Mupirocin-loaded dressing for the treatment of chronic wounds

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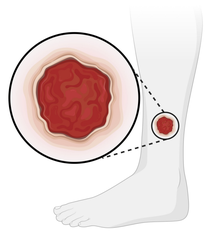
BACKGROUND



Chronic wounds, such as diabetic ulcers, are a major clinical burden. Their **impaired healing**, often caused by **inflammation**, **infection**, and **excess exudate**, leads to prolonged discomfort, higher complication risks, and **reduced quality of life**.

PURPOSE

Multifunctional biocompatible wound dressing:

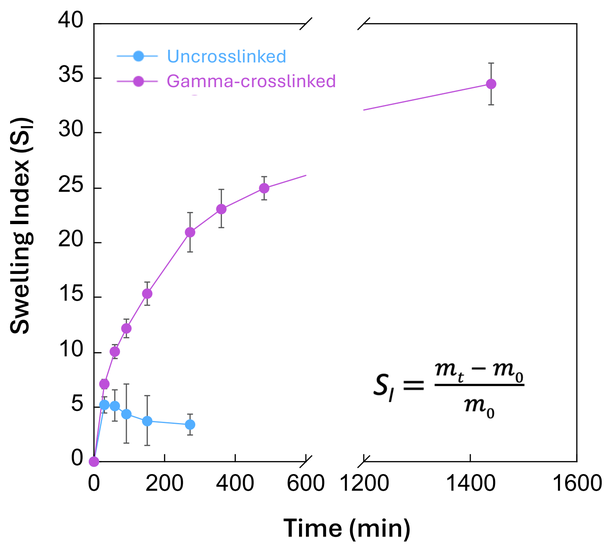
- **Exudate absorption**
- **Mechanical stability and sterilization** through gamma irradiation
- **Controlled release** of mupirocin and TPGS micelles
- **Antimicrobial activity** against common wound pathogens

MATERIALS AND METHODS

COMPONENT	CONCENTRATION (%, w/w)
PVA 87	73.42
XG	14.28
TPGS 1000	9.73
MUP	2.57

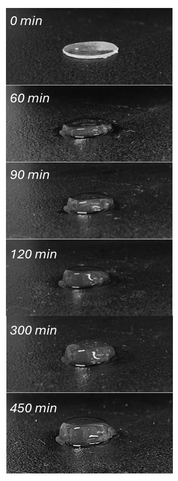
RESULTS

SWELLING STUDIES

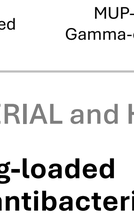


Uncrosslinked sample dissolved after 5h in PBS pH 7.4, while the **gamma-crosslinked one remained intact** upon immersion, **swelling for over 24h** and **degrading by 29.29 ± 2.44 %**.

The crosslinked film absorbed a volume comparable to the exudate produced by a wound of the same area.

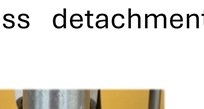


MECHANICAL PROPERTIES, WETTABILITY and ANTIOXIDANT ACTIVITY



Tensile stress test showed a statistically significant **increase in stiffness**, with the Young's modulus increasing from 499.23 ± 82.74 MPa (uncrosslinked) to 717.76 ± 7.62 MPa (crosslinked).

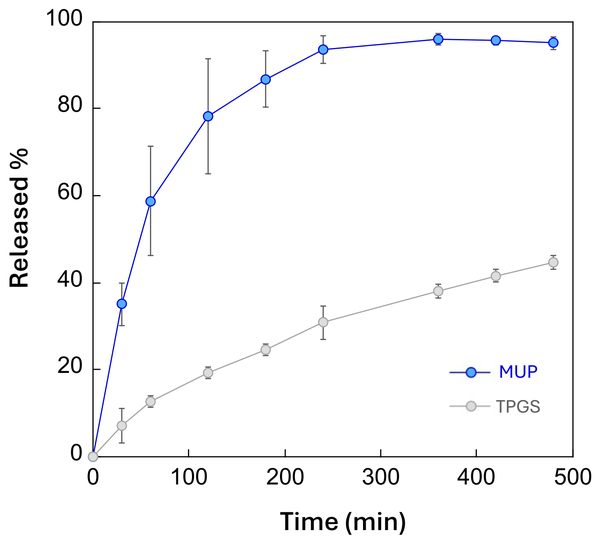
Both uncrosslinked and gamma-crosslinked films exhibited similar wettability, with contact angles of 49.18 ± 3.33° and 49.85 ± 4.62°, respectively, indicating **comparable surface hydrophilicity**.

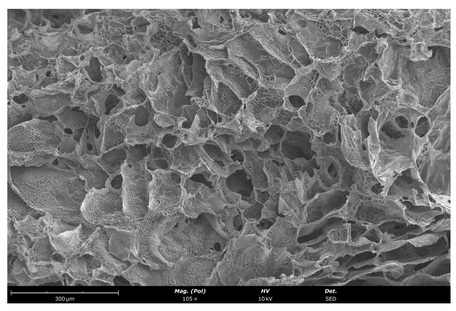


ROS

The crosslinked sample showed antioxidant activity, with DPPH radical scavenging activity of 17.26 ± 0.90 % after 1 hour and 34.87 ± 3.69 % after 24 hours, demonstrating a **time-dependent increase in radical scavenging capacity**.

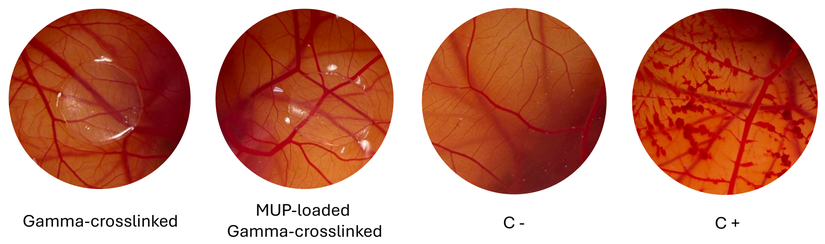
RELEASE STUDIES and SEM ANALYSIS





The **crosslinked system controlled the release of TPGS and MUP** over time, possibly due to the **tortuous path** that slowed diffusion through the network.

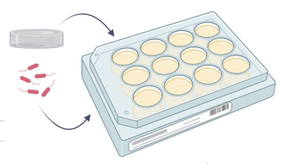
HET – CAM ASSAY

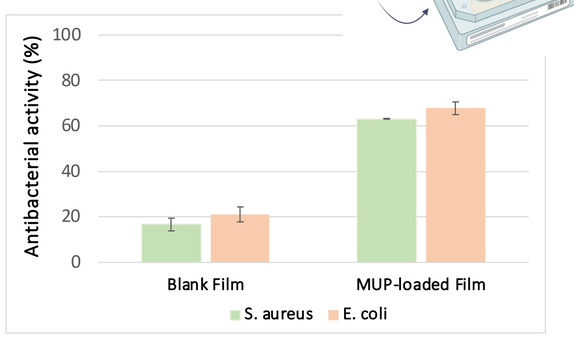


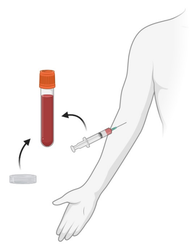
Both unloaded and loaded formulations showed **no CAM irritation after 5 min** (score < 0.9).

ANTIBACTERIAL and HEMOCOMPATIBILITY

The **drug-loaded film** showed **improved antibacterial activity** against both E. coli and S. aureus, with slightly higher efficacy against E. coli.



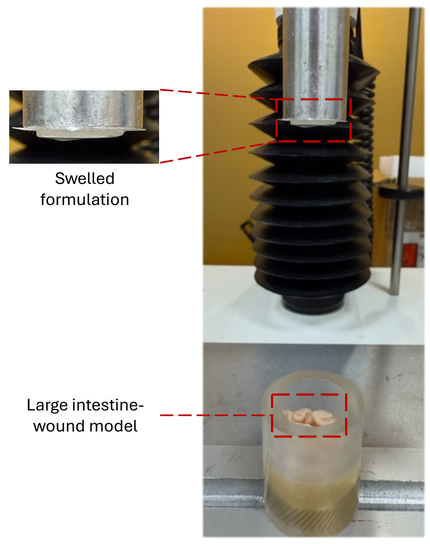




The system also demonstrated **hemocompatibility**.

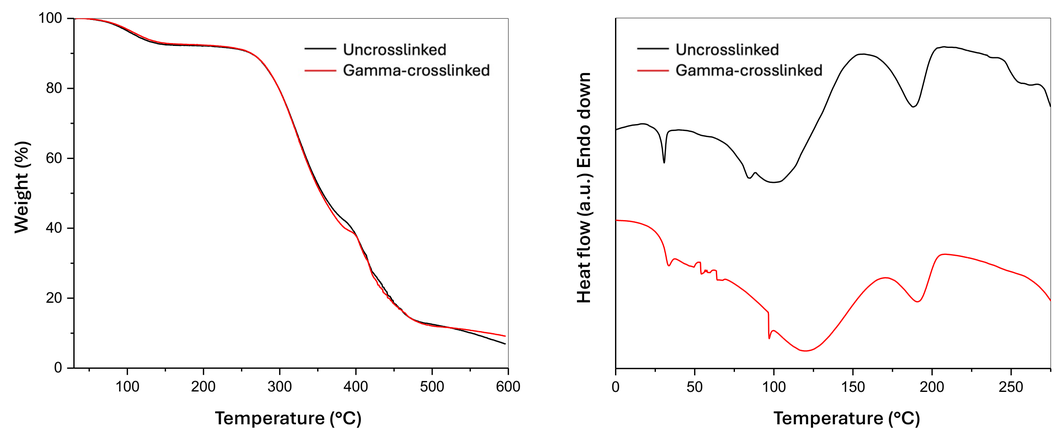
ADHESION TEST

The crosslinked and swelled film showed **moderate adhesion**, suitable for painless detachment from the skin.



Fmax = 0.023 ± 0.003 N
Smax = 1.762 ± 0.340 mm
Wad = 0.017 ± 0.002 mJ

TGA and DSC



TGA and DSC analyses revealed **minor changes in thermal properties** due to crosslinking, including a slight shift in Tg.

CONCLUSIONS

The **crosslinked film** exhibits **structural stability**, **sustained release**, **antioxidant activity**, **effective antibacterial properties**, confirmed **non-irritability**, **hemocompatibility**, and **moderate adhesion.** These features make it a **promising candidate for wound healing** applications.