

Drug Delivery Performance and Fugitive Emission Comparison of Two Commercially Available Nebulizer Systems

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Background

- Delivery of inhaled medications by nebulizer for the treatment of respiratory disease is widespread.
- Important factors to consider in a delivery system are the amount and consistency of drug delivered to the lungs, as well as the amount of drug/droplets that are emitted to the local environment (Fugitive Emissions).



**AEROECLIPSE* II
BAN* Nebulizer**



**Aerogen+ Ultra
Nebulizer**

Methodology

- Two nebulizers (**AEROECLIPSE* II BAN*** Nebulizer and Aerogen[†] Ultra) were evaluated with 2.5mg/3.0mL fill of salbutamol and connected to a breathing simulator mimicking adult tidal volume (500-mL) with inhalation/exhalation (I/E) ratios of 1:1, 1:2 and 1:3.
- Emitted aerosol was captured by filter at 1-minute intervals until sputtering to determine total mass (TM_{sal}).
- The percentage of drug mass lost to the environment (EL_{sal}) was determined by combining the TM_{sal} recovered from the inhalation filters along with the residual mass recovered from the nebulizer and subtracting that from the initial 2.5mg salbutamol placed in the nebulizer.
- Salbutamol assay was undertaken by HPLC. Fine droplet mass (FDM_{sal}, µg) was determined by laser diffractometry as the product of TM_{sal} and fine droplet fraction (%<4.7µm).

Results

- **AEROECLIPSE II BAN*** Nebulizer consistently produced more fine droplet mass of salbutamol (FDM_{sal}) and the percentage of drug mass lost to the environment (EL_{sal}) was reduced compared to the Aerogen[†] Ultra.

Table 1. Fine droplet mass of salbutamol (FDM_{sal}) and percentage of drug mass lost to the environment (EL_{sal}) at extended I:E ratios.

I:E Ratio	BAN* Nebulizer		Aerogen [†] Ultra	
	FDM _{sal} (µg)	EL _{sal} (%)	FDM _{sal} (µg)	EL _{sal} (%)
1:1	803 ± 76	4.1 ± 1.0	503 ± 31	23.8 ± 1.6
1:2	715 ± 82	5.2 ± 2.7	316 ± 12	34.0 ± 2.8
1:3	695 ± 52	4.2 ± 1.3	234 ± 13	37.8 ± 3.4

Conclusion

- Higher and more consistent delivery was achieved by the **BAN*** Nebulizer as well as lower fugitive emissions.
- Clinicians should be aware of the ability to get increased amounts of medication to the lungs while maintaining a safer work environment for staff with breath actuated delivery.