Honey/Gellan gum-based gels and dressings for cutaneous wound management

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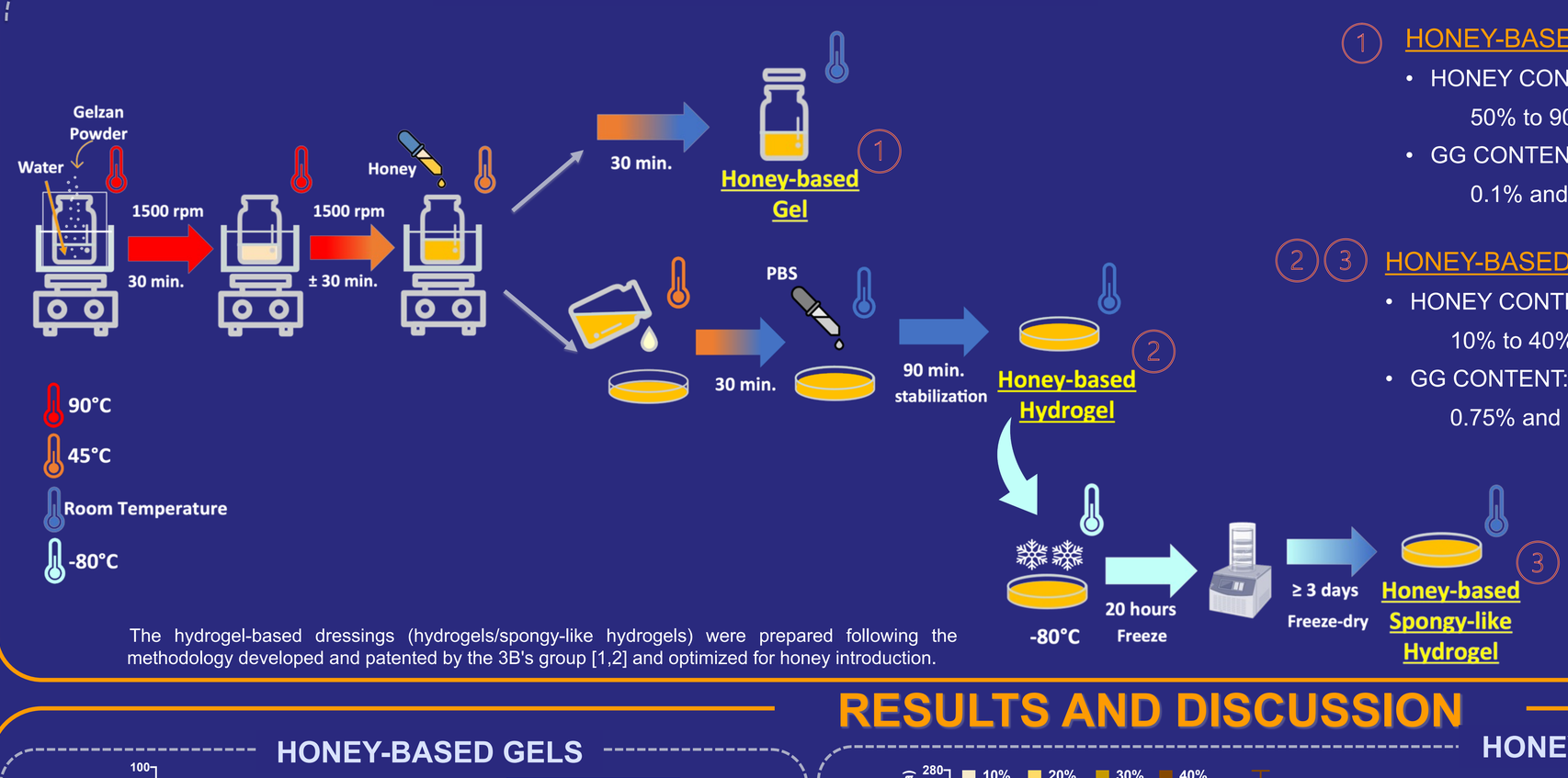
INTRODUCTION

The management of cutaneous wounds still faces innumerous difficulties, demanding the development of innovative approaches. Honey is an appealing bioactive agent due to its intrinsic properties such as antimicrobial action, elimination of necrotic tissue, maintenance of the moist wound environment and neutralization of bad odors. Additionally, gellan gum (GG) forms viscous gels at low concentrations and crosslinks through temperature/cations, making it an exquisite candidate to provide mechanical support and stability to honey-based formulations. In this work we aimed to take advantage of the individual features of those components to develop GG/honey-based gels and dressings with improved action for wound management. The honey was supplied and characterized by the company Portus Pharma.

MATERIALS AND METHODS

HONEY-BASED GELS/DRESSINGS PREPARATION



The hydrogel-based dressings (hydrogels/spongy-like hydrogels) were prepared following the methodology developed and patented by the 3B's group [1,2] and optimized for honey introduction.

CHARACTERIZATION

① HONEY-BASED GELS
- HONEY CONTENT: 50% to 90% (v/v)
- GG CONTENT: 0.1% and 0.2% (w/v)

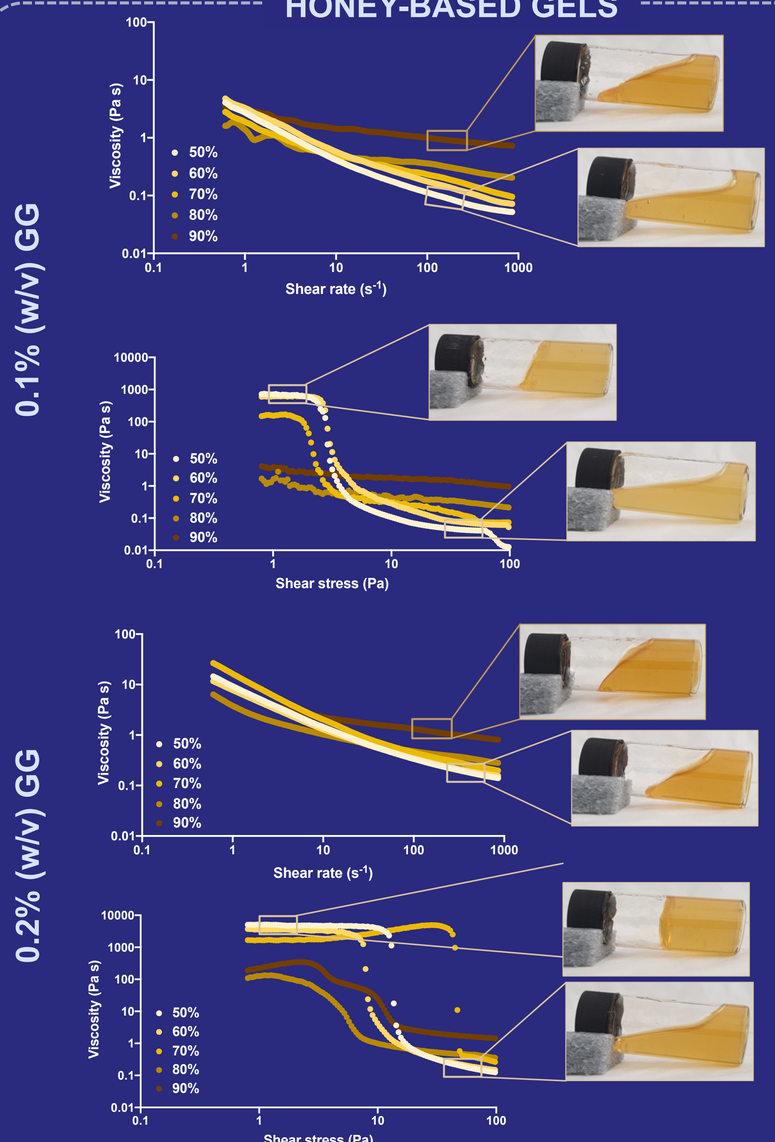
②③ HONEY-BASED DRESSINGS
- HONEY CONTENT: 10% to 40% (v/v)
- GG CONTENT: 0.75% and 1.25% (w/v)

☑ HONEY-BASED GELS
- ❑ Consistency
- ❑ Rheological Behavior

☑ HONEY-BASED DRESSINGS
- ❑ Mechanical Performance
- ❑ Water Uptake/content
- ❑ Degradation/Weight Loss
- ❑ Honey Release:
  - Directly by absorbance
  - Indirectly by released sugar quantification

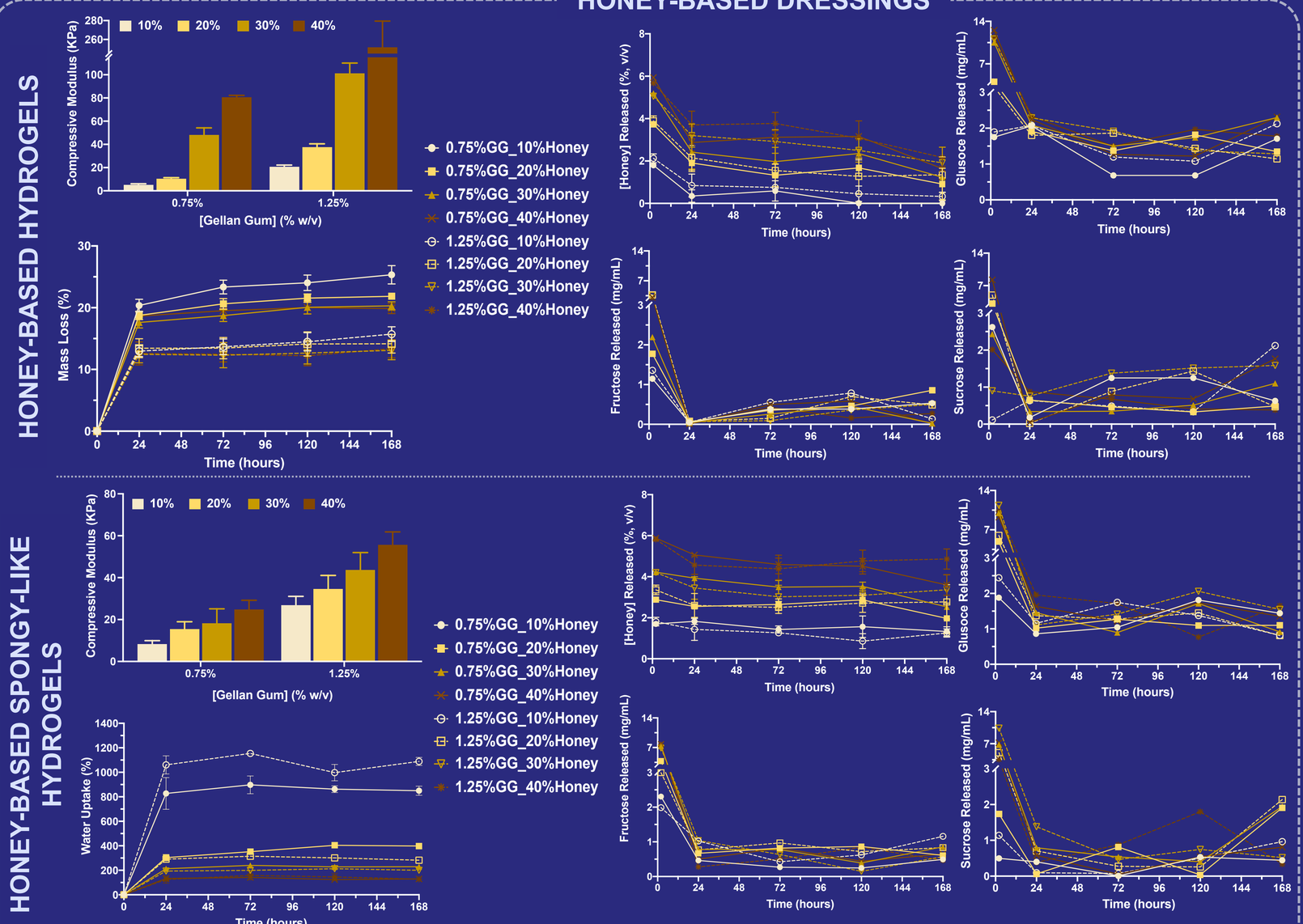
RESULTS AND DISCUSSION

HONEY-BASED GELS



All gel formulations showed a non-newtonian and shear-thinning behavior. Shear viscosityof the gels ranged between 1.7 and 705 Pa.s (at shear stress of 1 Pa). Moreover, with higher GG content were more viscous whereas gels with the highest honey amount (i.e. 80-90%) formed flowing and soft gels.

HONEY-BASED DRESSINGS



Hydrogels showed compressive modulus ranging from 5 to 251 KPa, while spongy-like hydrogels showed compressive modulus ranging from 8 to 54 KPa. Regardless the type, those dressings with higher GG presented higher stiffness. Moreover, independently of the honey amount in the dressings, the hydrogels with higher GG concentration showed lower mass loss. Spongy-like hydrogels were capable of absorbing high water amounts (~1000%), particularly those with lower honey content. When in contact with a simulated wound exudate, an initial (within the first 24 hours) burst release of honey and respective major sugars content were observed, followed by a constant release over time (until 168 hours). The release of honey is higher the higher the honey content present in the dressings.

CONCLUSIONS

In general, we were able to obtain flowing and soft gels appropriated for wound debridement. Moreover, hydrogels showed higher stiffness than spongy-like hydrogels (compressive modulus ranging from 5 to 251 KPa and from 8 to 54 KPa respectively) and both dressings were able to release honey in a controlled manner over time. Thereby, hydrogel-based dressings – honey-based hydrogels and spongy-like hydrogels – can possibly be used respectively for exudate absorption and wound hydration.

References:

[1] da Silva LP, Cerqueira MT, Sousa RA, Reis RL, Correlo VM, Marques AP, Engineering cell-adhesive gellan gum spongy-like hydrogels for regenerative medicine purposes, Acta Biomater (2014) 10(11):4787-4797, doi: 10.1016/j.actbio.2014.07.009

[2] da Silva LP, Cerqueira MT, Sousa RA, Marques AP, Correlo VM, Reis RL. Gellan Gum-Based Spongy-Like Hydrogels: Methods and Biomedical Applications Thereof. 2014. PCT/IB2014/060563, EP2983727A1, EP2983727B1, US9579417, US20160325017, WO/2014/167513

Acknowledgments:

The authors would like to acknowledge H2Cure Project (POCI-01-0247-FEDER-047032), UMINHO/BIPD/2021/18 (CC) and 2020.01541.CEECIND/CP160 0/CT0024 (LS) grants.

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