Introduction

Electronic cigarettes (e-Cigs) are battery operated devices that vaporize a solution of inert compounds, nicotine and food flavorings. When e-Cigs were first introduced into the American market in the early 2000s they designed look and operate similarly to tobacco cigarettes (TC). Lately, e-Cigs have evolved drastically towards high output, long lasting devices with many design innovations coming from vaping enthusiasts not manufacturers.

Results

Figure 1

3rd gen e-Cig, aka cig-a-like (top)
2nd generation e-Cig tank style (above)
1st generation e-Cig (Figure 2b) was used to generate puffs at maximum and minimum voltage settings. The puff was 10 puffs were administered at each power setting with 30 sec between puffs. Puffs were labeled (Lab Power Supply) and 3rd generation e-cigs. This also indicates greater size distribution of vaping aerosol produced with the e-cig battery and cigarette smoke.

Mass Distributions

Fig. 7. Cumulative Mass Fraction of vaping aerosol produced with lab power supply. As power increases, the mass of e-Cig vapor produced at several powers increases (figs 5 & 8)

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Conclusions

In the study we demonstrated that the mass of e-juice vaporized increases dramatically with increased vaping power. We demonstrated that aerosol concentration and respirable fraction increase with vaping power. Since produced more fine aerosol which is technically a greater fraction of the e-Cig vapor is respirable at high power compared to low power and cigarette aerosol has a smaller diameter at higher power (figs 7 & 10). Please send comments, criticisms and suggestions about this SmartPoster® format to Evan-Floyd@ouhsc.edu or Jun- Wang@ouhsc.edu

Methods and Materials

E-juice vaporization was measured at 9 powers spanning 3.0 - 11.9 Watts (3.0 - 6.0 V) using a lab power supply in place of the battery. Three trials were conducted with 5 or 10 puffs were administered at each power setting with 30 sec between puffs. Puffs were 60 mL (20 mL/vac, 3 sec) (Fig 2a).

Results Summary

• Voltage delivered by e-cig battery was linear, but differed substantially from the labeled voltage (figure 4, left)
• Voltage measured = 110V measured: 3.28, R²: 0.9999
• 86 times more e-juice was vaporized at 11.9 W than at 3.0 W (2X voltage = 4X power = 86X e-juice)
• Nano-sized aerosols are more abundant at lower voltages (figs 5 & 8)
• Particle Size Distributions are right shifted (larger) as vaping power increases (figs 5 & 8)

Size Distributions

Fig. 5. Size Distribution of vaping aerosol produced with the e-cig battery and cigarette smoke. This lower power setting clearly produced more nano-sized aerosol while higher power setting produced a greater fraction of the e-Cig vapor is respirable at high power compared to low power and cigarette smoke. Median diameter is 1.4 µm for high power vapor compared to 11.1 µm and 9.7 µm for cigarette aerosol. Fraction of the e-Cig vapor is respirable at high power compared to low power and cigarette smoke.

Cumulative Mass Distributions

Fig. 8. Size Distribution of vaping aerosol produced with the e-cig battery and cigarette smoke. The lower power setting clearly produced more nano-sized aerosol while higher power setting produced a greater fraction of the e-Cig vapor is respirable at high power compared to low power and cigarette smoke. Median diameter is 1.4 µm for high power vapor compared to 11.1 µm and 9.7 µm for cigarette aerosol. Fraction of the e-Cig vapor is respirable at high power compared to low power and cigarette smoke.

Fig. 10. Cumulative Mass Fraction of vaping aerosol produced with lab power supply. As power increases, the mass of e-Cig vapor produced at several powers increases (figs 5 & 8)

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