

Use Of an Ozone Washing Machine Prototype to Reduce the Microbiological Load On Hospital Linen

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Summary

Introduction: With a prototype of an ozone system, it is possible to reduce the microbiological load in hospital clothing. **Methods:** 6 samples were used, one control and another five subjected to different processes. **Results:** Five different processes, the use of ozone does reduce the microbiological load, being favorable for the disinfection of them; however, the fact of washing clothes with detergent and then rinsing them with ozone water ensures the reduction of the pathogenic load, bringing it to zero. **Conclusion:** Hospital linen washing processes ensure the reduction of the pathogenic load with the use of an ozone washing machine in rinsing.

Keywords: washing machine, ozone, microbiology, clothing, hospital



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INTRODUCTION

Health centers are required to comply with protocols established by the Ministry of Health of Peru (MINSA)¹, for the treatment of hospital linen. The directorial resolutions agree on three types of risks: high, medium, and low, and do not show anything related to the use of Ozone (O3). Calvo (2004) found that the use of ozone allows water savings in laundries in the textile industry. Korol et al. (1995) determined that ozone was a better disinfectant than chlorine. A prototype of an ozone system was built to test whether the microbiological load on laundry clothes at the San Francisco health center is reduced, thanks to funding from the Jorge Basadre Grohmann National University (UNJBG) in the city of Tacna. As these results are proven, then, the possibility of reducing occupational risks increases, as well as continuing research, since clothing that can be used outside the protocol could be the origin of cross-infection. (National Maternal and Perinatal Institute, 2021) (Hospital de Emergencias José Casimiro Ulloa, 2021) (Hospital Huaycan, 2023) (EsSalud, 2014)

METHODS

6 samples of used hospital clothing were collected, and each one was subjected to different disinfection methods. The samples are identified as follows. The control sample = 0; Sample 1 = 1; Sample 2 = 2; Sample 3 = 3, Sample 4 = 4; Sample 5 = 5.

If the sample has not yet undergone any treatment, the letter "A" is added, and if it has already undergone the disinfection treatment, then the letter "D" is added.

1. The control sample had normal washing with detergent and bleach for 15 minutes, then 5 rinses of 15 minutes at a time.
2. Sample 1 had a pre-rinse with ozonated water that lasted 8 minutes (5 minutes filling and 3 minutes of contact with the final volume) at all times with ozonated water. She was then subjected to normal washing with detergent for 15 minutes and then to 5 rinses of 15 minutes at a time.
3. Sample 2 was washed with detergent for 15 minutes and then rinsed 5 times with ozonated water for 23 minutes at a time.
4. Sample 3 was moistened with water alone until the clothes were covered, and then all the water was emptied so that ozone gas was immediately applied for 5 minutes, then it was washed with detergent for 15 minutes, and then rinsed with water alone 5 times.
5. Sample 4 was moistened with water alone until the clothes were covered, and then all the water was emptied so that ozone gas was immediately applied for 5 minutes, followed by washing with detergent for 15 minutes and then 5 rinses with ozonated water that lasted 23 minutes at a time.
6. Sample 5 was pre-rinsed with ozonated water for 8 minutes (5 minutes filling and 3 minutes contact with the final volume) at all times with ozonated water. Then it

was washed with detergent for 15 minutes and then rinsed with ozonated water for 5 repetitions.

- Each washing machine fill lasted 5 minutes
- Each wash with detergent lasted 15 minutes
- Each rinse was done with 5 repetitions and lasted 15 minutes each time
- Each flush of water lasted 15 minutes
- Each pre-rinse lasted 8 minutes (5 minutes of filling and 3 minutes of rinsing), always with ozonated water
- Each wetting consisted of filling water to cover clothes and then emptying everything, and then releasing ozone gas for 5 minutes

2 samples were taken per sample: before and after treatment.

In each sampling, the garment was spread on a table sanitized with 70° alcohol and approximately 10 cm x 10 cm was delimited to drag the swab moistened with microbiological conservation water (peptonated water) on the surface of the garment the same number of times vertically, horizontally, diagonally to the left and diagonally to the right and then the swab was placed in the vial containing the conservation water. The vial was closed, labeled, and prepared to send to the laboratory.

RESULTS

Once the prototype was located, the described methodology was executed.



Figure 1: Prototype of an ozone washing machine

Table 1: Laboratory Results

SHOW CONTROL			
	CFU/surface BEFORE	CFU/surface AFTER	% Reduction
Count of Viable Aerobes Mesophiles	22100000	160	99.99927602
Total Coliform Count	0	0	-
Staphylococcal Coagulase Count Positive	0	0	-
Pseudomonas sp. count	0	0	-

Filamentous and Yeasant Fungal Count	10	10	0
	SAMPLE 1		
	CFU/surface BEFORE	CFU/surface AFTER	% Reduction
Count of Viable Aerobes Mesophiles	134000000	0	100
Total Coliform Count	0	0	-
Staphylococcal Coagulase Count Positive	1140	0	100
Pseudomonas sp. count	0	0	-
Filamentous and Yeasant Fungal Count	650	0	100
	SAMPLE 2		
	CFU/surface BEFORE	CFU/surface AFTER	% Reduction
Count of Viable Aerobes Mesophiles	450000	0	100
Total Coliform Count	0	0	-
Staphylococcal Coagulase Count Positive	0	0	-
Pseudomonas sp. count	270000	0	100
Filamentous and Yeasant Fungal Count	70	0	100
	SAMPLE 3		
	CFU/surface BEFORE	CFU/surface AFTER	% Reduction
Count of Viable Aerobes Mesophiles	430000000	330	99.99992326
Total Coliform Count	0	0	-
Staphylococcal Coagulase Count Positive	0	0	-
Pseudomonas sp. count	390000000	0	100
Filamentous and Yeasant Fungal Count	0	0	-
	SAMPLE 4		
	CFU/surface BEFORE	CFU/surface AFTER	% Reduction
Count of Viable Aerobes Mesophiles	0	0	-
Total Coliform Count	0	0	-
Staphylococcal Coagulase Count Positive	0	0	-
Pseudomonas sp. count	12400	0	100
Filamentous and Yeasant Fungal Count	1400	0	100
	SAMPLE 5		
	CFU/surface BEFORE	CFU/surface AFTER	% Reduction
Count of Viable Aerobes Mesophiles	1400	0	100
Total Coliform Count	0	0	-
Staphylococcal Coagulase Count Positive	0	0	-
Pseudomonas sp. count	0	0	-
Filamentous and Yeasant Fungal Count	10	0	100

DISCUSSION

For the control sample, where washing was done on a regular basis, a good reduction was obtained. For aerobic mesophiles and no reduction for filamentous fungi.

In sample 1, a total reduction was obtained for aerobic mesophiles, staphylococci, and fungi. These were the only ones that were found.

In sample 2, the reduction was total for aerobic mesophiles, *Pseudomonas*, and filamentous fungi; these were the only ones that were found."

For sample 3, a total reduction was obtained for *Pseudomonas*, and a sufficient reduction of more than 5 logarithms for aerobic mesophiles; these were the only ones that were found.

For sample 4, the reduction was total for *Pseudomonas* and for total fungi; they were the only ones found.

For sample 5, the reduction was total for aerobic mesophiles and for filamentous fungi; these were the only ones found.

CONCLUSION

By applying ozone technologies, it is perfectly possible to disinfect hospital linen, the best being the one that considers washing with detergent, and with ozone, 100% disinfection is ensured.

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