

CLOSED SYSTEM TRANSFER DEVICE BASED ON AIR FILTRATION: THE DRUG VAPOUR CHALLENGE

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Background and importance

Chemotherapy drugs were shown to form hazardous vapors that pose a health risk to pharmacists and nurses [1]. One of the aims of using Closed System Transfer Devices (CSTDs) is to prevent this harmful exposure [2]. Chemfort® is an upgrade of the air cleaning CSTD Tevadaptor®, with enhanced usability and performance. Its TOXI-GUARD® filter (Fig. 1) includes an activated charcoal filter that prevents the escape of hazardous drug vapor from the vial [3].

Air cleaning CSTDs are known to be less cumbersome and more user friendly than physical barrier CSTDs [4], however, their vapor containment efficiency is perceived as less obvious and intuitive. Therefore it should be demonstrated throughout the shelf life of these devices in order to support the Instruction for Use (IFU).

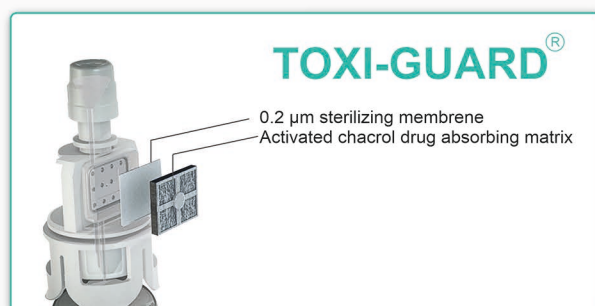


Figure 1: The Toxi-Guard® Air Cleaning System

Aim and objectives



To test the drug vapor containment capacity of Chemfort® of two widely used, relatively volatile, chemotherapy drugs.

Additional aim was to investigate if the Toxi-Guard® remains fully functional at the end of an accelerated aging of 3 years, as compared to the efficiency of fresh filters. According to the manufacturer's claim the device can be used on a drug vial for a period of 7 days, thus the study also challenged the filter functionality after it was exposed to vapors of a hazardous drug for 7 days.

Materials and methods

The study was performed by Nextar Labs (Nes Ziona, Israel). A closed test chamber was employed for capturing drug vapors (Fig. 2). Tested commercial drugs are detailed in Table 1. Extreme conditions were used in order to generate drug vapors inside the closed chamber - Heating a drug vial to 50°C and having a constant stream of nitrogen gas flow (250 mL/minute) into the vial for 5 hours via the Vial Adaptor (VA) fluid pathway. Vapors released through the air filter of the CSTD were trapped, recovered and quantified using validated LC/MS/MS methods. As a positive control parallel testing was performed using Chemfort® VA from which the filter system had been removed.

Table 1: Commercial drugs used for Chemfort® air cleaning testing

Generic drug name	Molecular structure	Product name	Manufacturer	Concentration
5 Fluorouracil (5-FU)		Adrucil	Teva Pharmaceuticals	50 mg/mL
Cyclophosphamide		Endoxan	Baxter	20 mg/mL

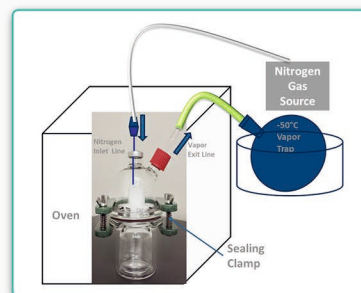


Figure 2: Test system setup to artificially increase drug evaporation in order to challenge the TOXI-GUARD® air cleaning system

Results

No drug was found in any of the test samples with intact air filter system in Chemfort® VAs, either fresh, following aging of 3 years or after 7 days exposure to drug vapors (Table 2). In contrast, a significant amount of recovered vapor was consistently found in the positive control samples which had Chemfort® VAs without air cleaning system.

Table 2: Quantity of Drug Recovered following drug Vaporization and air cleaning

Drug tested	System Limit of quantification	Tested Vial Adaptor		Quantity Drug Recovered from outside of the Vial Adaptor	
		Device age	Pre-exposure to drug vapor	Positive Control (TOXI-GUARD® Removed)	Test Sample (TOXI-GUARD® Present)
5 Fluorouracil	5 ng	Fresh	-	35 ng	Below LOQ
	1 ng	Fresh	-		Below LOQ
Cyclophosphamide	1 ng	3-year simulated aging	-	69 ng	Below LOQ
	1 ng	3-year simulated aging	7 days		Below LOQ

Conclusion and relevance

The absence of recovered drug vapor in the test samples confirms the efficacy of the TOXI-GUARD® system present in the Chemfort® VA to stop hazardous drug vapors release to the environment.

The results also confirm the efficacy of Chemfort® air cleaningsystem even after 7 days exposure to drug vapor and a shelf life of 3 years.

References

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