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Calculation of Quantity of Use Disinfectant Solution for Fogging and Mopping

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Abstract

The pharmaceutical industry operates under stringent regulatory requirements to maintain sterile environments and safeguard product quality. Microbial contamination in controlled areas poses significant risks to both patient safety and manufacturing outcomes. Among the strategies adopted, fogging and mopping are widely implemented disinfection techniques for reducing microbial load across surfaces and enclosed spaces. This article provides a structured review of the calculation methods required to determine the appropriate quantity of disinfectant solution for fogging and mopping applications in pharmaceutical facilities.For fogging, calculations are based on room volume, application rate, and fogger flow rate, enabling precise estimation of disinfectant quantity and fogging duration. The study illustrates these steps through practical examples, emphasizing the role of ULV foggers in producing fine aerosols (3–15 µm) to ensure efficient coverage of inaccessible surfaces. For mopping, the article outlines a methodology derived from field practices, including surface area estimation for floors, walls, and ceilings, to guide accurate disinfectant usage. The findings highlight that accurate volume-based calculations are critical for optimizing disinfectant efficiency, minimizing wastage, and ensuring compliance with Good Manufacturing Practices (GMP). Ultimately, fogging should complement, not replace, routine cleaning and disinfection, serving as a supplementary safeguard for contamination control in pharmaceutical manufacturing environments.

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Fogging, mopping, disinfectant solution, pharma manufacturing facilities.

Introduction

The Pharmaceutical industry is a critical sector that plays a vital role in healthcare delivery. Due to the nature of the work, pharma manufacturing facilities are at risk of contamination from harmful microorganisms.

Fogging and mopping are an essential method of disinfection that is used to eradicate pathogens and prevent the spread of contamination in manufacturing facilities. This paper is an academic review highlighting the calculating method of volume of disinfectant solution for Fogging and mopping purposes to ensure the effectiveness of the disinfection process.

Fumigation and fogging are two methods commonly used in pharmaceutical companies to control the aerosol microbial contamination in controlled area. But now a day's fumigation of formaldehyde solution with potassium permanganate is not permitted by different agencies because of its negative effect (causing of irritation to the eyes, nose and skin). Fogging, as the term suggests, uses disinfectant sprayed from a ULV fogging machine to create what looks like fog in the room.

These machines are designed to generate a precise, submicron particle size (3-15 microns) for effective and efficient disinfection, saving on disinfectant consumption and time.

It is an effective way to disinfect high levels of horizontal surfaces, hard to reach areas that are often missed or forgotten and small, and confined spaces such as extractor units. It can also be effective at disinfecting

vertical surfaces. By ULV fogger machine, disinfectant solution is sprayed in the area in form of aerosol.

The small particles of disinfectant solution suspended in air for long time and kill all the airborne bacteria, fungus and their spores.

Technical features & specifications of ULV fogger

- ✓ Uniform spread to achieve max. disinfection
- ✓ Easy to clean, detachable & non-corrosive
- ✓ Specially designed intake air filter to prevent dust / dirt & chemicals which helps to protect the motor
- ✓ Consistent particle size generation: Submicron
- ✓ Reach: 20 – 30 ft. height cover
- ✓ Space treatment: Upto 10,000 cu. ft.
- ✓ Chemical compatibility: All water based disinfectant
- ✓ Input power: 220V, 5 – 6 Amp, 50 Hz
- ✓ Nozzle Assembly: Non rotating, Non clogging
- ✓ Precision metering system: Discharge capacity 0 – 100 ml/min.

Similarly effective floor disinfection in the facilities can be achieved by proper mopping techniques and usage of disinfectant. The application involves wiping of floors, walls and ceilings with proper bucketing systems i.e. 2-bucket / 3-bucket as per the availability.

2-Bucket System Trolley

Featuring two separate compartments for clean and dirty water, it is ideal for large areas, offers the convenience of a wringer and wheels.

3-Bucket System Trolley

Built for heavy-duty use, this model features a robust design, larger capacity, for more intensive cleaning tasks, offers the convenience of a wringer & wheels and often additional compartments for cleaning supplies.

Guide For Calculations in Fogging

Always wear appropriate personal protective equipment (PPE), such as gloves and eye protection, when handling and using disinfectants in a ULV fogger. Switch off the AHU (Air Handling Unit) in the room to be fogged.

Step 1: Determine the volume of space to be fogged

Total area volume or space to be fogged = Length (ft.) x Width (ft.) x Height (ft.)

E.g. Total area volume (in cu.ft.) = 10 ft. x 10 ft. x 10 ft.

= 1000 cu.ft.

Step 2: Calculation of total quantity of In-use Disinfectant solution

Total quantity of In-use Disinfectant solution = area volume x application rate (500ml/1000 cu.ft.)

E.g. Total quantity of In-use Disinfectant solution (ml) = 1000 cu.ft. x

= 500 ml

$$\frac{500\ \text{ml}}{1000\ \text{cu.ft.}}$$

Note that application rate is recommended by the manufacturer of ULV fogger machine and is based on flow rate. Also the In-use disinfectant solution is the diluted disinfectant solution in water.

Step 3: Calculation of fogging time

Before application, set the flow rate of the ULV fogger machine by adjusting the nozzle.

Fogging time (mins.)

$$= \frac{\text{Total quantity of In-use disinfectant solution}}{\text{Flow rate}}$$

E.g. Flow rate adjusted = 50ml / min

So, Fogging time (mins.) = $\frac{500}{50}$ = 10 mins.

Based on above calculations following data can be considered as represented in Table 1.

Guide for Calculations in Mopping

The calculation of total quantity of disinfectant solution required during mopping has been derived from onsite practical experience on actual usage of disinfectant solution in various facilities.

Step 1: Determination of Area (floor)

Total floor Area = length (ft.) x breadth (ft.)

E.g. Total floor Area = 10 ft. x 10 ft.

= 100 sq. ft.

Table.1

Room Name	Length	Width	Height	Cubic Ft	Concentrated Disinfectant %	Total Diluted "Ready -to-Use" Fogging Solution (ml)	Concentrated Disinfectant Required (ml)	DM Water Required (ml)	Fogging Time (Approx. Mins.)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(J)	(K)
				(B x C x D)		Consider 500ml "Ready-to-Use" solution per 1000 cubic ft area. Formula = (E x 500)/1000	(G x F)	(G - H)	(G/50)
No. 1	10	10	10	1000	2.5%	500	12.5	487.5	10 mins.
No. 2	20	10	10	2000	2.5%	1000	25	975	20 mins.

Table.2

Area size (sq.ft.)	Total quantity of disinfectant solution to use
100	2 Litres
200	3 Litres
300	4 Litres
400	5 Litres
500	6 Litres
600	7 Litres
700	8 Litres
800	9 Litres
900	10 Litres
1000	12 Litres

Figure.1

Figure.2 2-Bucket System Trolley

Figure.3 3-Bucket System Trolley

Step 2: Determination of Total Surface Area (includes walls, floor and ceiling)

Total Surface Area = 2 {(length x breadth) + (breadth x height) + (height x length)}

E.g. Total Surface Area = {(10 ft. x 10 ft.) + (10 ft. x 10 ft.) + (10 ft. x 10 ft.)

= 2 (100 + 100 + 100) sq. ft.
= 2 (300) sq. ft.
= 600 sq. ft.

A typical recommended total quantity of disinfectant solution to be used for mopping is shown in Table 2.

Conclusion

Now a days fogging is used in pharmaceuticals to control the aerosol microbial contamination in controlled area. Proper calculations involved in fogging and mopping based on the room sizes can effectively control the contamination in the facility. Generally, Fogging should be viewed as an additional, belt and braces measure that is used following successful cleaning and disinfection practices, the technique should be regarded as the top-level measure for disinfection and should not be considered as a replacement for cleaning & disinfection practices.

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