

Design and Evaluation of Gallium-Rutin Gellan Gum Hydrogels as Advanced Bioactive Dressings: Physicochemical and Biological Properties



Jin Hui Yip¹, Yoon Yee Then², Yun Khoon Liew³, Lai Chun Wong²

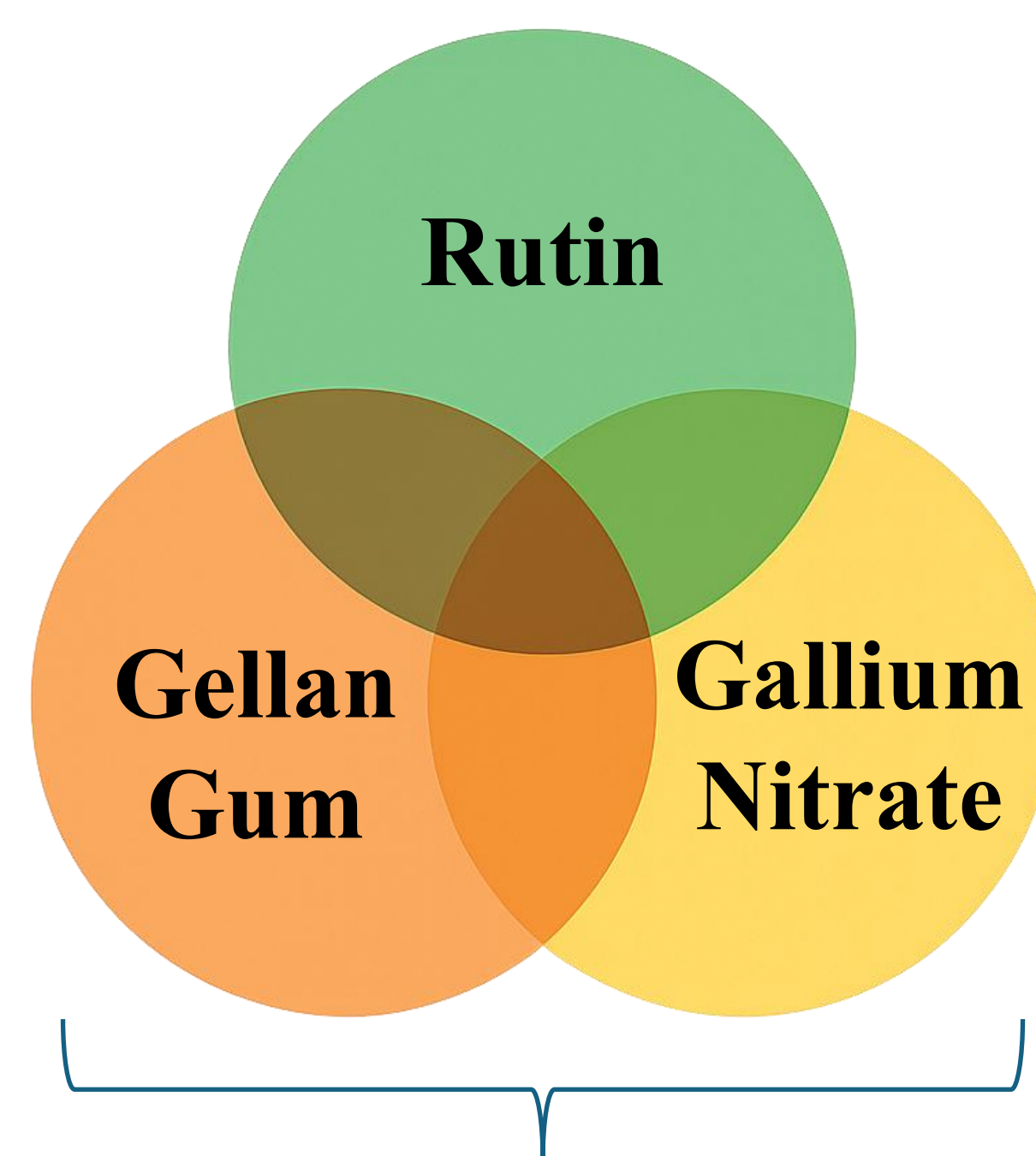
¹Department of Pharmacy, School of Pharmacy, IMU University, Bukit Jalil, Kuala Lumpur, Malaysia

²Department of Pharmaceutical Chemistry, School of Pharmacy, IMU University, Bukit Jalil, Kuala Lumpur, Malaysia

³Department of Life Sciences, School of Pharmacy, IMU University, Bukit Jalil, Kuala Lumpur, Malaysia

Introduction

Multifunctional hydrogels represent a promising class of advanced wound dressings, offering synergistic benefits including antibacterial activity, controlled therapeutic delivery, and tissue regeneration to enhance wound healing. In this study, a bioactive hydrogel was developed by cross-linking gallium ions (Ga^{3+}) with gellan gum (GG) via ionic gelation, followed by the incorporation of varying concentrations of rutin (R), a natural phytochemical renowned for its antibacterial, antioxidant, and anti-inflammatory properties. The Ga^{3+} served a dual role: reinforcing the hydrogel's structural integrity through crosslinking and exerting antibacterial effects by disrupting bacterial iron metabolism.



A multifunctional bioactive hydrogel wound dressing

Problem statement

1. How does rutin affect physicochemical characteristics and biological properties of Ga-GG/R hydrogels?

Objectives

1. To prepare gallium-rutin gellan gum hydrogels (Ga-GG/R) using ionic gelation and lyophilisation methods
2. To study physicochemical characteristics and biological properties of Ga-GG/R hydrogels.

Methodology

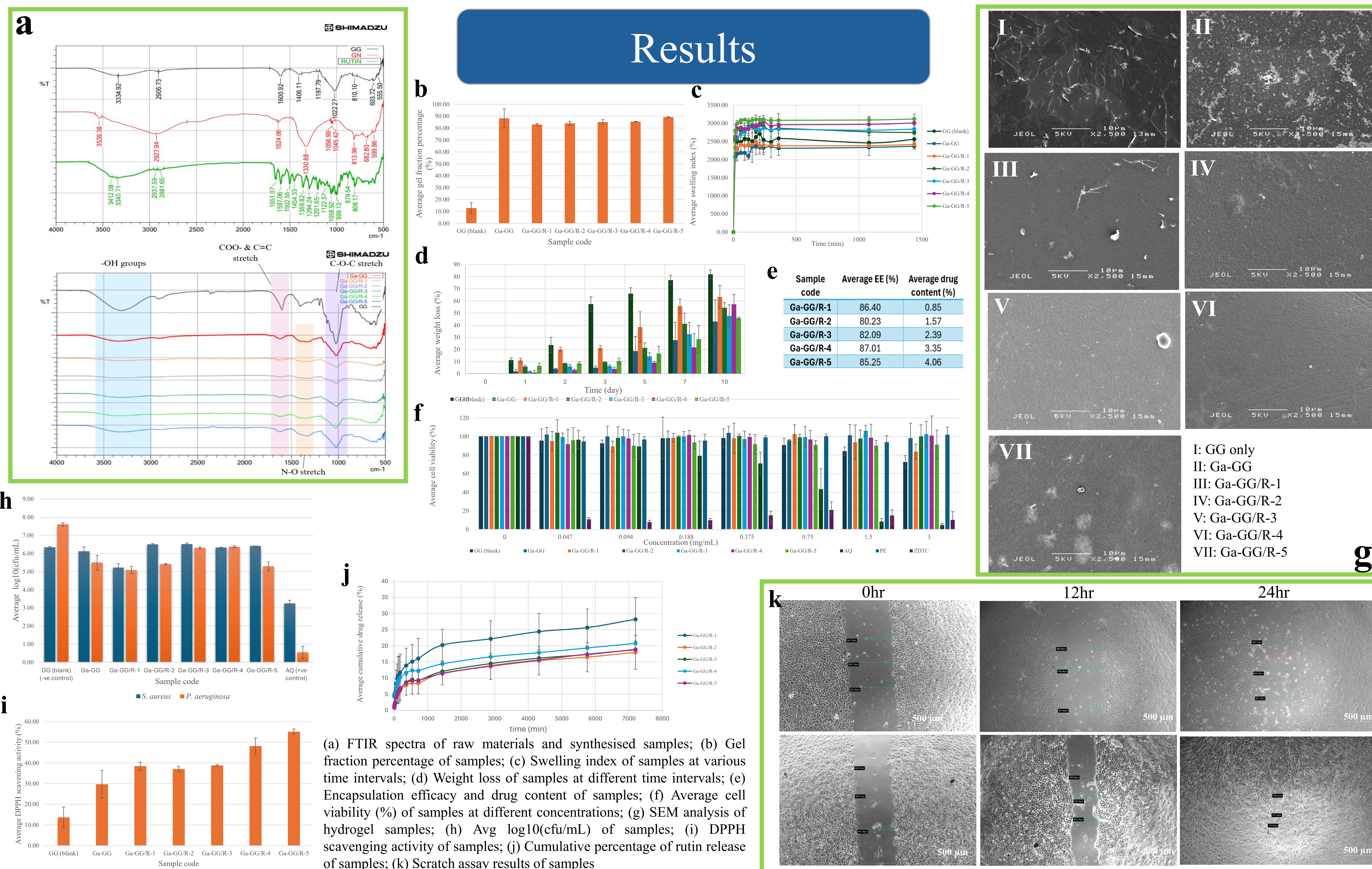
Pre-synthesis optimisation

Synthesis of Ga-GG/R hydrogels at various rutin concentration (1% - 5%)

Characterisation of Ga-GG/R hydrogels using FTIR, SEM & other physicochemical tests

Evaluation of antibacterial, antioxidant and *in vitro* wound healing properties of Ga-GG/R hydrogels

Results



Conclusion

- Ga-GG/R hydrogels were successfully prepared using ionic gelation and lyophilisation methods.
- Incorporation of rutin has enhanced the mechanical and swelling properties, as well as slowing down degradation for a more sustained release of the active substances.
- In addition, Ga-GG/R hydrogel was confirmed to be non-cytotoxic and have wound healing effect on HaCaT cells as well as resulted in improvement of antibacterial and antioxidant properties of the hydrogels.

Future work

Animal Studies

In vivo wound healing assay

Evaluation of pro-inflammatory & anti-inflammatory cytokines

Acknowledgement

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References

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