

Effectiveness of Five Decontamination Strategies for Armrests Deliberately Contaminated with Cyclophosphamide

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BACKGROUND



The handling of hazardous drugs presents **proven risks for the user** (carcinogenicity, teratogenicity, mutagenicity, organ toxicity or reproductive toxicity).

In Canada, this use is **controlled by several guidelines and recommendations**, in order to protect healthcare workers and ensure regular maintenance of the most exposed areas.

Several studies have revealed the **presence of traces of hazardous drugs, particularly cytotoxic drugs, in the environment**. Pinet et al. have published the results of their Canadian environmental monitoring program for traces of antineoplastics in 2022.

They reported the presence of at least one hazardous drug on chair arms in 81% (97/120) of samples taken.



OBJECTIVE

To evaluate the effectiveness of five decontamination strategies for chair armrests deliberately contaminated with cyclophosphamide

METHODS

- This is a **descriptive simulation study**.
- Site :**
 - The study was conducted at CHU Sainte-Justine. Manipulations were carried out in a biological safety cabinet (BSC) (Class II, NuAire).
- Material :**
 - A roll of tissue (100% silicone on a knit/polyester base, blue, Designtex[®]), cut into 600cm² pieces.
 - Cyclophosphamide (Procytox[®], Baxter Corporation, Canada)
 - Decontamination liquid products: quaternary ammonium (DR-100[®]), hydrogen peroxide 0.5% (Zochlor[®]), detergent 0.005% (Action 3[®]), sodium hypochlorite 0.5%
 - Wipes hydrogen peroxide, (Oxivir[®])
 - Microfiber wipe (Micronsolo[®], Vileda, Canada)
- Protocol :**
 - Each piece of tissue was **deliberately contaminated with 10ug (0.5mL) of cyclophosphamide** over five points
 - A quintuplicate recovery test and three blank measurements were performed.
 - Five decontamination scenarios were tested**, involving single, double and triple cleaning with each product (liquid and wipe).
 - A sixth decontamination scenario involving a single cleaning and two cleanings was carried out using a combination of two liquid products (detergent 0.005% (Action 3[®]) and sodium hypochlorite 0.5%).
 - The scenarios were carried out in **triplicate**.
- Analysis :**
 - All samples were analyzed on a **high-performance liquid chromatography-tandem mass spectrometry system**. The **limits of detection (LOD) and quantification (LOQ) for cyclophosphamide were identical (0.0006 ng/cm²)**. The **efficacy rate** (mean, standard deviation) was calculated.

RESULTS

- Fifty-nine samples were taken** (three blank, five recovery and 51 experimental). The recovery rate was 93.7 ± 4.6%. All three blank samples were negative.
- Table 1 presents a profile of the effectiveness of six decontamination scenarios.
- The average efficiency rate of decontamination products **was greater than or equal to 99.79%**, with the exception of the commercial wipe (98.80%). Whatever the agent used, the efficacy rate was 99.30±1.20% after one cleaning (n=18), 99.90±0.15% after two cleanings (n=18) and 99.95±0.06% after three cleanings (n=15).

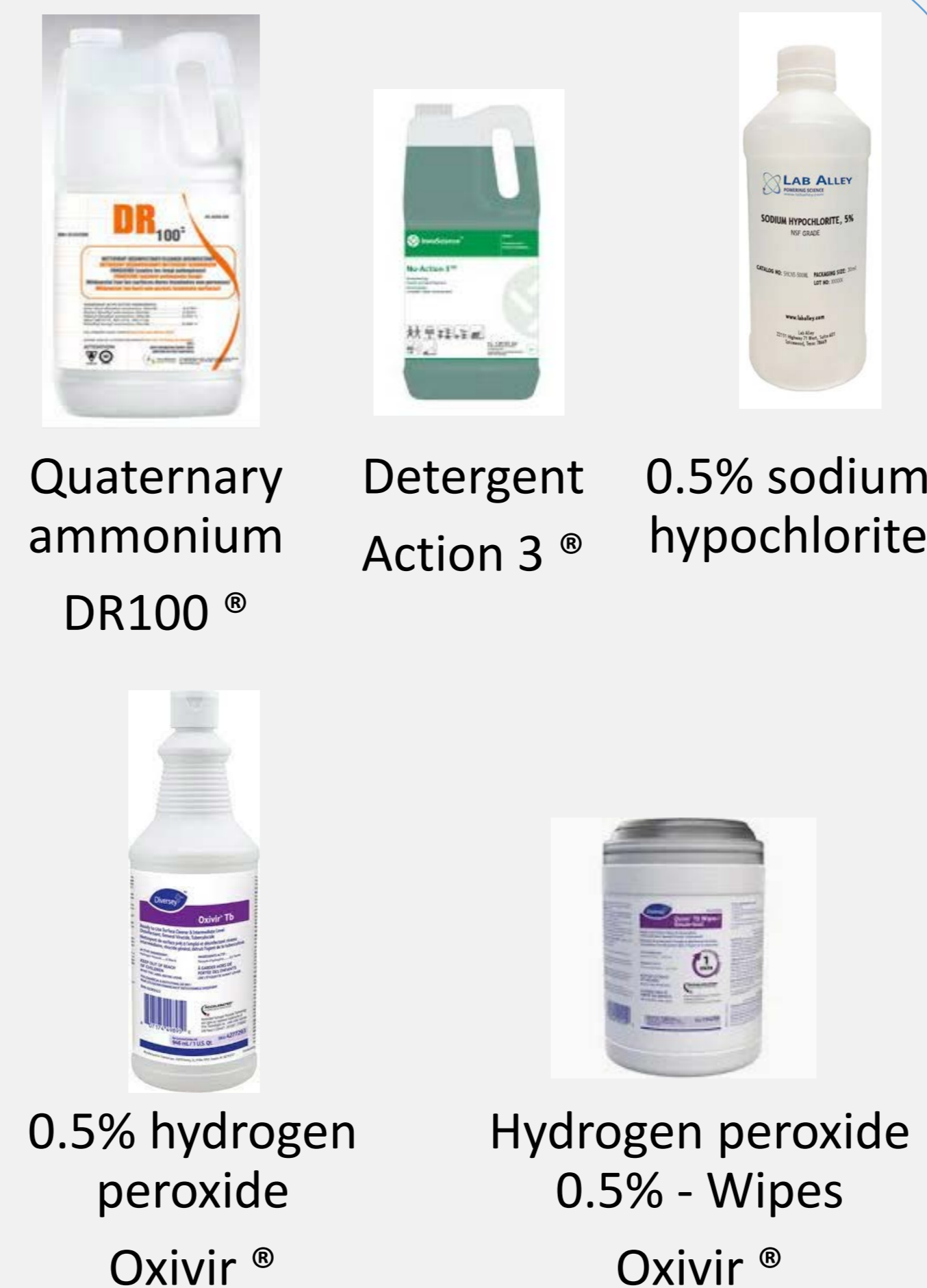


Figure 1. Products tested

Table 1. Efficacy rate of decontamination scenario

Scenarios	Products	Cleaning (n)	Efficacy rate(%)			Mean ± standard deviation
			#1	#2	#3	
1	Quaternary ammonium (DR-100 [®])	1	99,87	0,9973	0,9936	99,86±0,21
		2	99,99	0,9997	0,9994	
		3	0,9997	0,9999	0,9997	
2	Hydrogen peroxide 0.5% (Zochlor [®])	1	0,9948	0,9934	0,9952	99,79±0,26
		2	0,9995	0,9995	0,9992	
		3	0,9997	0,9998	0,9999	
3	Detergent 0,005% (Action 3 [®])	1	0,9986	0,9986	0,9957	99,91±0,13
		2	0,9999	0,9999	0,9999	
		3	0,9999	0,9997	0,9998	
4	Sodium hypochlorite 0,5%	1	0,9995	0,9996	0,9993	99,97±0,02
		2	0,9997	0,9998	0,9997	
		3	0,9998	0,9998	0,9998	
5	Hydrogen peroxide 0,5% (Oxivir [®]) wipes	1	0,9870	0,9669	0,9563	98,80±1,56
		2	0,9967	0,9953	0,9957	
		3	0,9981	0,9979	0,9987	
6	Detergent 0,005% (Action 3 [®]) – Sodium hypochlorite 0,5%	1	1,0000	0,9999	0,9999	99,99±0,01
		2	0,9999	1,0000	1,0000	

CONCLUSION

- The five decontamination products used **are highly effective** in removing almost all the cyclophosphamide deliberately deposited on a fabric surface.
- Many factors can influence the effectiveness of decontamination strategies:**
 - the **choice of product** or product combinations,
 - contact time**,
 - the **type of wipe** used to clean the surface,
 - the **nature of the surface** to be decontaminated and its wear,
 - compliance with the decontamination technique**.