

Bioactive Hydrogel Scaffolds Based on Chitosan-Gelatin and Bimetal-Organic Frameworks for Promoting Tissue Regeneration

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PROJECT SUMMARY

An ideal wound dressing should **mimic healthy skin**, act as a **protective barrier**, and **prevent infection**. In this study, a bioactive hydrogel scaffold composed of **chitosan-gelatin (CTS-GLT)** incorporated with **curcumin-functionalised bimetallic-organic framework (MOFs)** was developed. **Curcumin (Cur)**, a natural polyphenol with antioxidant, anti-inflammatory, and broad-spectrum antibacterial activity, was stabilised within **MOFs** to enhance its therapeutic efficacy before being integrated into the CTS-GLT hydrogel. Physicochemical analysis confirmed **successful incorporation** of Cur-MOFs into the CTS-GLT matrix, while in vitro assay demonstrated **antibacterial activity** against *Staphylococcus aureus* and *Pseudomonas aeruginosa*. A wound healing assay further showed **improved keratinocyte proliferation**. These results suggest that the **Cur-functionalised MOF-loaded CTS-GLT hydrogel scaffold** has strong potential as an **advanced wound dressing**, providing infection control and accelerating tissue repair.

METHODOLOGY



RESULTS

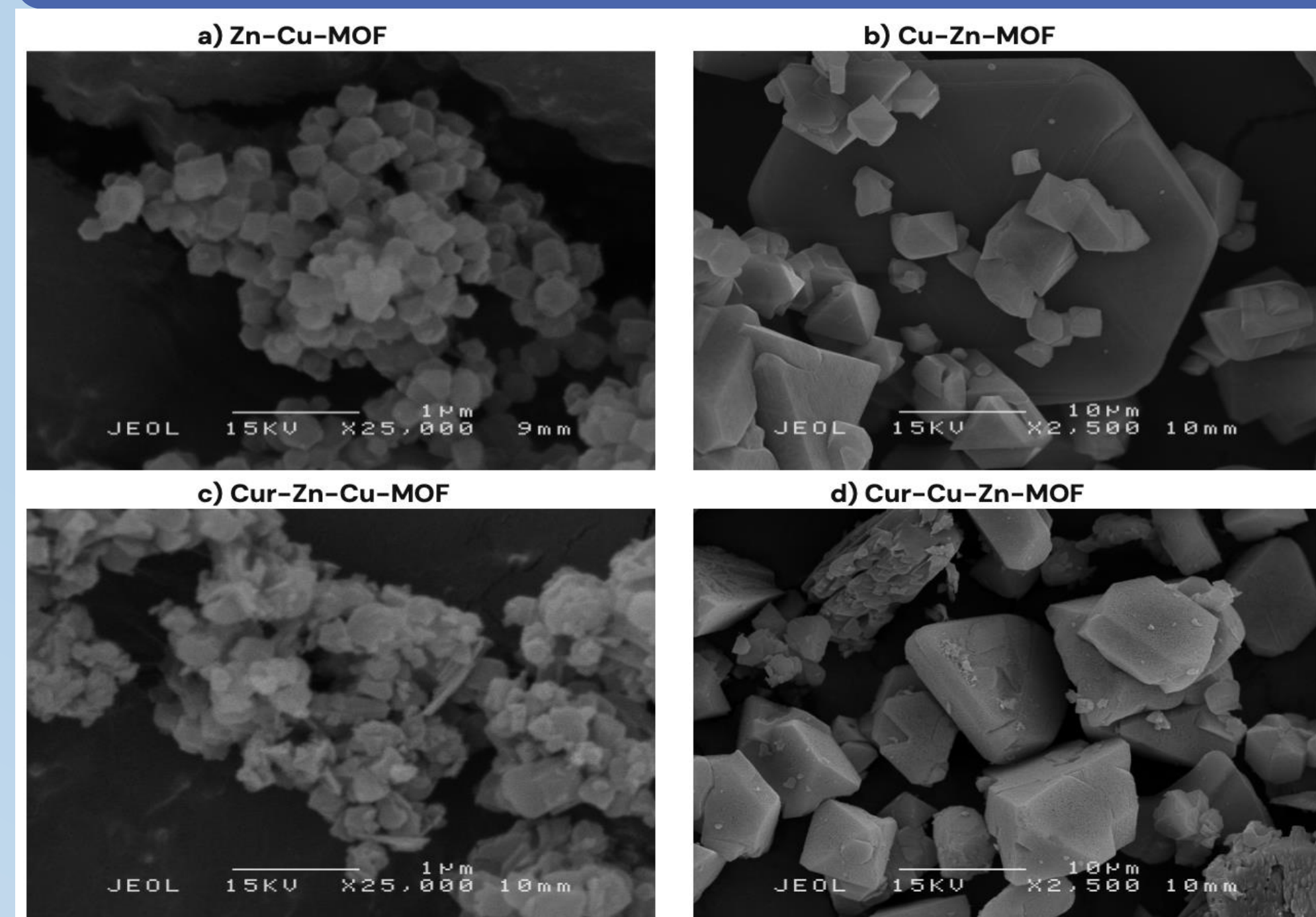


Figure 1: The SEM images of Zn-Cu-MOF, Cu-Zn-MOF, Cur-Zn-Cu-MOF and Cur-Cu-Zn-MOF

List of Samples:
A: CTS/GLT (control)
B: CTS/GLT-Cur1
C: CTS/GLT-Cur3
D: CTS/GLT-Zn-Cu-MOF-1
E: CTS/GLT-Zn-Cu-MOF-3
F: CTS/GLT-Cu-Zn-MOF-1
G: CTS/GLT-Cu-Zn-MOF-3
H: CTS/GLT-Cur-Zn-Cu-MOF-1
I: CTS/GLT-Cur-Zn-Cu-MOF-3
J: CTS/GLT-Cur-Cu-Zn-MOF-1
K: CTS/GLT-Cur-Cu-Zn-MOF-3

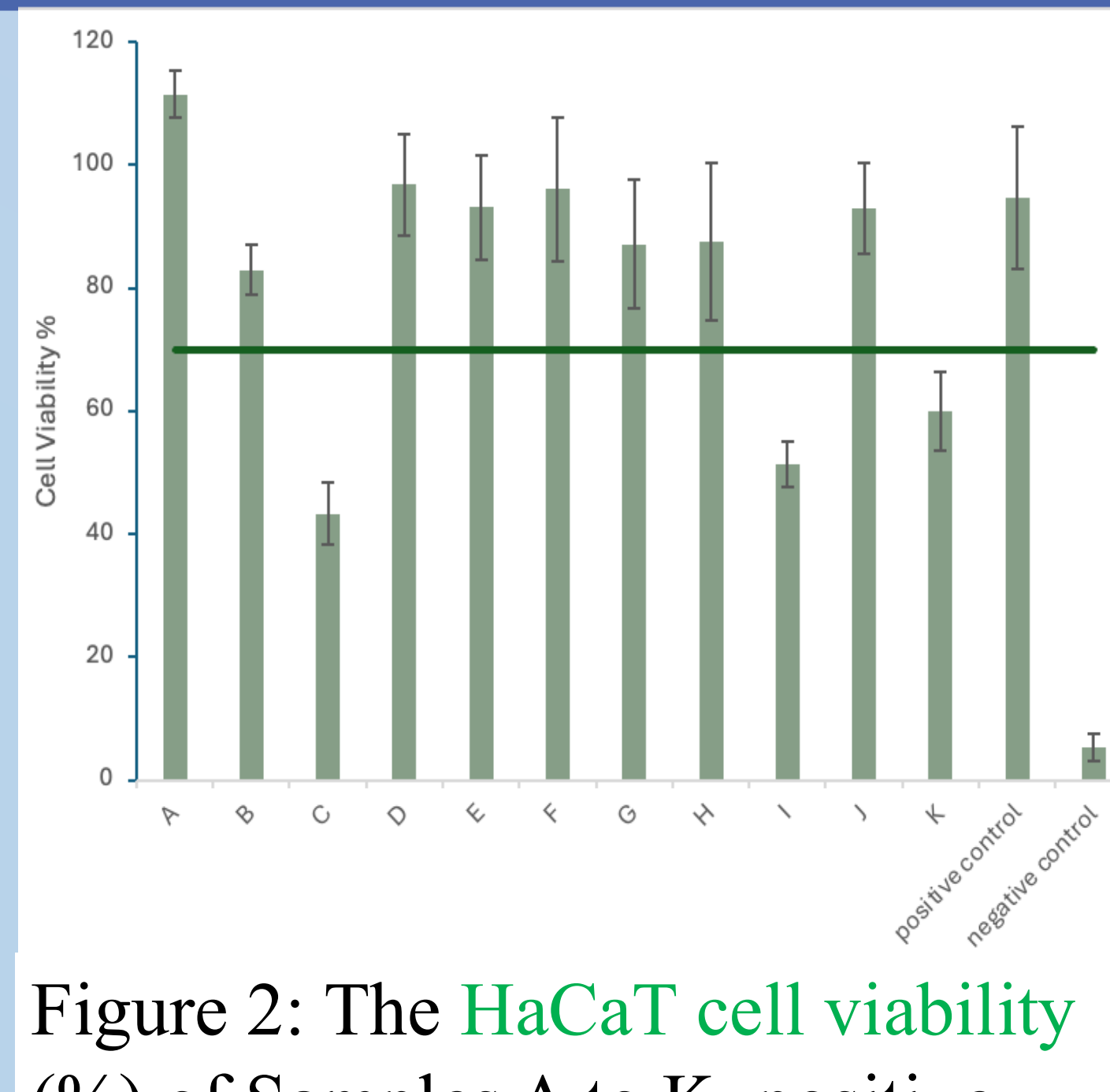


Figure 2: The HaCaT cell viability (%) of Samples A to K, positive control and negative control.

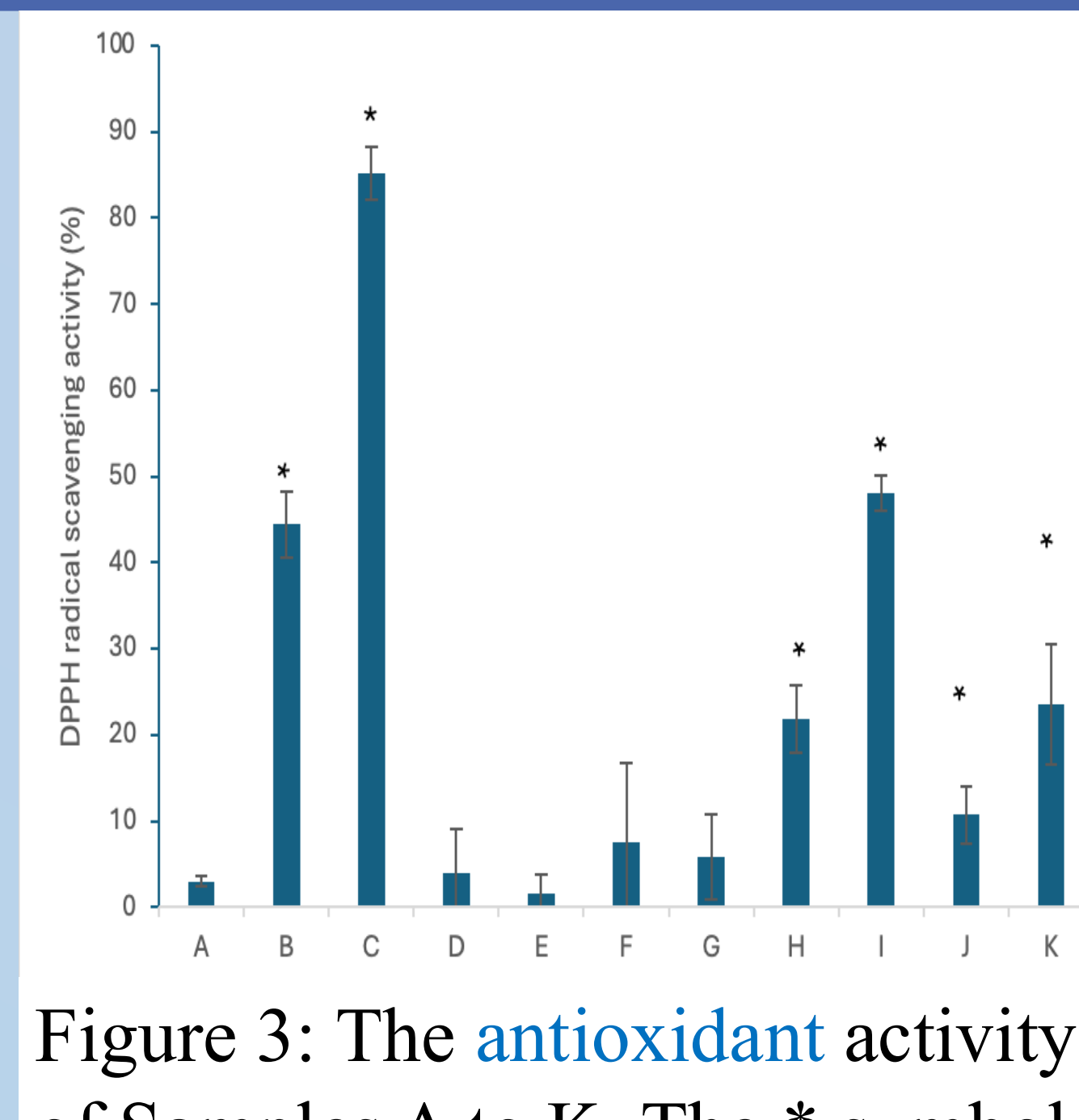


Figure 3: The antioxidant activity of Samples A to K. The * symbol represents a significant difference at $p < 0.05$ compared to Sample A.

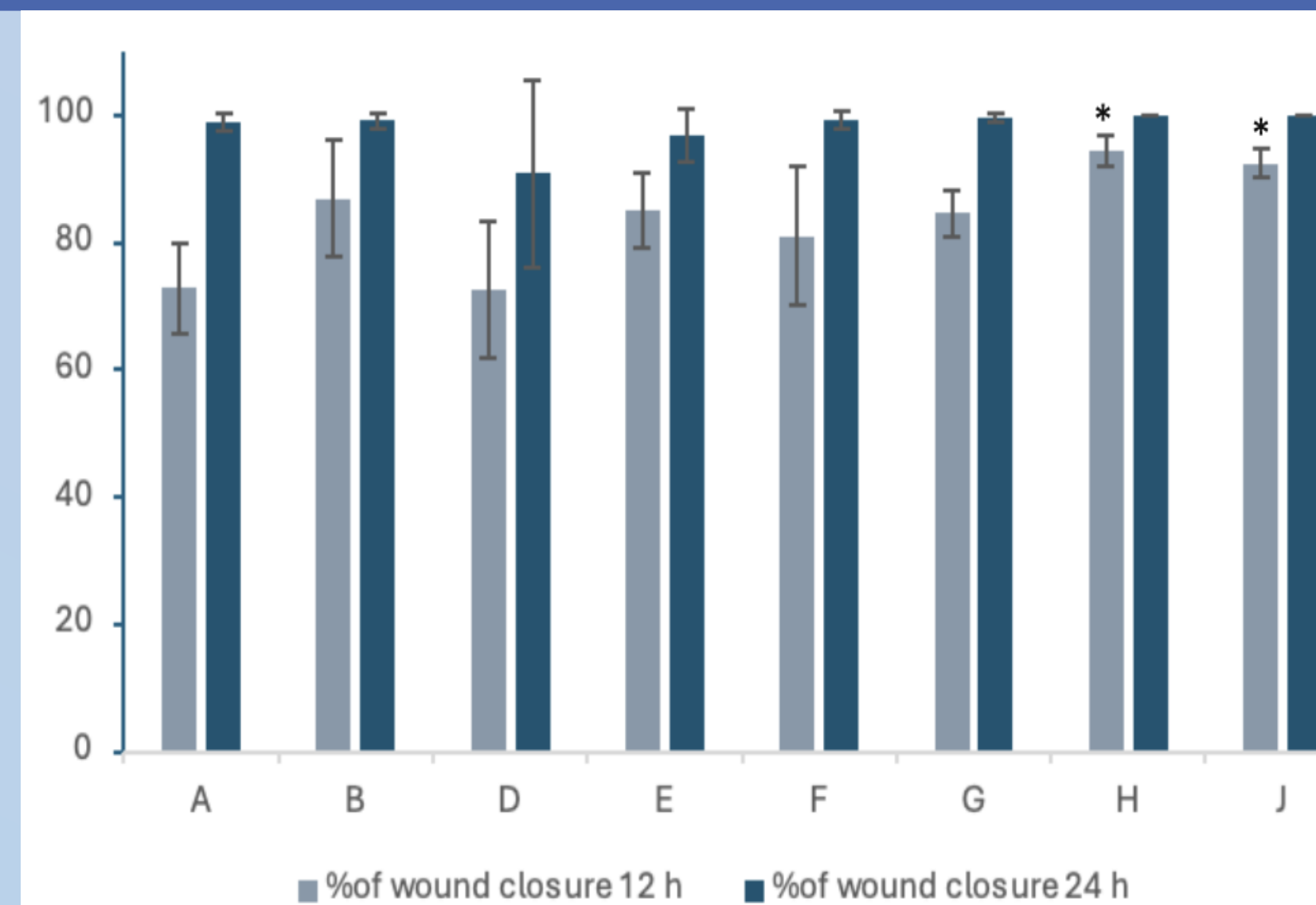


Figure 4: Scratch wound healing assay of HaCaT cells treated with Samples A to K at 12 and 24 h after wound induction. The * symbol represents a significant difference at $p < 0.05$ compared to Sample A.

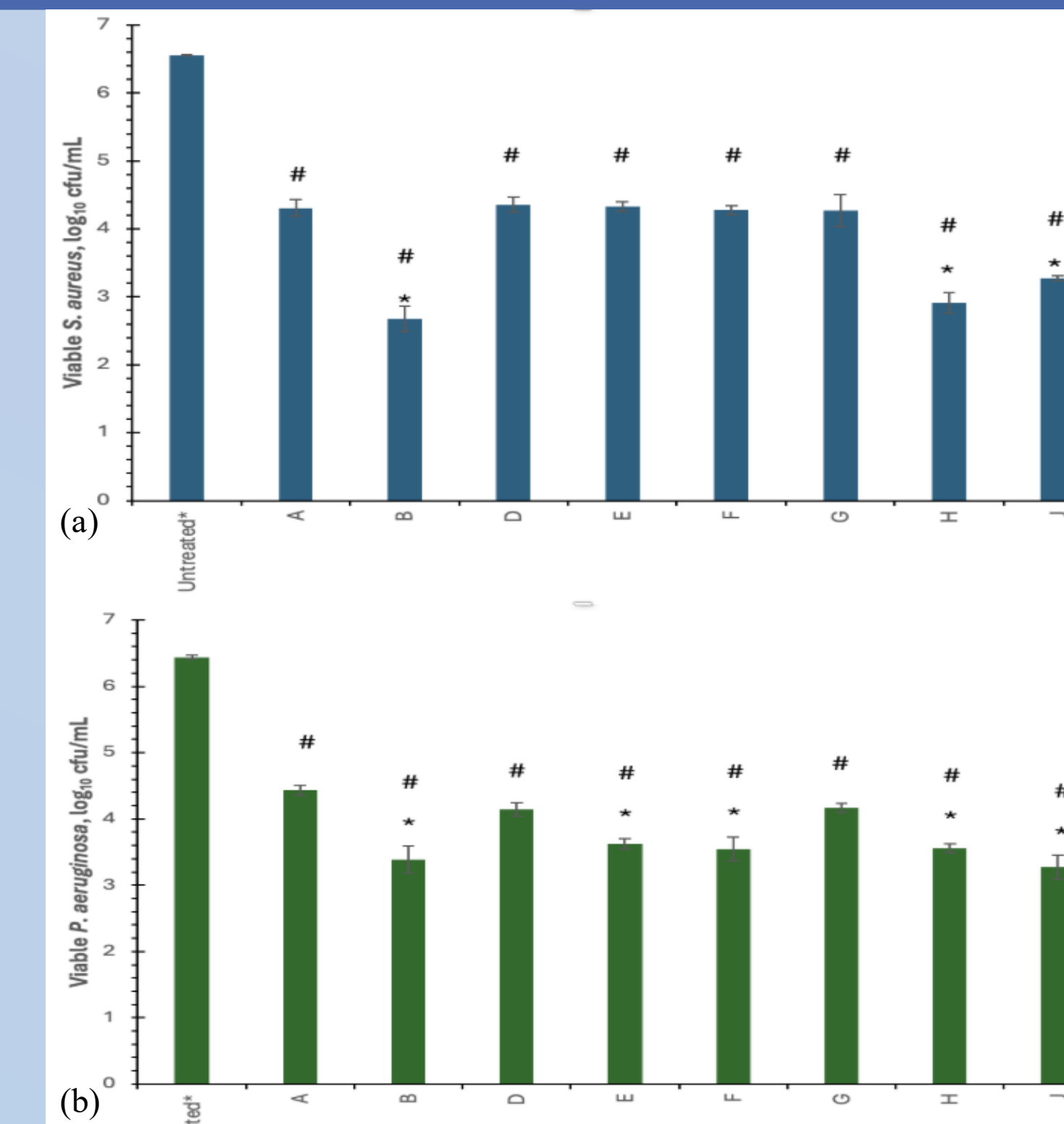


Figure 4: Antibacterial effect of Sample A to K against (a) *S. aureus* and (b) *P. aeruginosa*. The * symbol represents a significant difference at $p < 0.05$ compared to Sample A. The # symbol represents a significant difference at $p < 0.05$ against the untreated group.

CONCLUSION

- A **multifunctional scaffold** was successfully synthesised via lyophilisation.
- These scaffolds demonstrated:
- Enhanced antioxidant activity**
- Increased wound healing rates** at 12 hours following scratch induction
- Enhanced antibacterial activity.**

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