# *In Vitro* Comparison of Aerosol Characteristics of Two Pressurized Metered Dose Inhaler Formulations Commonly Used in COPD

**M1027**

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## Introduction

Figure 1. The OptiChamber Diamond VHC can be used to optimize delivery from pMDIs.

The valved holding chamber (VHC) has been designed to help improve and optimize delivery for those using pressurized metered dose inhalers (pMDIs). [1] The OptiChamber Diamond VHC (Diamond; Philips Respironics, Respironics New Jersey, Inc., Parsippany, NJ) is a compact, anti-static VHC designed to facilitate effective aerosol delivery to respiratory patients. The *in vitro* aerosol characteristics of two pMDI drug formulations commonly used for the treatment of COPD, HFA albuterol sulfate and HFA ipratropium bromide, were compared using a preproduction Diamond VHC, an AeroChamber Plus Z-Stat (Z-Stat, Monaghan Medical Corp., Plattsburgh, NY) VHC and the pMDI alone. The tests were conducted using two flow rates, 30 L/min and 15 L/min.

## Method

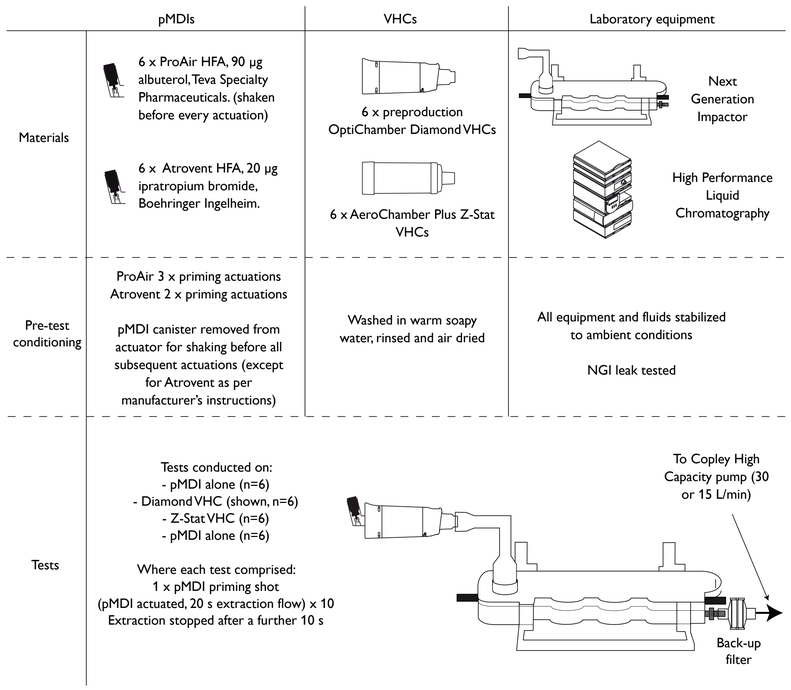


Figure 2. Experimental test method.

After each test the induction port, back-up filter, NGI cups and VHCs were processed using HPLC assay diluent for ipratropium bromide tests and 10% acetonitrile solution for albuterol tests. CITDAS V3.10 software was used to generate the aerosol characteristics data. The mean emitted dose (drug entering NGI), fine particle dose (amount of drug in NGI ≤ 4.7 µm), and Mass Median Aerodynamic Diameter (MMAD) were calculated. The equipment was washed and dried after each drug/VHC test.

## Results

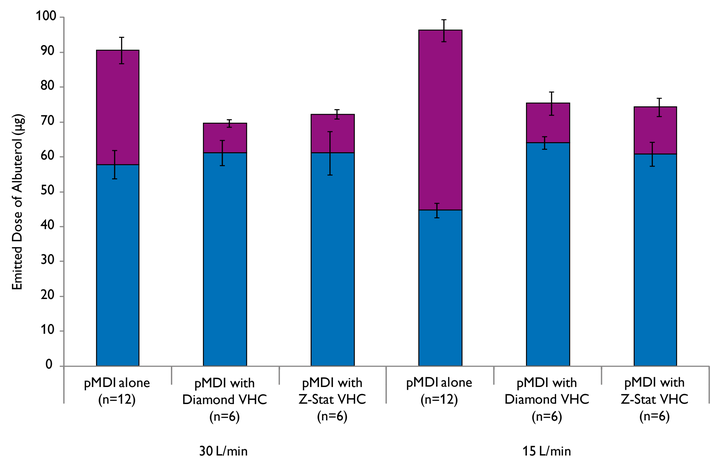


Figure 3. Emitted dose (drug entering the NGI) from the pMDI alone, pMDI with Diamond VHC, and pMDI with Z-Stat VHC using albuterol. Fine particle dose is highlighted and the dose in particles > 4.7 µm highlighted. Error bars denote standard deviation about the mean.

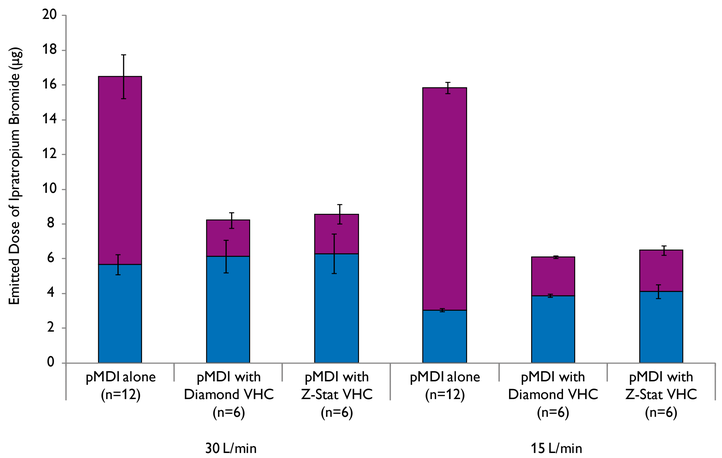


Figure 4. Emitted dose (drug entering the NGI) from the pMDI alone, pMDI with Diamond VHC and pMDI with Z-Stat VHC using ipratropium bromide. Fine particle dose is highlighted and the dose in particles > 4.7 µm highlighted. Error bars denote standard deviation about the mean.

The dose emitted from each device comprised of the fine particle dose (particles ≤ 4.7 µm) and the dose in particles > 4.7 µm in diameter. Although the emitted dose for the pMDI alone was greater than for the pMDI VHC combinations, this difference was mainly derived from a difference in particles > 4.7 µm in diameter for both flow rates. This implies that the VHCs retained a large proportion of particles over 4.7 µm in size, which would otherwise have been deposited in the throat and upper stages of the impactor. The fine particle dose was higher for the pMDI VHC combinations compared with the pMDI alone at the 15 L/min flow rate.

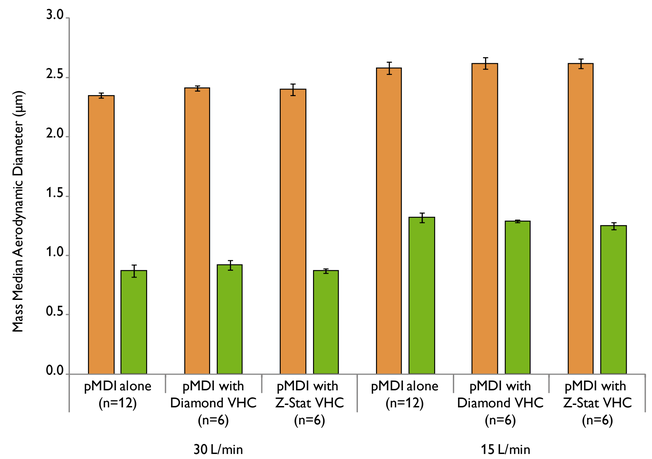


Figure 5. Mean Mass Median Aerodynamic Diameter (MMAD) of the aerosol from the pMDI alone, pMDI with Diamond VHC and pMDI with Z-Stat VHC for albuterol and ipratropium bromide. Error bars denote standard deviation about the mean.

The MMAD of aerosol from the pMDI alone and each pMDI VHC combination was similar within each drug and flow rate variable.

## Discussion

The fine particle dose from the pMDI alone was similar or smaller than from the pMDI VHC combinations, but the emitted dose was higher for the pMDI alone, meaning a greater amount of drug was delivered in larger particles that would be expected to deposit in the throat and upper airways. [2] The aerosol delivery characteristics from the two pMDI VHC combinations were comparable.

## Conclusions

- The fine particle dose was higher using a pMDI VHC combination than the pMDI alone for both drugs at the 15 L/min flow rate despite a higher emitted dose from the pMDI alone.
- The emitted dose was higher from the pMDI alone across both drug and flow rate variables.
- The MMAD was higher at the 15 L/min flow rate than the 30 L/min flow rate across both drugs using both the pMDI alone and the pMDI VHC combinations.

## References

1) Virchow J.C., Crompton G.K., Dal Negro R., Pedersen S., Magnan A., Seidenberg J., Barnes P.J. Importance of inhaler devices in the management of airway disease. Respir Med. 2008;102:10-19.
2) Heyder, J., Gebhart, J., Rudolf, G., Schiller C.F., Stahlhofen, W. Deposition of particles in the human respiratory tract in the size range of 0.0005 – 15 µm. J Aerosol Sci. 1986; 17(5):811-815

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