

Spores in fabrics: resistance to disinfection by UVC radiation and ozone

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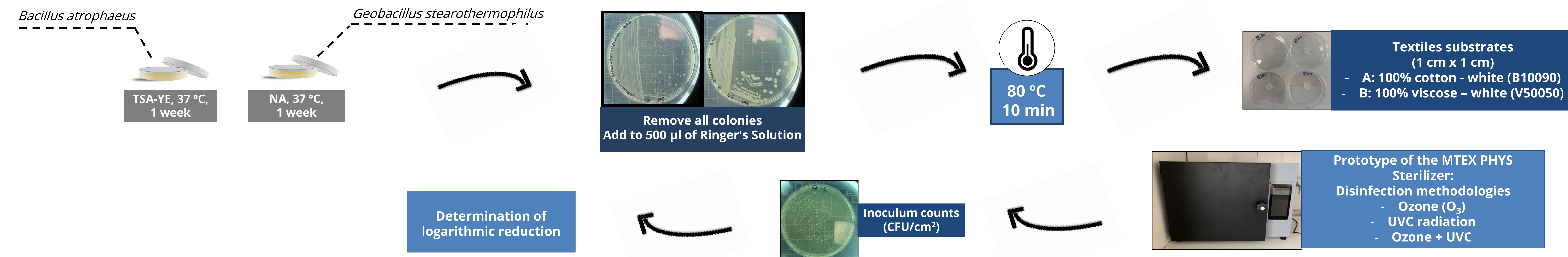
Introduction

The emergence and transmission of the COVID-19 disease in 2019 have led to an increased concern about disinfection, including textile clothing. Therefore, the use of disinfection methodologies without resorting to the use of harmful chemicals are under study, such as UV radiation and ozone. Ozone (O₃) has been used for several years as a disinfectant [1]. With an oxidizing power 3,000 times more effective than chlorine, O₃ is the second most powerful oxidant. UVC radiation (200 – 280 nm) has been shown to destroy viruses, bacteria, and fungi [2]. Disinfection treatments combining O₃ with UVC can be used in places, such as nursing homes, hospitals, clinics, clothing stores, hotels, among others.

Objectives

The aim of this study was to investigate the impact of treatments with ozone (30 and 60 ppm) and UVC radiation and their combination at different times (60 and 90 minutes) on the elimination of spores inoculated on different textile substrates. These treatments were applied in the MTEX prototype PHYS Sterilizer. Spores of *Bacillus atrophaeus* and *Geobacillus stearothermophilus* were used due to their high resistance to different decontamination processes.

Methodology



Results and discussion

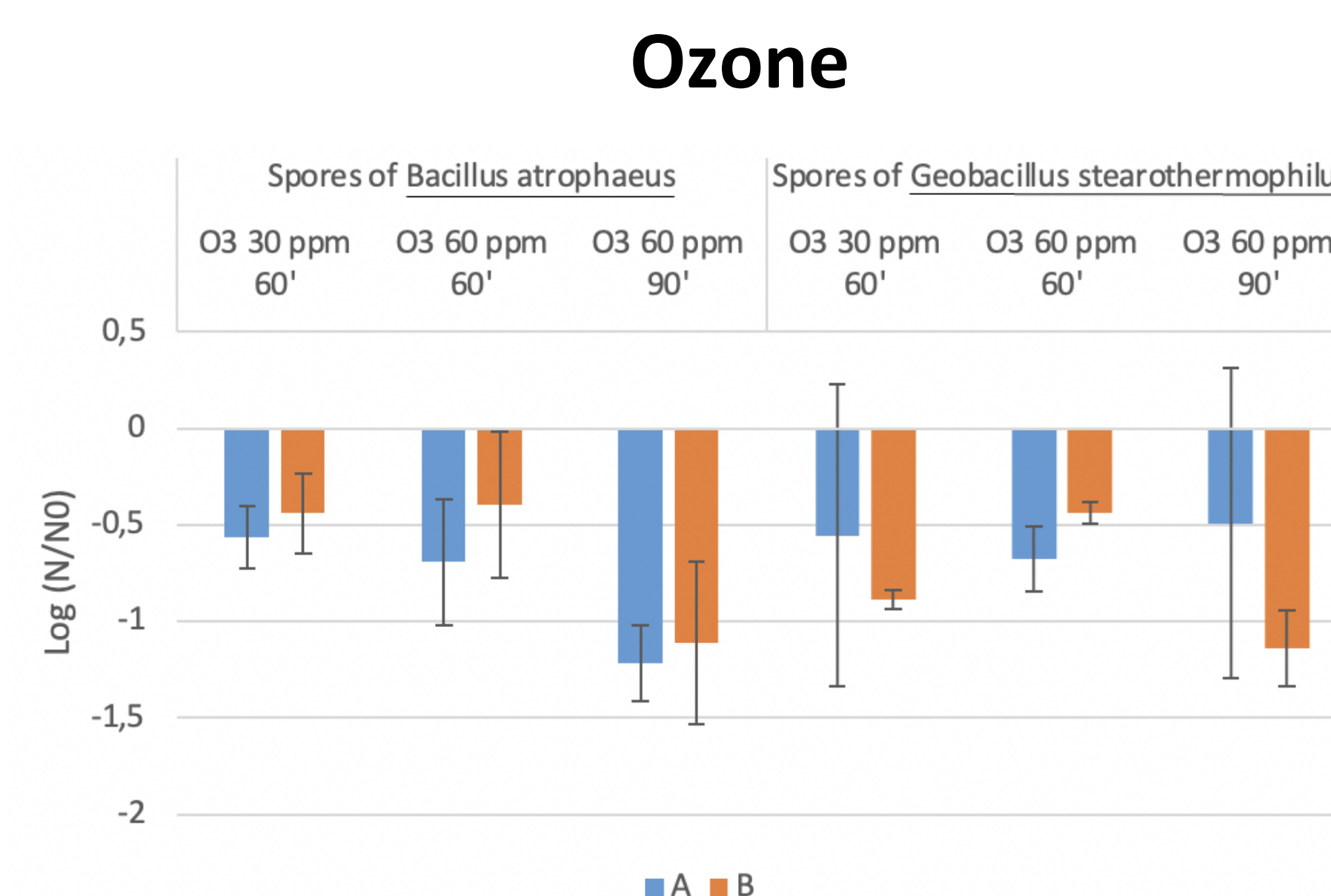


Figure 1. Logarithmic reduction of spores of *Bacillus atrophaeus* and *Geobacillus stearothermophilus* in textiles substrates after ozone treatments.

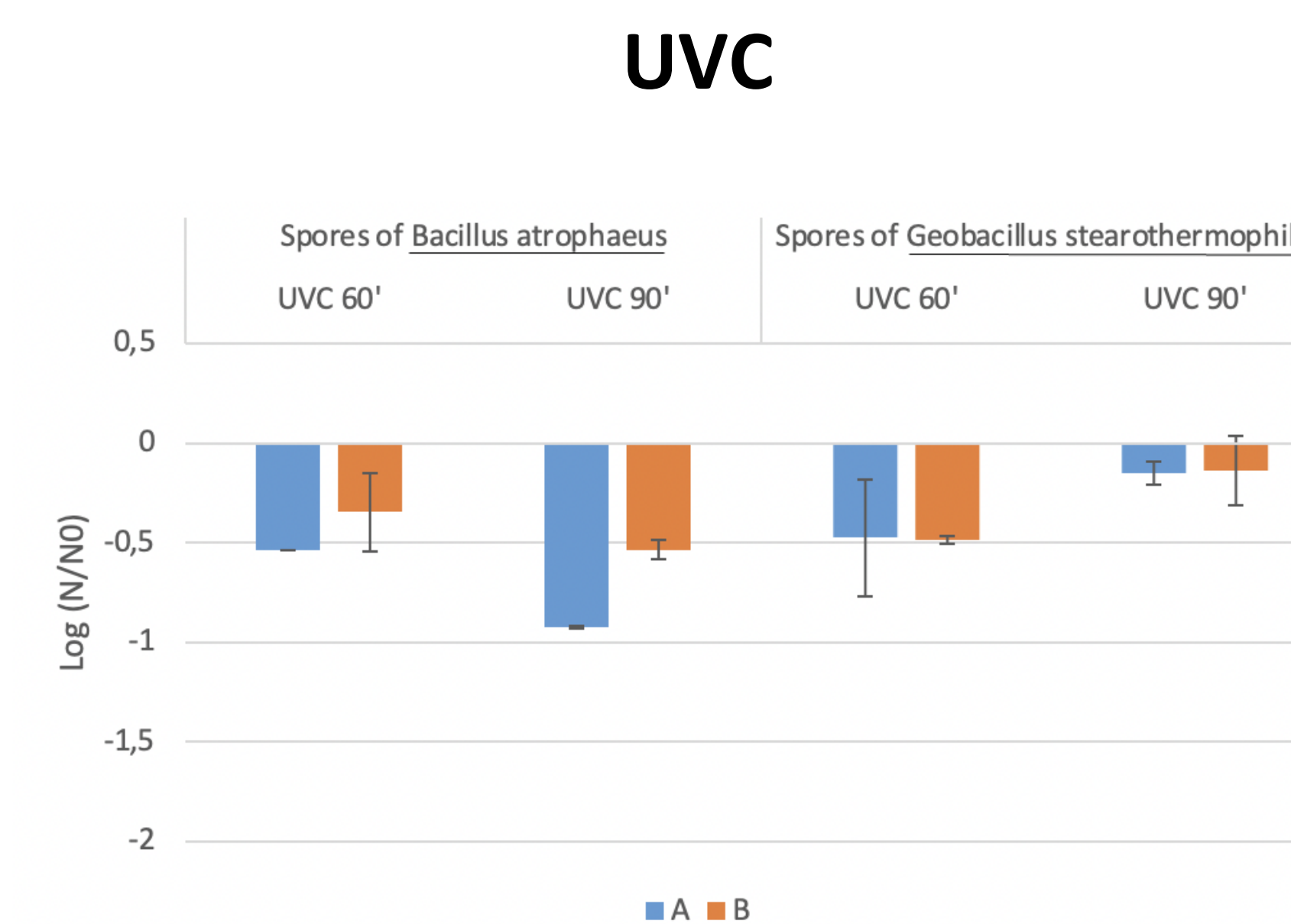


Figure 2. Logarithmic reduction of spores of *Bacillus atrophaeus* and *Geobacillus stearothermophilus* in textiles substrates after UVC treatments.

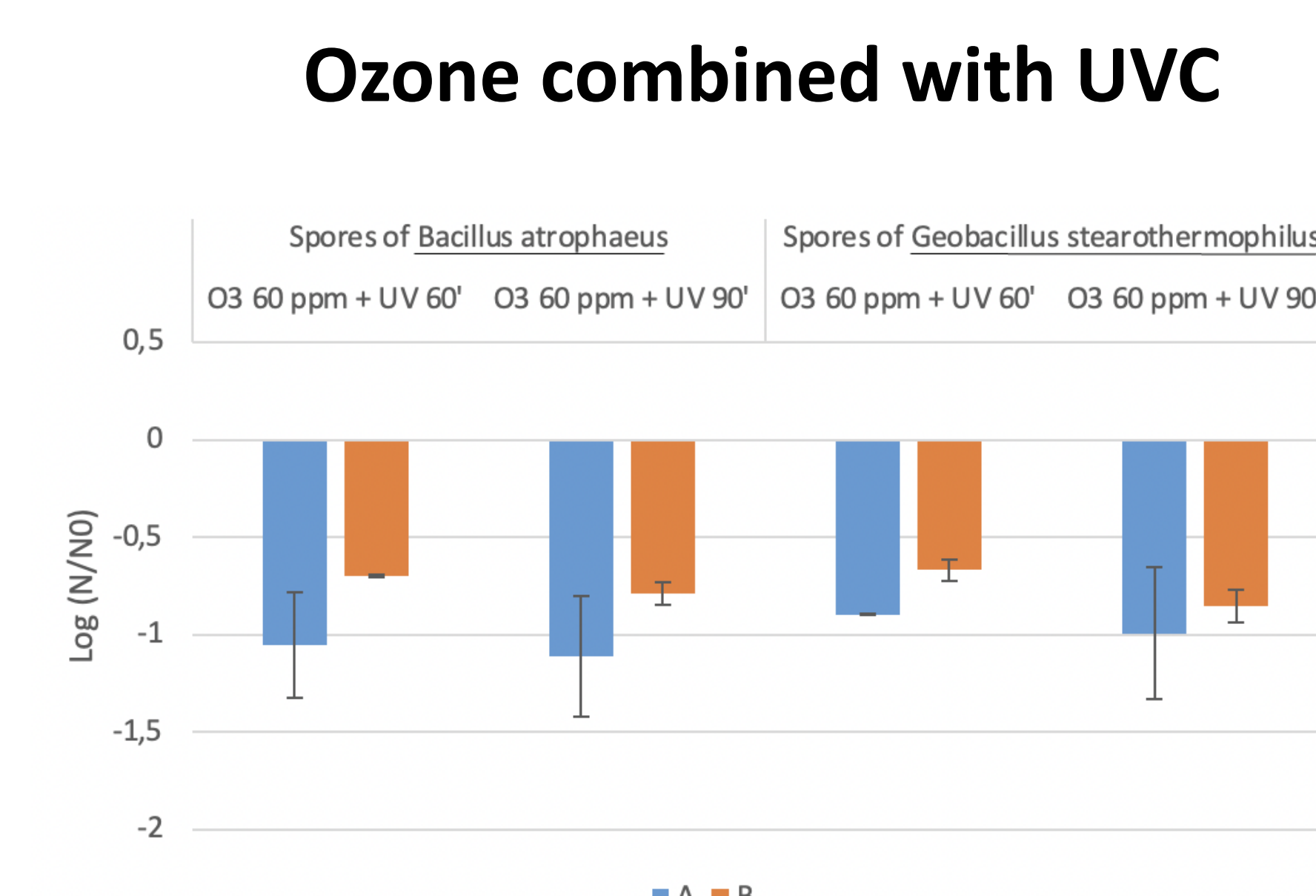


Figure 3. Logarithmic reduction of spores of *Bacillus atrophaeus* and *Geobacillus stearothermophilus* in textiles substrates after ozone and UVC treatments.

- The spore reduction was low for the three disinfection treatments applied.
- The greatest spore reduction was observed for the ozone treatment (~1.4 log cycles; 60 ppm/ 90 min).
- There were no relevant differences in the ozone treatment at 30 ppm and 60 ppm.
- There were no relevant differences between the times of 60 and 90 min of treatment and even 90 min were not enough to eliminate the spores.

Conclusions

- Low spore inactivation was observed (with reductions of 1.4 log cycles) for any of the disinfection treatments (ozone, UVC, ozone + UVC) at the different times (60 and 90 min) used.
- This demonstrates the resistance of the spores to ozone and UVC treatments and the need for more studies with other combinations and/or treatments to efficiently eliminate them from textile clothing.

Acknowledgements

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References

- 1] Grignani E. et al. Safe and Effective Use of Ozone as Air and Surface Disinfectant in the Conjunction of Covid-19. Gases 2020, 1: 19-32.
- 2] Mackenzie D. Ultraviolet Light Fights New Virus. Engineering 2020, 6: 851-853.