

Efficiency of a Nebulizer Filter Kit to Prevent Environmental Contamination During Nebulizer Therapy

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Background

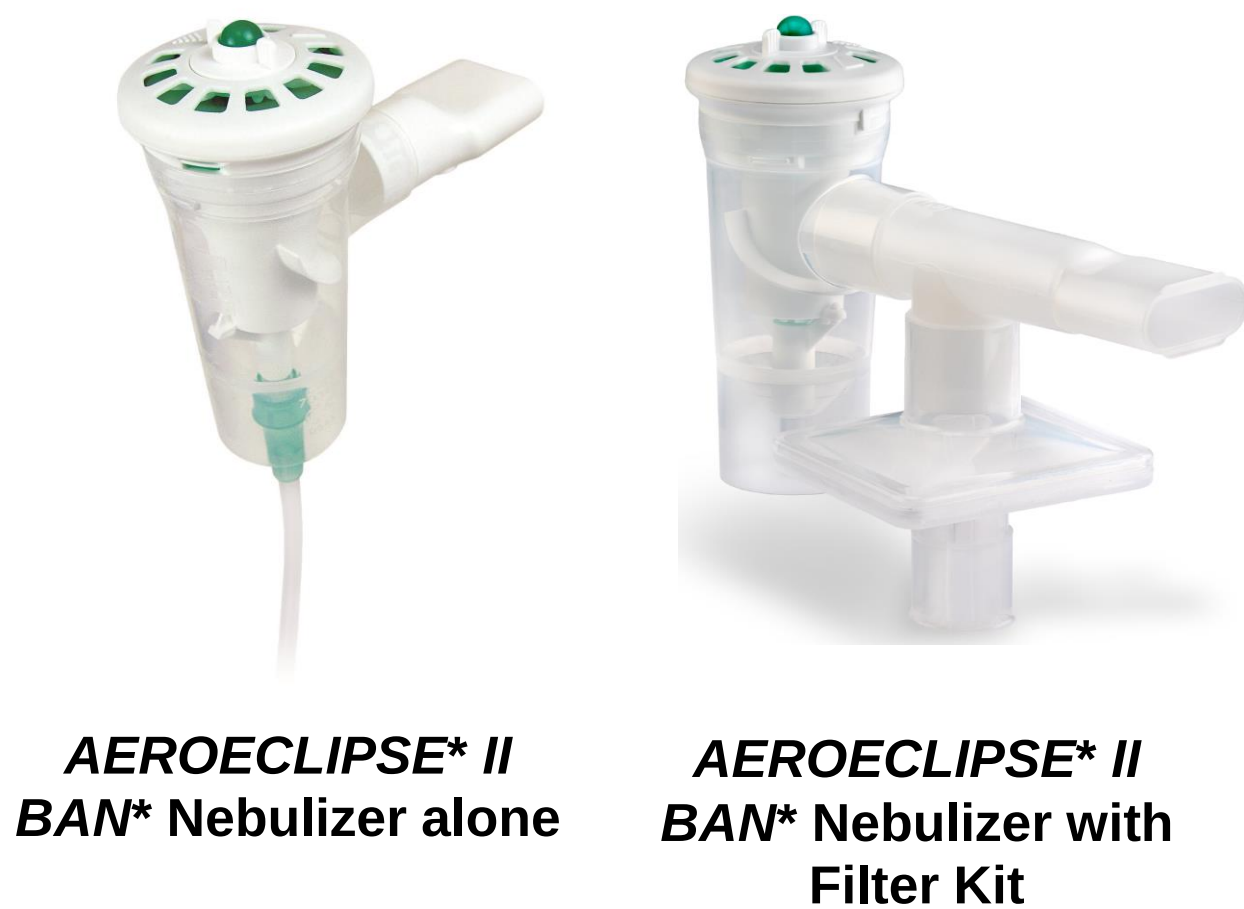
- The SARS-CoV-2 (COVID-19) pandemic has highlighted the need to improve safety for frontline workers and avoid environmental contamination from aerosols.
- To aid in this, a breath actuated nebulizer is available with a filter set to capture any exhaled aerosol.

Objective

- To determine the aerosol amounts emitted to the environment during nebulizer therapy with the **AEROECLIPSE* II BAN*** Nebulizer and to test the efficiency of the nebulizer filter system.

Methods

- The **BAN*** Nebulizer was operated at 50 psig initially without its optional filter kit ($n = 5$). Five nebulizers with the filter kit were also repeatedly tested, 2 hours apart, up to five times. Each device was evaluated with 2.5mg/3.0mL fill of salbutamol and connected to a simulator mimicking adult tidal breathing (R-13, Tv-500). In addition to inspiratory and expiratory filters, the nebulizer was placed under an extraction system to capture any aerosol emitted through leakages or exhalation. Salbutamol assay was undertaken by HPLC-UV spectrophotometry.



Results

- The mass of salbutamol captured from the extraction system with the **BAN*** Nebulizer alone was found to be $2.6 \pm 0.4\%$ of the initial dose as shown in Table 1.
- When the filter kit was added, zero fugitive emissions were recovered as shown in Table 1.
- Even after four subsequent treatments no salbutamol was recovered.

Table 1. **AEROECLIPSE* II BAN*** Nebulizer environmental loss testing as percent of the initial dose.

	BAN* Nebulizer Alone	BAN* Nebulizer with Filter Kit				
		Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5
Device 1	2.1 %	0 %	0 %	0 %	0 %	0 %
Device 2	2.9 %	0 %	0 %	0 %	0 %	0 %
Device 3	3.0 %	0 %	0 %	0 %	0 %	0 %
Device 4	2.6 %	0 %	0 %	0 %	0 %	0 %
Device 5	2.2 %	0 %	0 %	0 %	0 %	0 %
Average	2.6 % $\pm$ 0.4 %	0 % $\pm$ 0 %	0 % $\pm$ 0 %	0 % $\pm$ 0 %	0 % $\pm$ 0 %	0 % $\pm$ 0 %

Conclusion

- The **BAN*** Nebulizer alone had environmental losses of less than 3%, which is at least five times less than previously reported for continuous nebulizers and is consistent with previous data published for this device.¹
- The filter kit eliminated all losses, and even if the filter was not replaced after each treatment (label use), the efficiency appeared to be maintained for at least five uses.
- The data generated with this study only relates to the **BAN*** Nebulizer filter system. Different filter types may produce different outcomes and continuous nebulizers are likely to saturate the filter sooner.

1. Nagel M, et al. Respiratory Drug Delivery 2021. 2021;1:287-292.