

ANTIBACTERIAL ACTIVITY OF CHITOSAN-BASED COMPOSITE HYDROGELS AGAINST STAPHYLOCOCCI FOR WOUND-HEALING APPLICATIONS IN AN ORTHOPAEDIC CONTEXT

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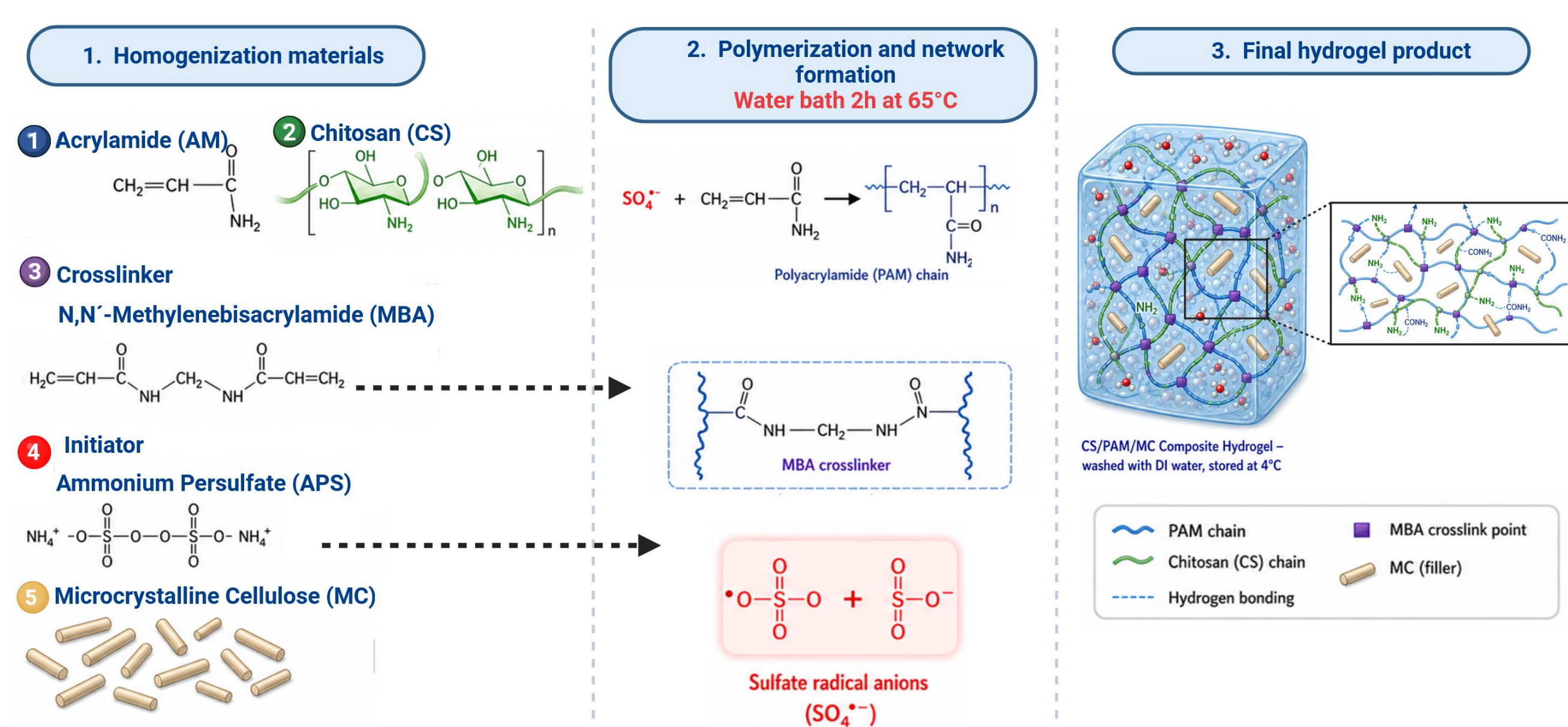
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INTRODUCTION

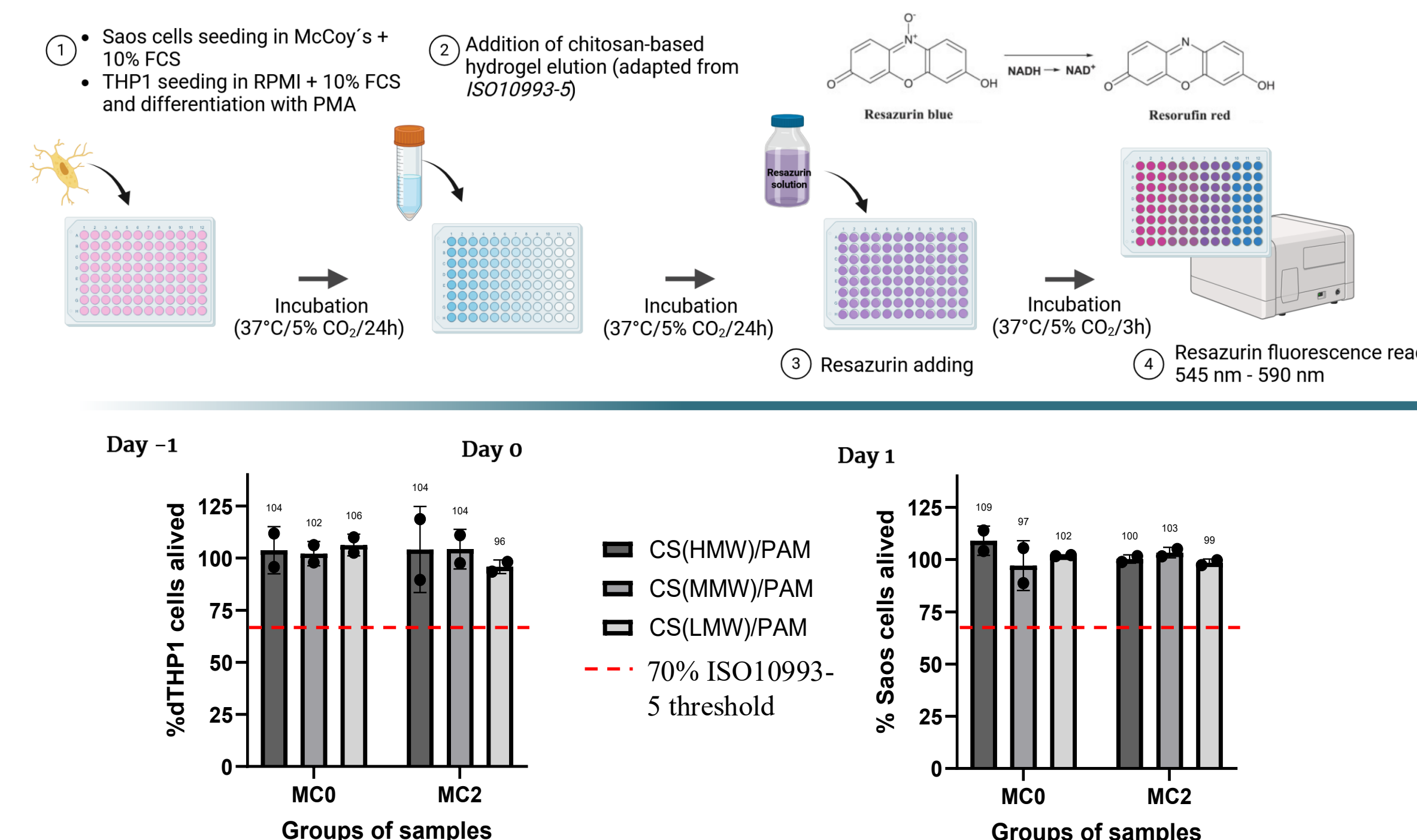
- Diabetic foot ulcers (DFUs) are frequently colonized by *Staphylococcus spp.*, which are important early wound and dressing-associated pathogens.
- Dressings materials can become sites of bacterial attachment and survival, making surface-level antimicrobial activity relevant.
- Chitosan (CS)–based hydrogels may reduce bacterial colonization by contact-mediated effect, while remaining suitable for wound application.
- We therefore compared hydrogels with varying chitosan molecular weight (high, medium, low) and microcrystalline cellulose concentration (MC0, MC2) to identify formulation balancing wound-relevant properties, bacterial attachment and biocompatibility.

METHODS AND RESULTS

Chitosan-based hydrogels formulation

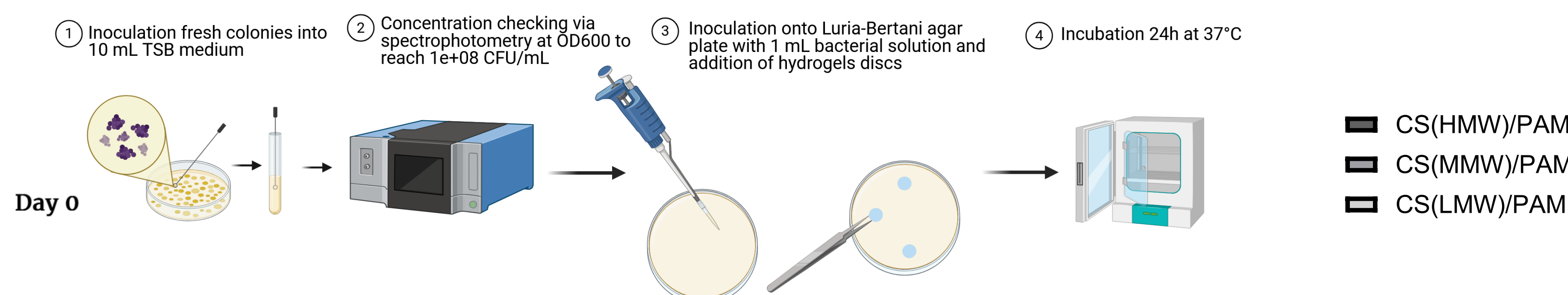


Cytotoxicity assessment (ISO10993-12)

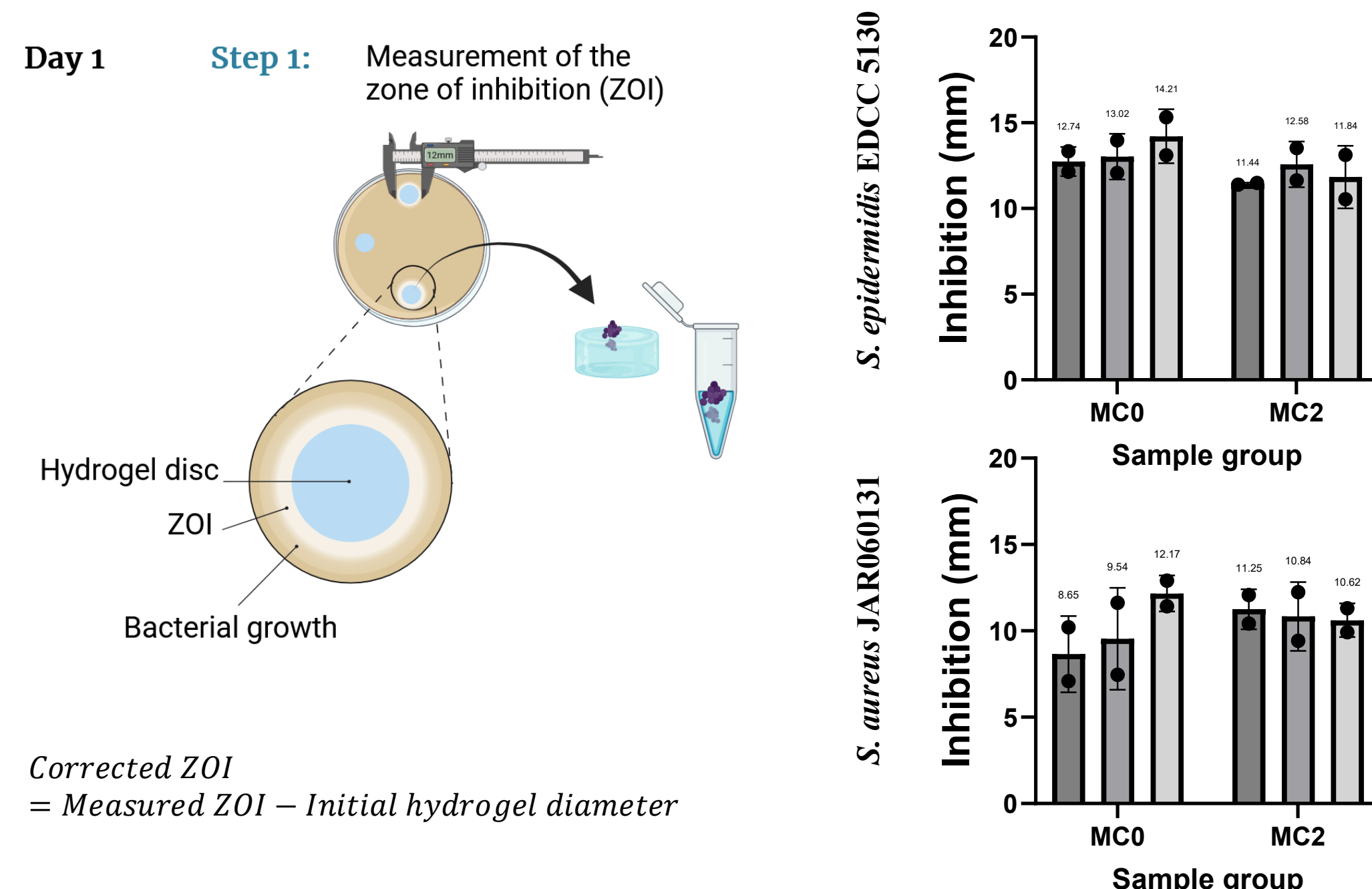


Agar diffusion assays: bacterial attachment on chitosans-based hydrogels

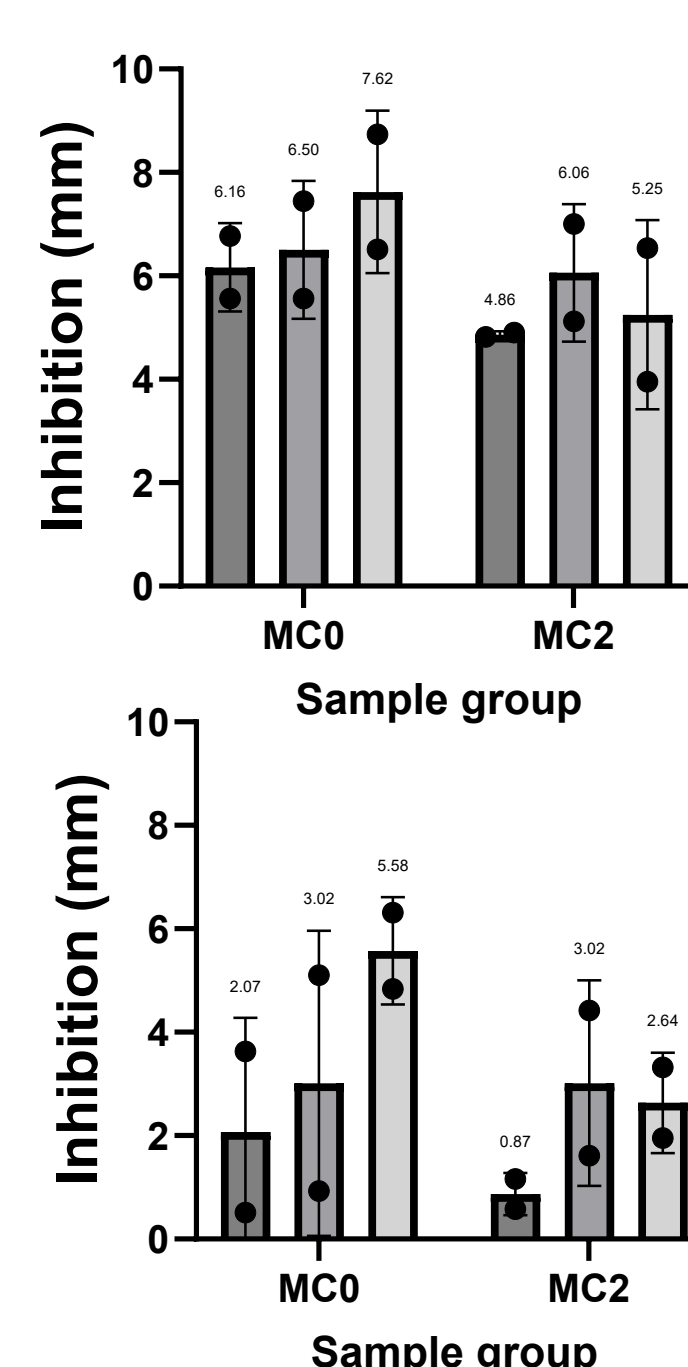
Hydrogel groups	Initial diameter (mm)	% variation after incubation	n
CS(HMW)/PAM	6.58 ± 1.05	+ 31.84 ± 1.45	2
CS(MMW)/PAM	6.52 ± 0.34	+ 59.23 ± 1.01	2
CS(LMW)/PAM	6.59 ± 0.69	+ 57.30 ± 1.32	2
CS(HMW)/PAM/MC2	7.42 ± 0.55	+ 43.86 ± 1.11	2
CS(MMW)/PAM/MC2	7.82 ± 0.66	+ 33.27 ± 0.54	2
CS(LMW)/PAM/MC2	7.98 ± 0.22	+ 33.28 ± 0.30	2



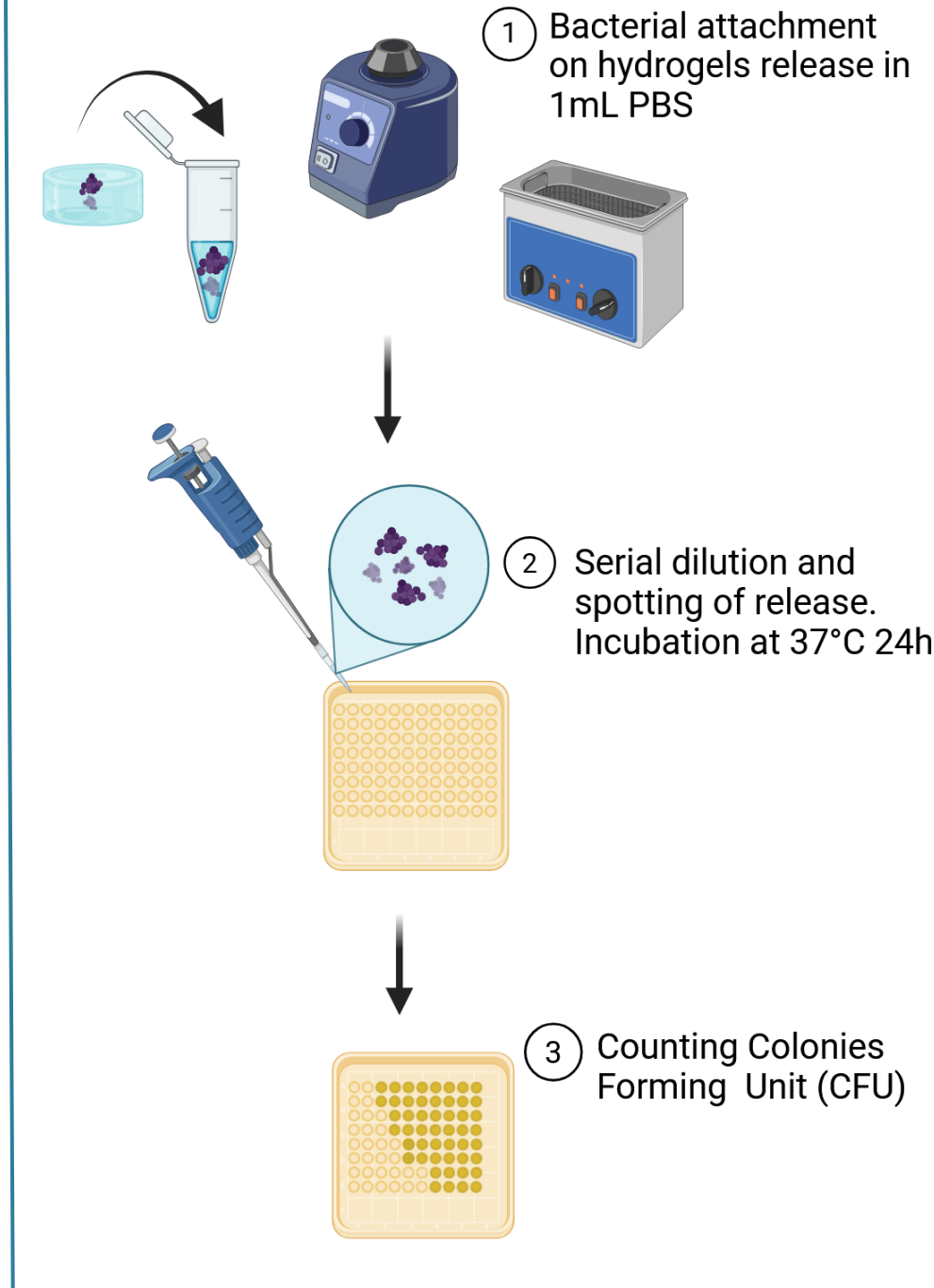
Zone of Inhibition (ZOI):



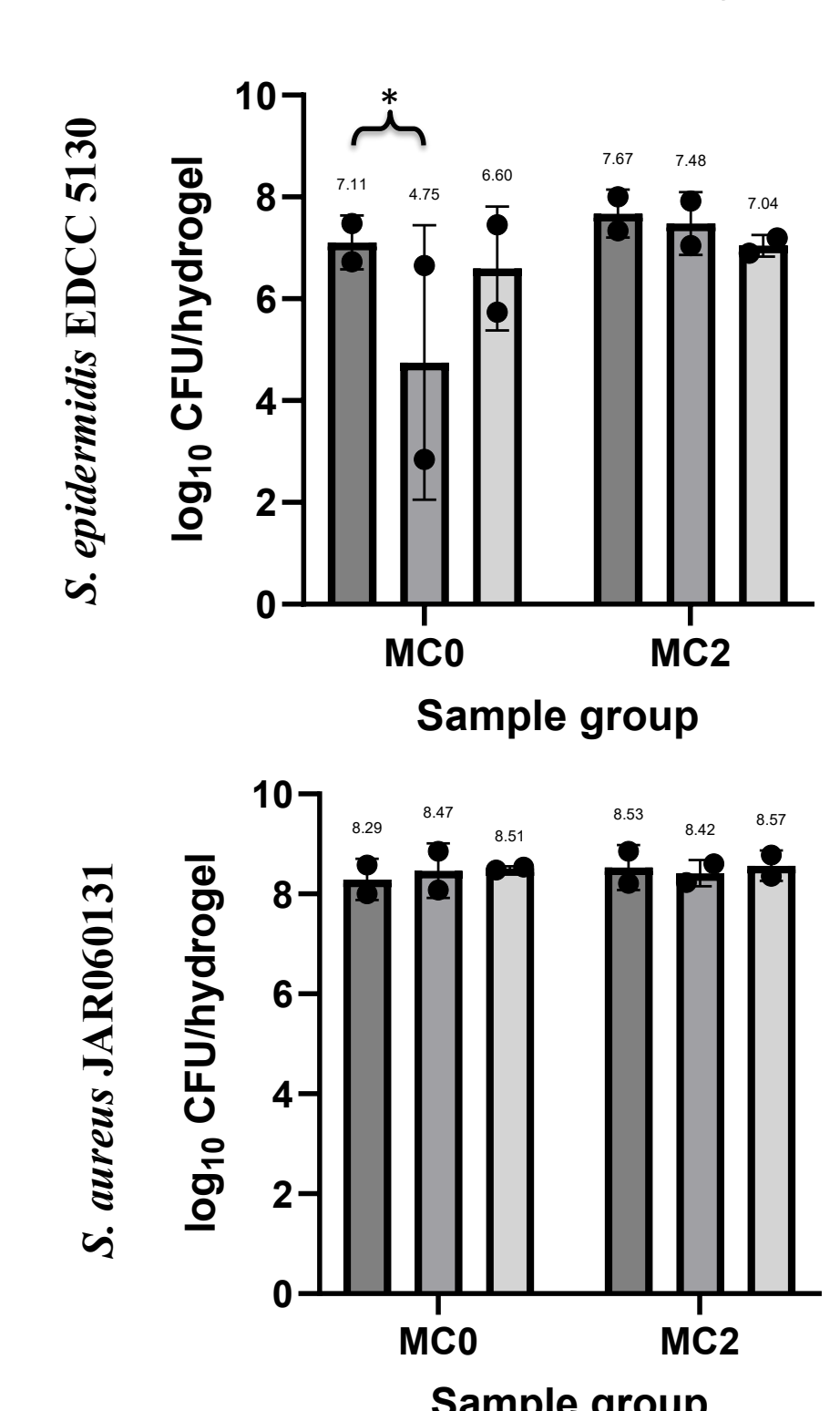
Corrected ZOI adjusted for initial hydrogel diameter before incubation:



Step 2:



Bacterial attachment on surface:



CONCLUSION

Chitosan-based hydrogels showed species- and formulation-dependent antibacterial activity with the strongest effect observed against *S. epidermidis*. The reduced bacterial attachment from CS(MMW) highlights the contact-associated anti-staphylococcal effect. Overall, we found that higher MC concentration tends to correlate with lower antibacterial performance.

Regarding cytotoxicity testing, all formulations confirmed good biocompatibility using osteogenic- and macrophage-like cells.

Together, these findings indicate that CS-based hydrogel compositions can be tuned to prevent bacterial colonization of wound dressings and maintain biocompatibility.

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