Evaluating a New Option for Delivered Dose Uniformity: Proveris DUSA Tubes

A Dosage Unit Sampling Apparatus (DUSA) is a standardized collection vessel used in regulatory testing to measure the delivered dose uniformity of inhalation aerosols and sprays. Standardization of this apparatus is essential to ensure consistent testing conditions, as it allows for accurate and reproducible measurements, meeting strict regulatory requirements, and supporting reproducible development and approval of drug products.

In this study we evaluated the performance of a new product offering from Proveris Scientific – Proveris DUSA tubes – to demonstrate conformance with industry guidance as well as to compare results with samples taken with currently available DUSA tubes. Using identical methods and analysis we compared the results of Delivered Dose Uniformity testing as outlined in U.S Pharmacopeia General Chapter 601 (USP <601>) for inhaled aerosols and oral sprays.

Introduction: Delivered Dose Uniformity is a Critical Quality Attribute (CQA) required by major regulatory agencies across the world. The U.S Pharmacopeia has established a standard method and sample collection vessel that has been widely adopted in many other regions globally. This DUSA, in compliance with <601> Apparatus A, has strict dimensional performance requirements and is an essential tool for the development and approval of Inhalation Aerosol and Inhalation Spray products. Until now, the DUSA market has been dominated by a single product, but with the introduction of the Proveris DUSA tube, a new fully compliant-ready option, OINDP companies have the choice to redefine DDU testing.

> “This DUSA, in compliance with <601> Apparatus A, has strict dimensional performance requirements and is an essential tool for the development and approval of inhalation aerosols and spray products.”

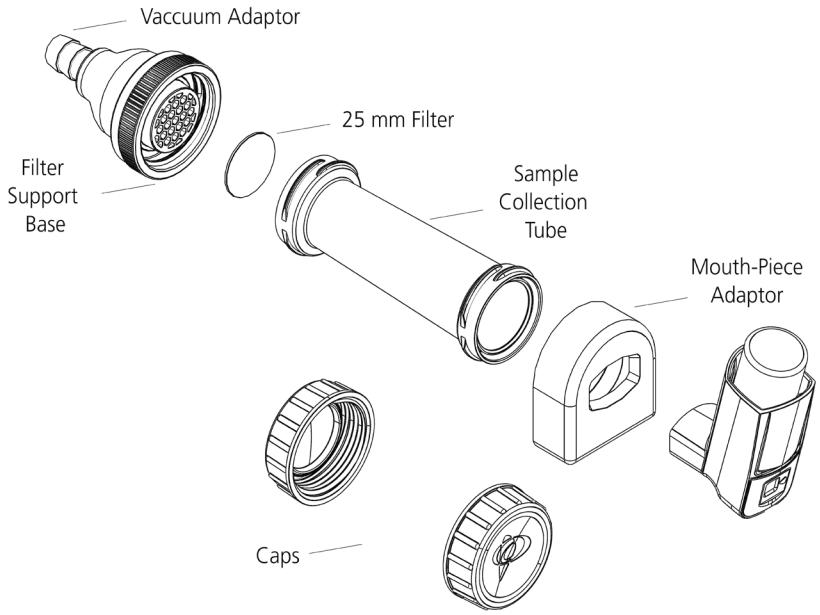

Figure 1. Proveris DUSA Tube Diagram and Accessories

proveris SCIENTIFIC

Conformance: The Proveris DUSA tube, shown in Figure 1, meets USP <601> dimensional requirements with an interior diameter of 26.70-mm and an internal length of 9.4-cm.[1] Proveris DUSA kits comprise all the necessary accessories such as a Vacuum Connector, Filter Support Base, mouthpiece adaptor, caps and the collection tube. When assembled using a commercially available vacuum pump, a timer controlled two-way solenoid valve, and the necessary vacuum tubing, the Proveris DUSA tube works as described in USP <601> and shown in Figure 2.

"...components of the apparatus are airtight so that when a vacuum is applied to the base of the filter, all of the air drawn through the DDU sampling apparatus passes through the device component", as well as a flowmeter. [1]

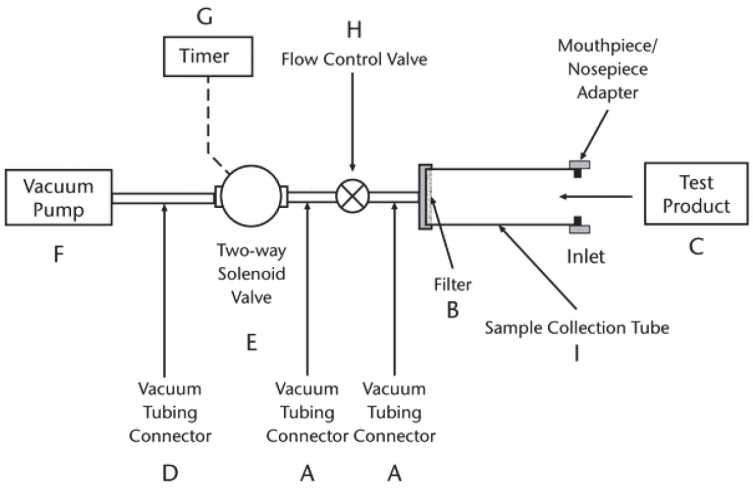

Figure 2. Delivered Dose Uniformity (DDU) Sampling Assembly

The design and manufacturing techniques used for the Proveris DUSA tube improve upon several characteristics of traditional DUSA tubes. The Proveris design, which implements the same inert Delrin construction but at 3.5x less weight than other DUSA tubes, means a lower risk of cracks from common laboratory usage. Durability testing showed that Proveris DUSA tubes are crack resistant when dropped or knocked off laboratory bench height (4 feet – 122 cm) with and without 30mL diluent load. Gasket-less sealing caps simplify cleaning and reduce any risk of cross contamination between samples. Cleaning of existing DUSA tubes is particularly complicated because liquids tend to become trapped under the gasket requiring extra time and attention paid during their cleaning and drying. The Proveris DUSA tubes are compatible with standard PALL 25-mm filters as well as new high-performance 25-mm filters. These tubes can also be used on other equipment for automated shaking, actuation and sample collection for pressurized metered dose inhalers.

Figure 3. Internal Comparison of DUSA Caps. Proveris (left) and Industry Alternative (right)

Performance Testing: Delivered Dose Uniformity was performed using the Proveris Kinaero Cx™ for automated actuation and sample collection to reduce human variation. Sampling procedures were carried out as detailed in USP <601> with verified flow rates (28.3 L/min) and a validated HPLC method. Three new Atrovent HFA devices were used for this testing and all doses were taken from the beginning of life of the inhaler.

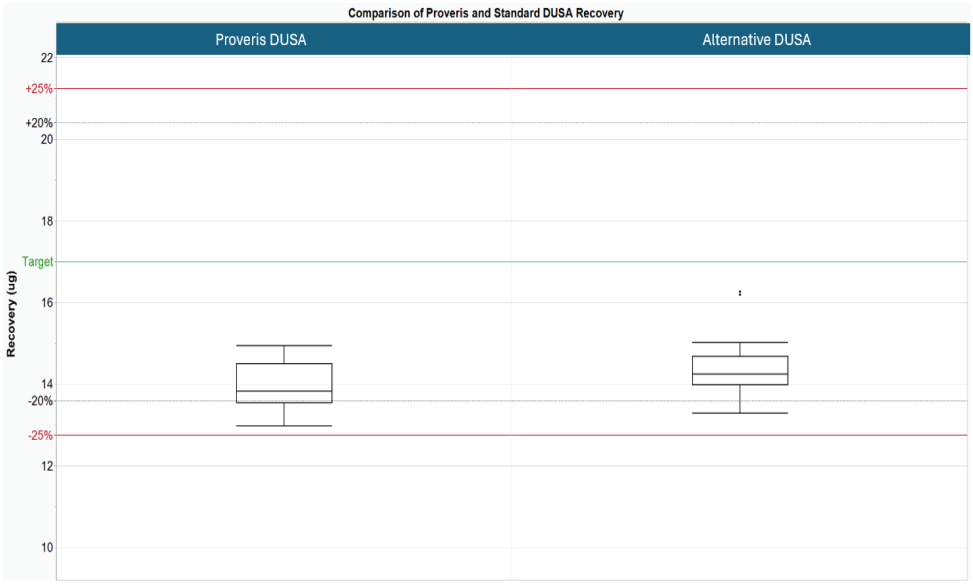

Figure 4. Data Comparison of Delivered Dose Uniformity of Proveris and Alternative DUSA Tubes using Atrovent HFA inhalers (17mcg)

	API Recovery Atrovent	% Recovery of Label Claim	Relative Standard Deviation	USP 601 Compliant	Price
Proveris DUSA	13.96 mcg	82%	4.0%	Yes	$
Existing DUSA	14.41 mcg	85%	5.0%	Yes	$$

Conclusion: In Figure 4 we present Delivered Dose Uniformity data of Atrovent HFA using both the Proveris DUSA (left) and alternative DUSA (right). Proveris DUSA tubes show similar performance when compared to alternative tubes, with mean values of 13.96 mcg and 14.42 mcg respectively. Repeatability of DDU results were also comparable between Proveris and the other DUSA tubes, showing Relative Standard Deviation rates of 4.05% and 5.0%, respectively.

Although low recovery rates were observed across all devices and DUSA tubes, this experiment successfully confirmed the Proveris DUSA tube's comparability to alternative DUSA tubes, while also offering enhanced durability, ease of use, and cost-effectiveness.

The launch of the Proveris DUSA tube provides consumers with a choice in Delivered Dose Uniformity testing that reduces risks and costs as well as improving user experience.

References: General Chapter: USP. <601> INHALATION AND NASAL DRUG PRODUCTS: AEROSOLS, SPRAYS, AND POWDERS—PERFORMANCE QUALITY TESTS

Proveris Scientific Corporation
Two Cabot Road, Hudson, MA 01749 USA
(508) 460-8822 • sales@proveris.com

Proveris®, Proveris Scientific®, Proveris Scientific and Design®, SnapLock®, Solo®, SprayVIEW®, Vereo®, Viota®, Indizo®, INVIDA®, and Kinaero®, are registered trademarks of Proveris Scientific Corporation. Ergo™, Proveris by Design™ and Kinaero Cx™ are trademarks of Proveris Scientific Corporation. Refer to the "Proveris Trademarks" section at http://www.proveris.com/about-us/intellectual-property/ for other Proveris Scientific Corporation trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies.