

The activity of a nitric oxide-generating dressing against surface-associated bacterial aggregates using a polycarbonate membrane colony model

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Introduction

- The presence and aggregation of microorganisms in hard-to-heal wounds is strongly associated with delayed healing and increased infection risk¹
- The reactive and short-lived free radical, nitric oxide (NO), is used by the innate immune system to combat pathogens^{2,3}
- NO is known to act against common features of microbial aggregates, including extracellular polymeric substances, microbial aggregation, and microbial communication (quorum sensing)³
- An NO-generating dressing (NOGD[†]) has previously been shown to exert action against aggregated microbes *in vitro*⁴

Objective

To assess the antimicrobial activity of NOGD[†] against surface-associated aggregates of wound pathogens, *Pseudomonas aeruginosa* and *Staphylococcus aureus*, using a challenging *in vitro* model

Methods

- Surface-associated aggregates of *P. aeruginosa* (NCIMB 8626) or *S. aureus* (NCIMB 9518) were cultured by inoculating 1x10⁴ colony-forming units (CFU)/mL onto the center of 25 mm dia., 0.2 µm pore dia., polycarbonate membranes (Cyclopure™)
- These were placed onto Tryptone Soy Agar for 24 hours at 35±3°C
- Bacterial aggregates were exposed to test dressings (NOGD[†]) for 4, 24, 72, or 168 hours (N=3 for each bacterium and timepoint); a without-dressing control was performed to ensure cell viability throughout the testing period
- Following NO neutralization and membrane homogenization, bacterial viability on the membranes was quantified by viable plate counts of the resultant suspension

Results

- NOGD achieved rapid and sustained activity against surface-associated aggregates of both pathogens
- P. aeruginosa* aggregates:
 - Reduced from >4x10⁹ CFU/membrane to undetectable levels (<20 CFU/membrane) within 24 hours (>8 log₁₀ reduction)
 - Activity was maintained at 168 hours (7 days)
- S. aureus* aggregates:
 - Reduced from 4x10⁹ CFU/membrane by ~2 log₁₀ reduction at 24 hours
 - Numbers were reduced to undetectable levels (<20 CFU/membrane) within 72 hours (>8 log₁₀ reduction)
 - Activity was maintained at 168 hours (7 days)
- The without-dressing controls maintained high bacterial numbers throughout

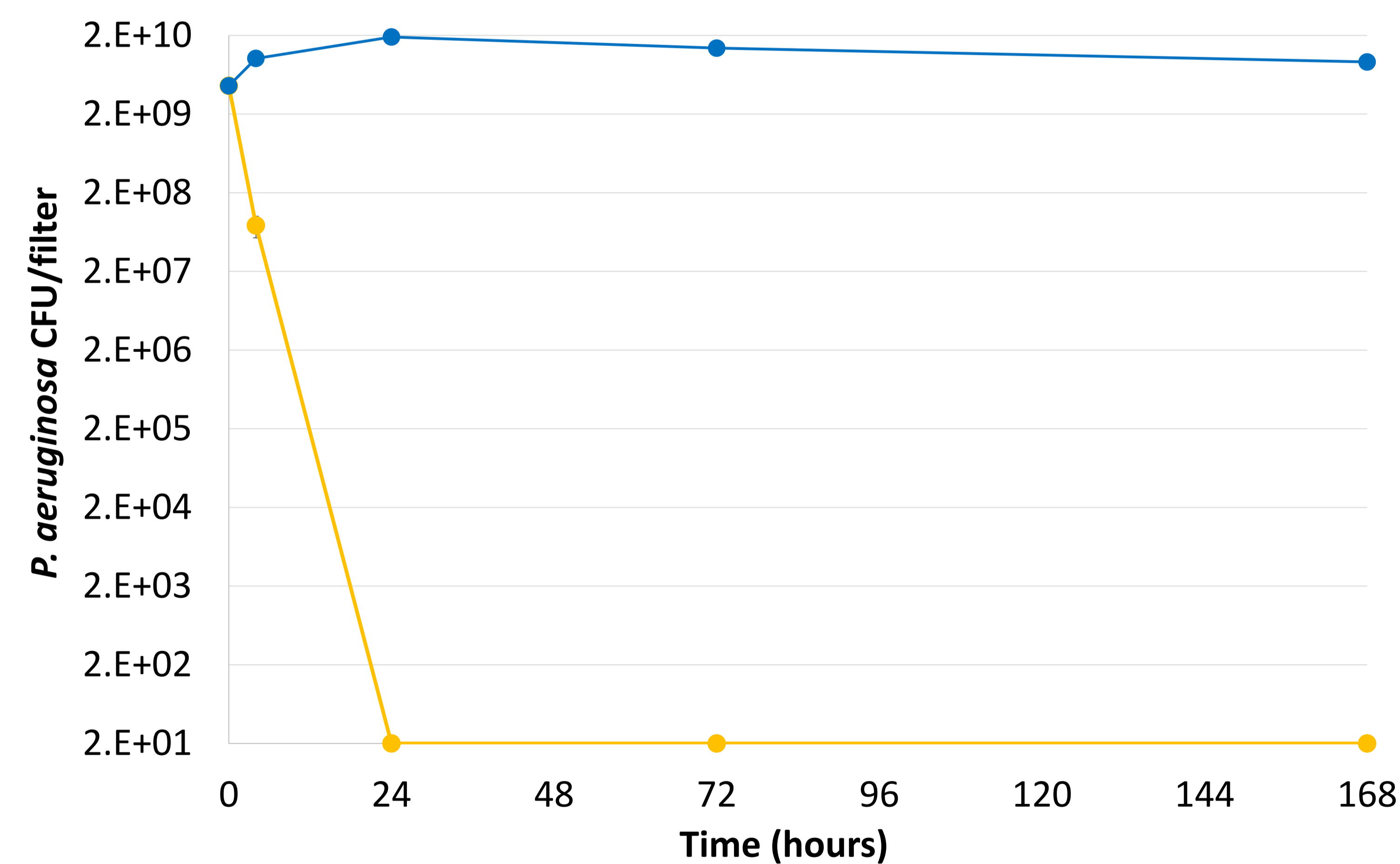


Figure 1. Sustained antimicrobial activity of NOGD against *P. aeruginosa* surface-associated aggregates. (●) NOGD (N=3); (●) control (N=1)

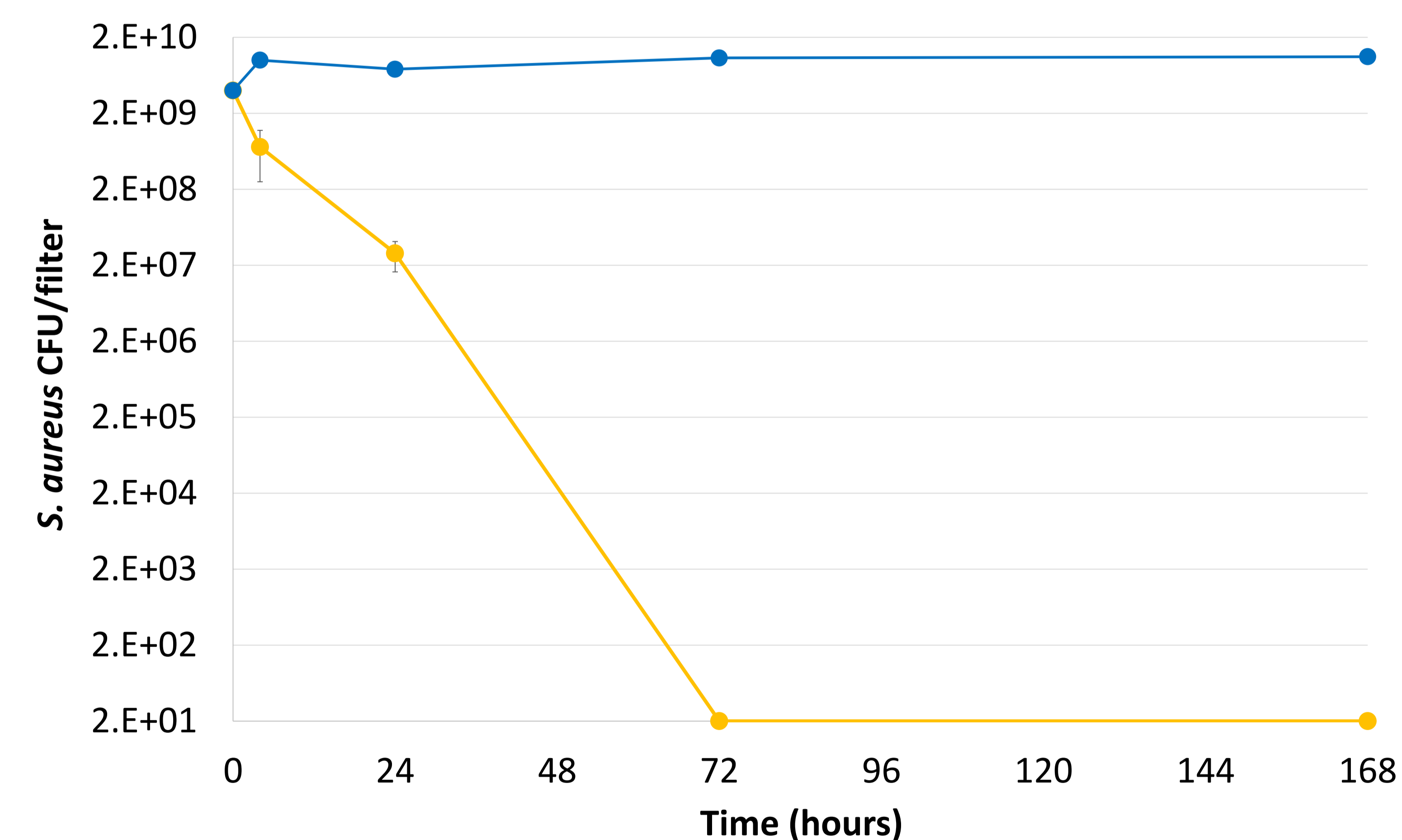


Figure 2. The antimicrobial activity of NOGD against *S. aureus* surface-associated aggregates. (●) NOGD (N=3); (●) control (N=1)

References

- Malone et al. *J Wound Care* 2017;26(1):20-25.
- Bogdan C. *Nature Immunol* 2001;2:907-916.
- Roberts et al. *Microorganisms* 2024;12:2543.
- Waite et al. *Int J Antimicrob Agents* 2018;52:338-343.

Conclusion

NOGD dressing demonstrated potent activity against surface-associated aggregates of two key wound pathogens in a challenging *in vitro* model, achieving complete eradication within 24-72 hours

Discussion

- Clinicians recognize the value of interventions that deliver rapid and long-lasting source control in locally infected or vulnerable wounds, especially when microbial aggregates may be contributing to delayed healing¹
- This study highlights the potential of NOGD in disrupting and killing surface-associated microbial aggregates of wound pathogens known to impede wound healing
- NOGD achieved complete kill of clinically relevant bacterial aggregates within 24-72 hours; activity of NOGD was maintained for 7 days after application

[†] ConvaNiox™ (Convatec) – available in the EU and UK. ConvaNiox™ is not available in the US