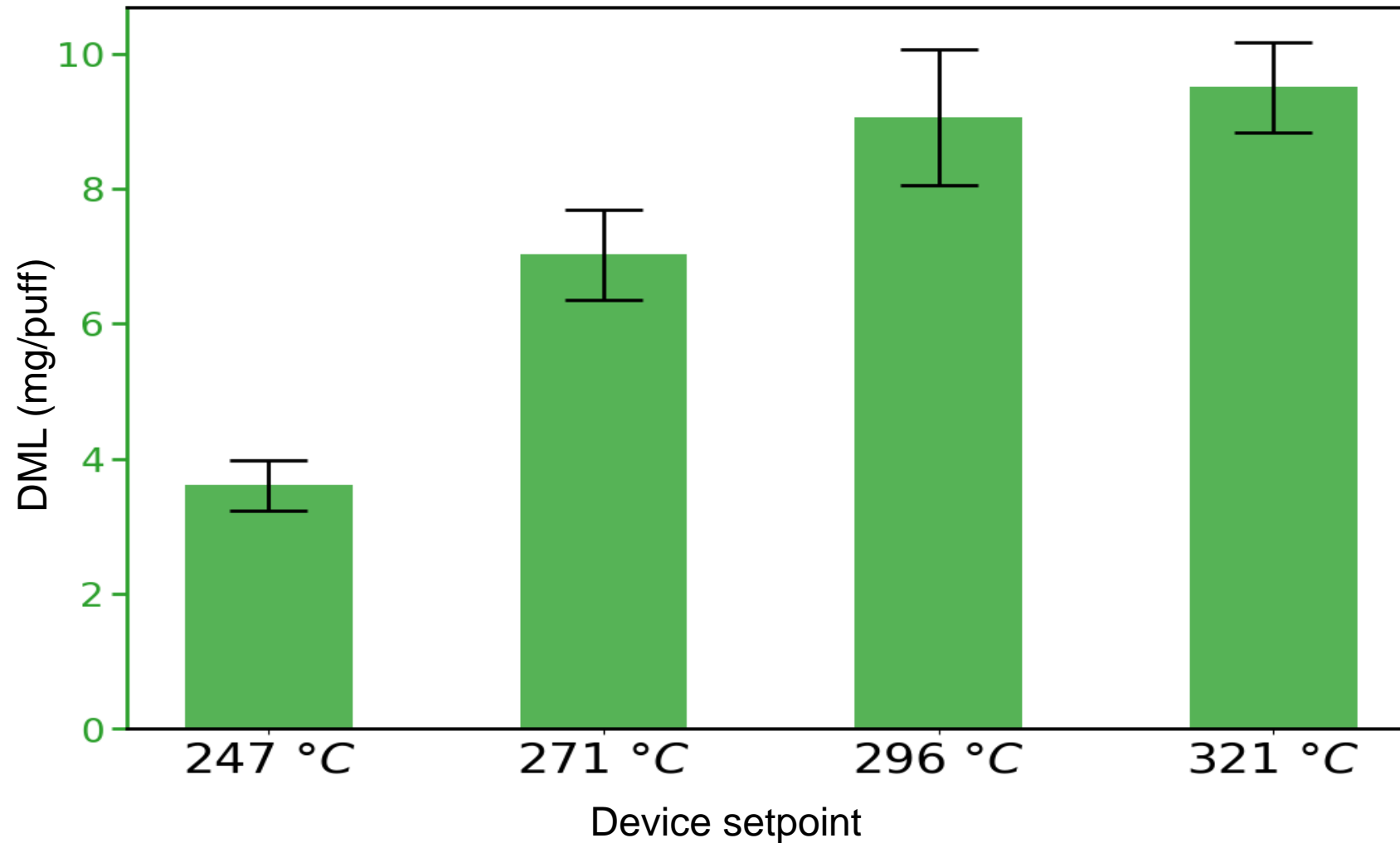
Experimental Design

- JUUL2 devices with temperature setpoints:
 - **247°C, 271°C, 296°C, 321°C**
 - E-liquid composition: PG:VG (50:50 by weight), 4% added nicotine
 - Aerosol collection:
 - Puff volume: 55 mL
 - Duration: 3 seconds
 - Interval: 30 seconds
 - Puff Profile: Square
 - Puff segment: 50 (80 puffs for glycidol)
 - Device Orientation: Vertical 45 degrees
 - Condensates collected on CFP's/impingers per test method
 - 3 replicates per test
- Continuous device temperature monitoring as measurement of coil resistance changes
 - PG, VG , Nicotine measurements by GC-FID
 - Carbonyl measurements by LC-MS
 - Glycidol measurements by GC-MS

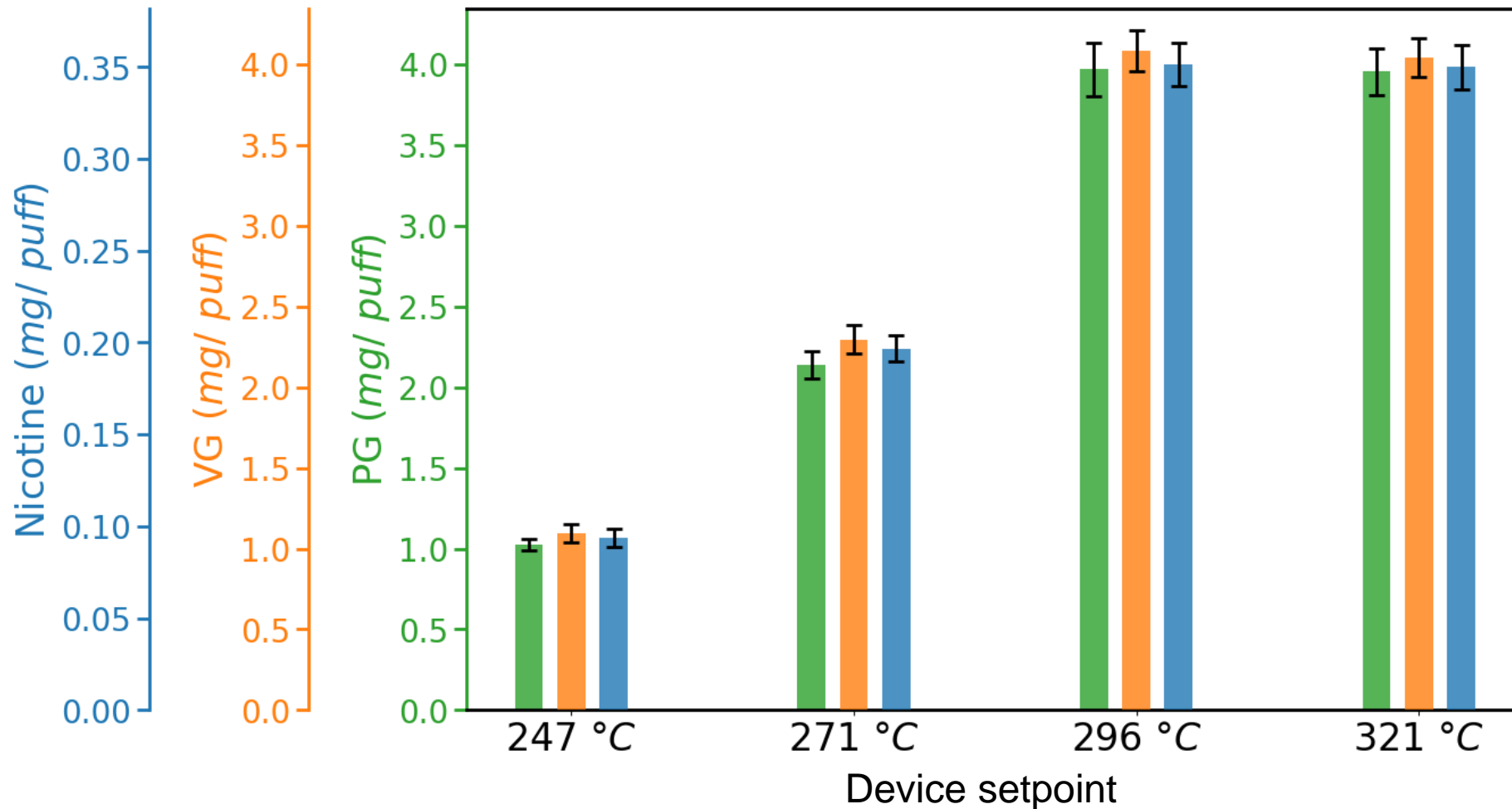
Device Temperature Monitoring During Aerosol Collection



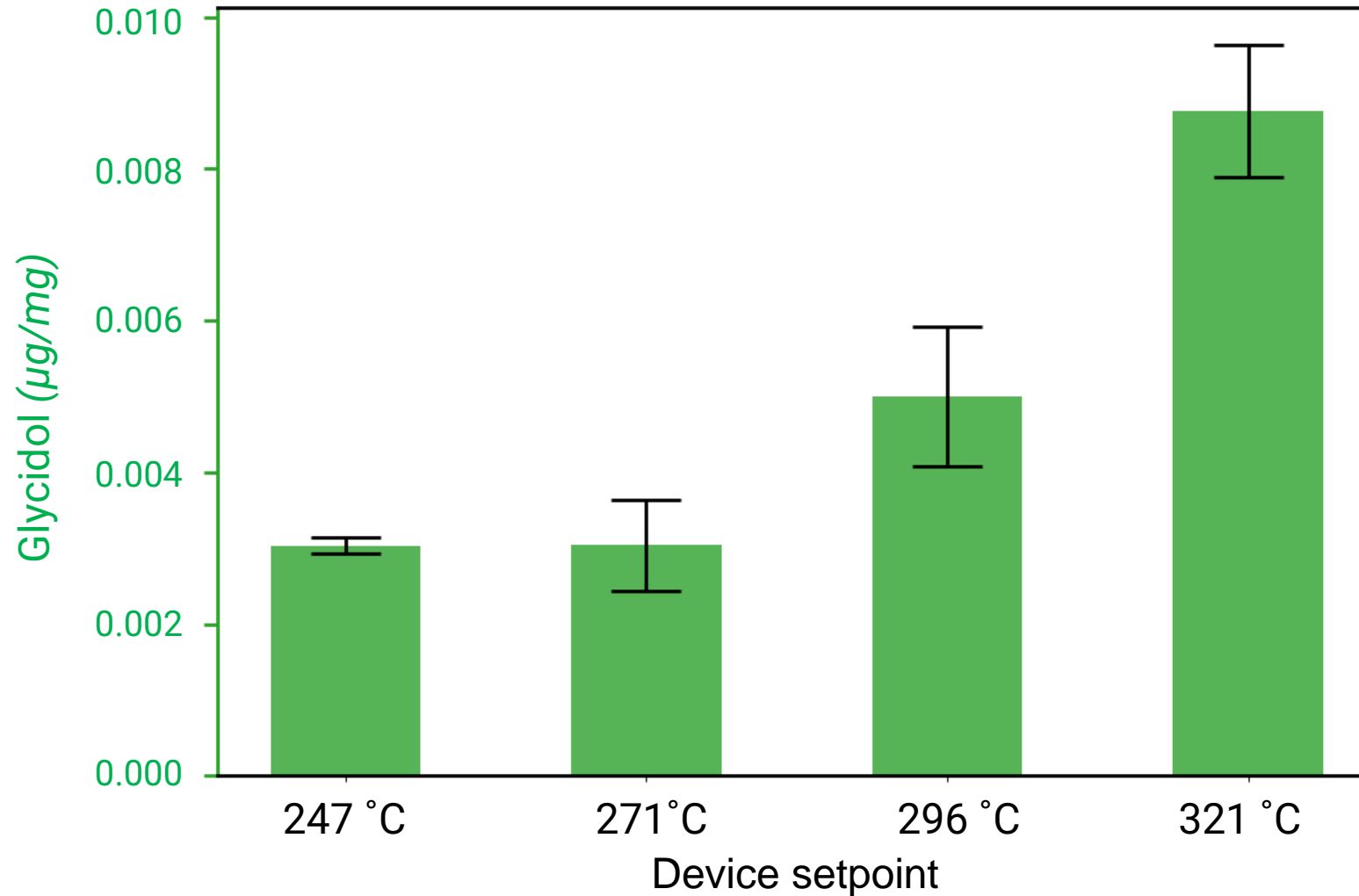
Device Mass Loss (DML) (mg/puff)



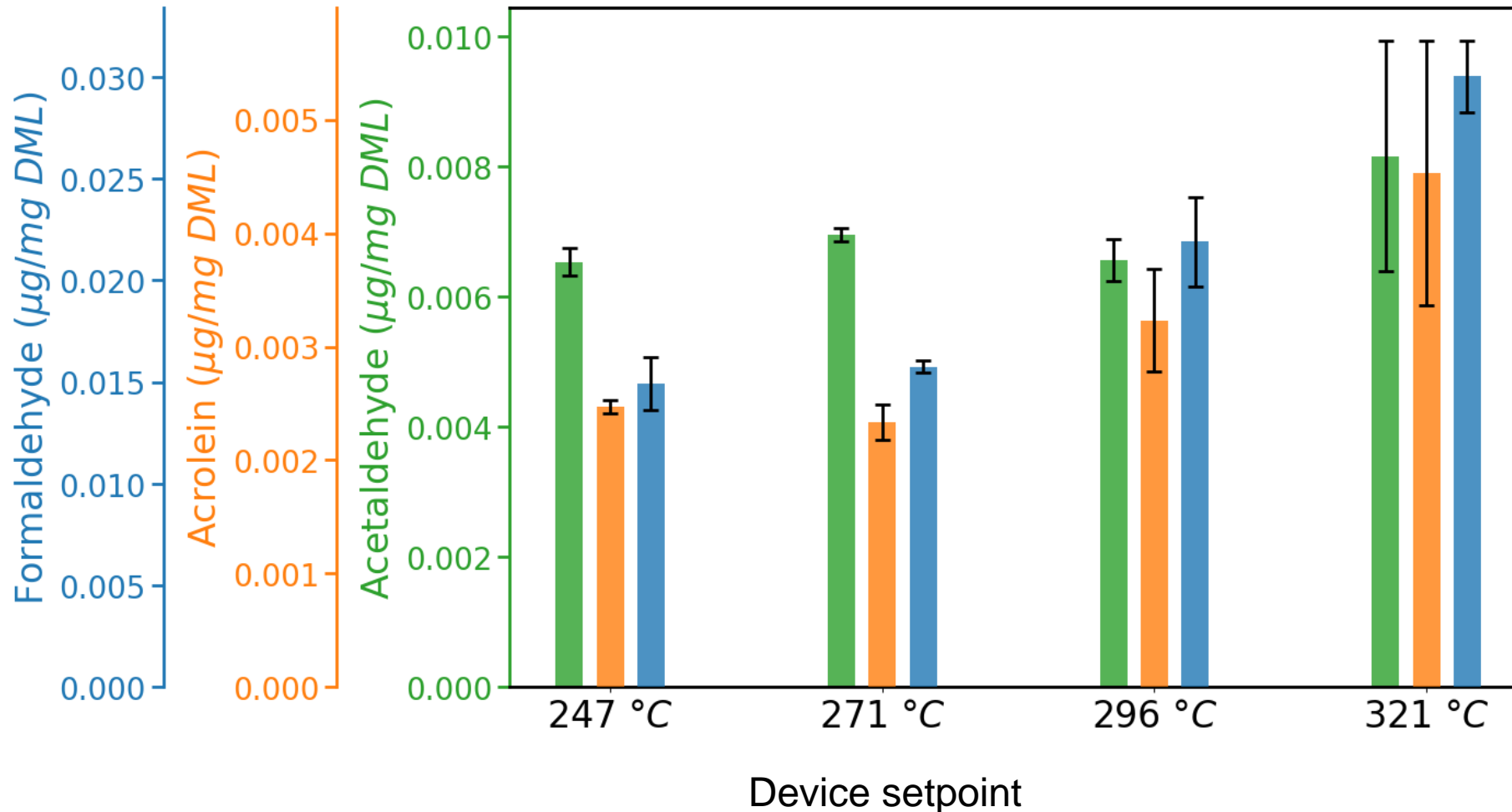
Nicotine, VG and PG in Condensate (mg/puff) vs. Temperature



Glycidol Concentration in Condensate ($\mu\text{g}/\text{mg}$) vs. Temperature

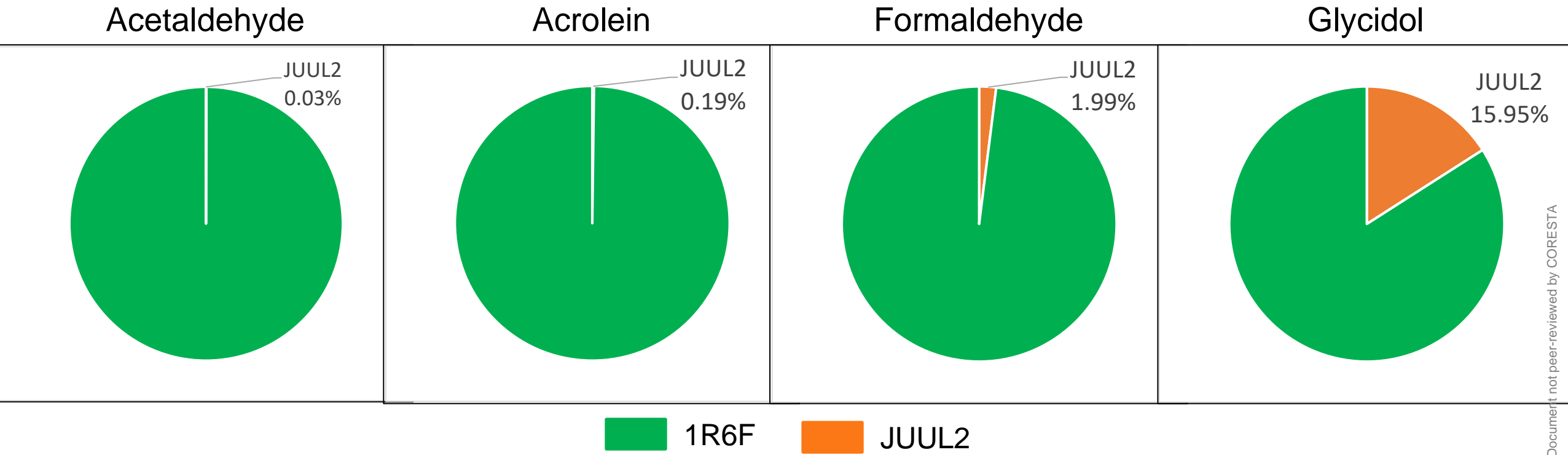


Carbonyl Concentration in Condensate ($\mu\text{g}/\text{mg}$) vs. Temperature



Selected HPHC Emissions for JUUL2 vs. 1R6F Reference Cigarette

- JUUL2 setpoint: 321°C
- Nicotine normalized: mg analyte per mg nicotine



Conclusions

- Temperature control of non-commercial JUUL2 devices was studied at various temperature setpoints
 - JUUL2 devices are equipped with precise temperature control mechanisms to effectively avoid temperature overshooting.
 - DML increases with temperature, exhibiting minimal variability
 - JUUL2 devices ensure steady temperature and delivery, as evidenced by DML and the primary constituents' distribution
 - HPHC concentrations remain constant up to the normal setpoint of JUUL2 and increase at higher temperatures, but remain consistently low indicating the device's proficiency in maintaining uniform delivery.
 - At the highest temperature studied (exceeding the normal operating range by more than 30 °C), the device's HPHCs output is significantly lower compared to a combusted cigarette.
- **JUUL2's temperature control enables a more stable and controlled aerosolization process mitigating the formation of HPHCs**

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- Venessa Tse – Research Associate, Formulation Chemistry
- Valerie Schwartz – Senior Technical Project Manager, Regulatory Science

Thank you for your attention

Any Questions?