# Impact of Flow Rate Change on the Aerosol Characteristics of HFA Albuterol (Salbutamol) Pressurized Metered Dose Inhaler Formulation with an Anti-Static Valved Holding Chamber

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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 the extensive patient population who use 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 aerosol characteristics from an HFA albuterol sulfate pMDI alone and with a preproduction Diamond VHC and an AeroChamber Plus Z-Stat (Z-Stat; Monaghan Medical Corp., Plattsburgh, NY) VHC were compared using two different flow rates of 30 L/min and 15 L/min. These flow rates represent typical adult and child inhalation flows during tidal breathing (Figures 2 & 3).[2]

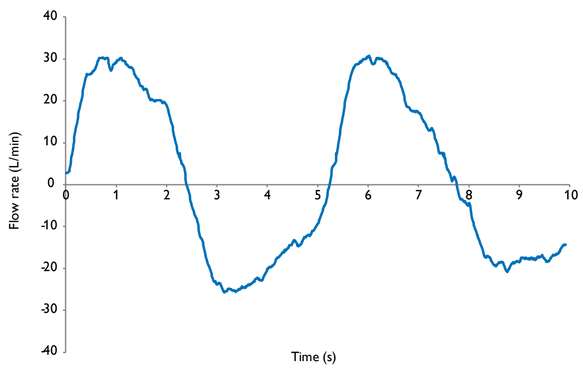


Figure 2. Typical adult breathing pattern described in Nikander et al.[2] Table 1, pattern 3.

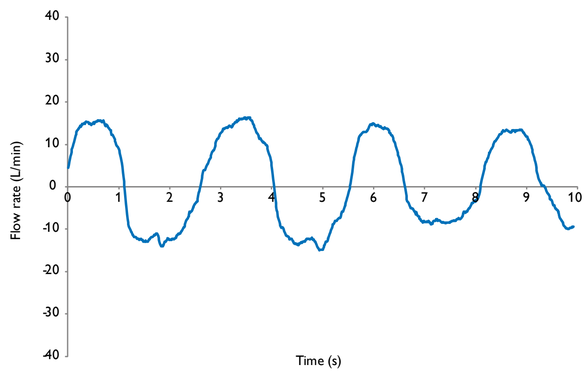


Figure 3. Typical child breathing pattern described in Nikander et al.[2] Table 2, pattern 3.

## Method

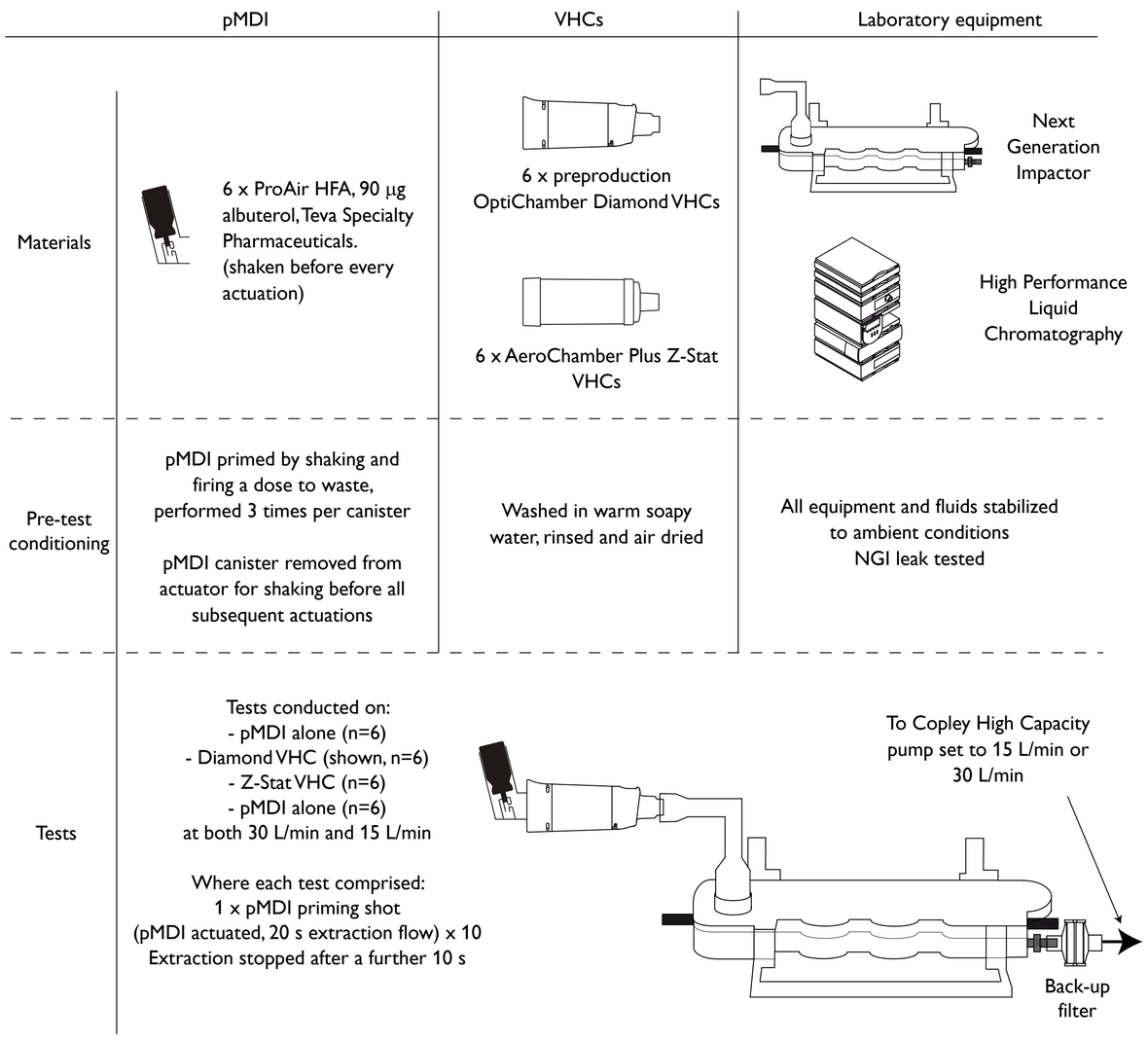


Figure 4. Experimental test method.

After each test the induction port, back-up filter, NGI cups and VHCs were processed using 10% Acetonitrile solution. CITDAS V3.10 software was used to generate the aerosol characteristics data. The fine particle fraction (percentage of emitted dose in particles ≤ 4.7 µm) and Mass Median Aerodynamic Diameter (MMAD) were calculated.

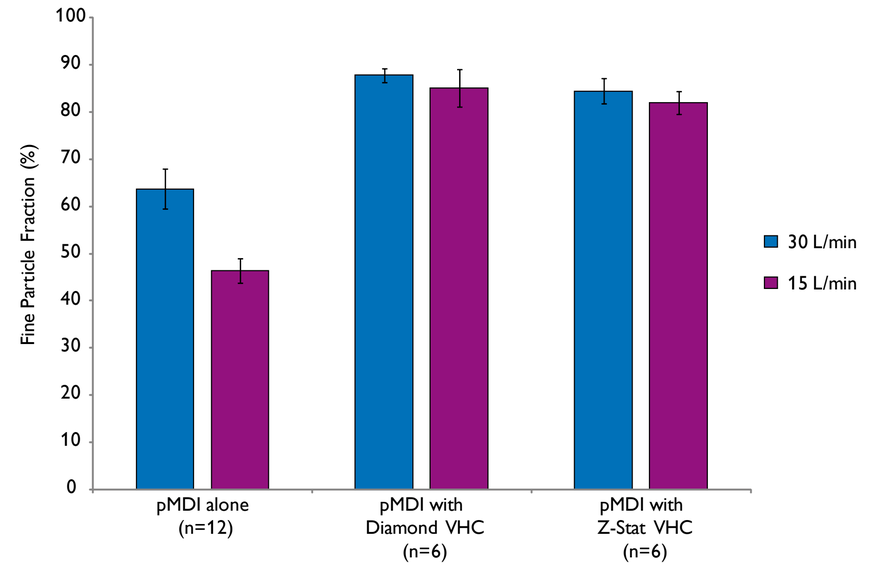


Figure 5. Fine particle fraction (percentage of the emitted dose in particles ≤ 4.7 µm) from the pMDI alone, pMDI with Diamond VHC and pMDI with Z-Stat VHC at 30 L/min and 15 L/min flow rates. Error bars denote standard deviation about the mean.

From the pMDI alone, fine particle fraction was significantly affected by the flow rate; fine particle fraction was higher at the 30 L/min flow rate than 15 L/min as shown in Figure 5. The fine particle fraction from the pMDI VHC combinations at both flow rates was similar. Figure 5 shows the aerosol delivery from the pMDI alone to be less efficient than from the pMDI VHC combinations for the delivery of drug to the lungs.

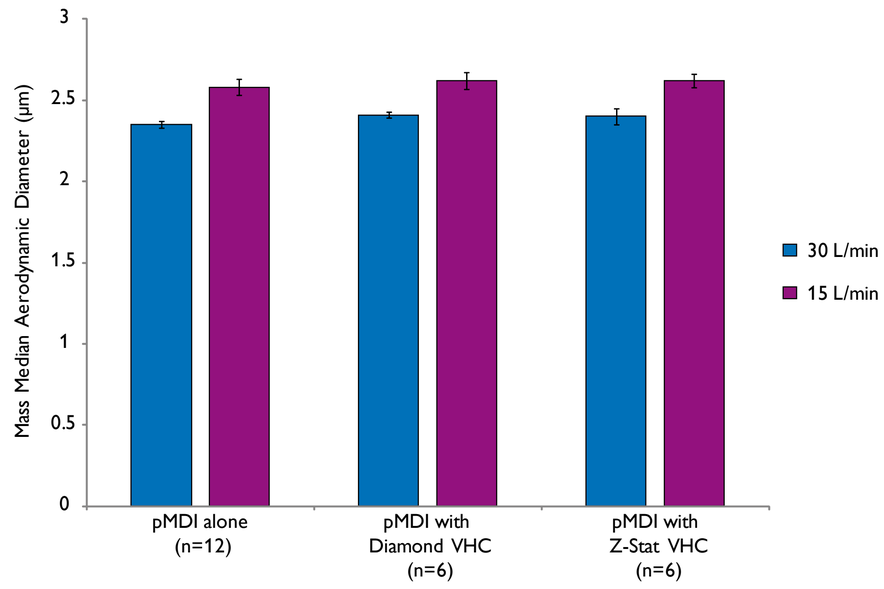


Figure 6. Mass Median Aerodynamic Diameter of the aerosol from the pMDI alone, pMDI with Diamond VHC and pMDI with Z-Stat VHC at 30 L/min and 15 L/min flow rates. Error bars denote standard deviation about the mean.

There were only minor differences in the MMAD between the two flow rates for the pMDI alone and the pMDI VHC combinations.

## Conclusions

- The fine particle fraction was higher using a pMDI VHC combination than the pMDI alone due to the fact that the VHC acts as a filter for large particles, which could reduce the oropharyngeal deposition in patients using a pMDI.
- The MMAD was slightly smaller at 30 L/min compared with the 15 L/min flow rate.
- The aerosol characteristics from the two VHCs were similar.

## References

1) Virchow J.C., Crompton G.K., Dal Negro R., Pederson 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) Nikander K., Denyer J. Breathing Patterns. Eur Respir Rev. 2000;10(76):576-579.

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