GinExtraMed: A new sustainable and biocompatible dressing based on Spanish broom and *Rosa canina* L.

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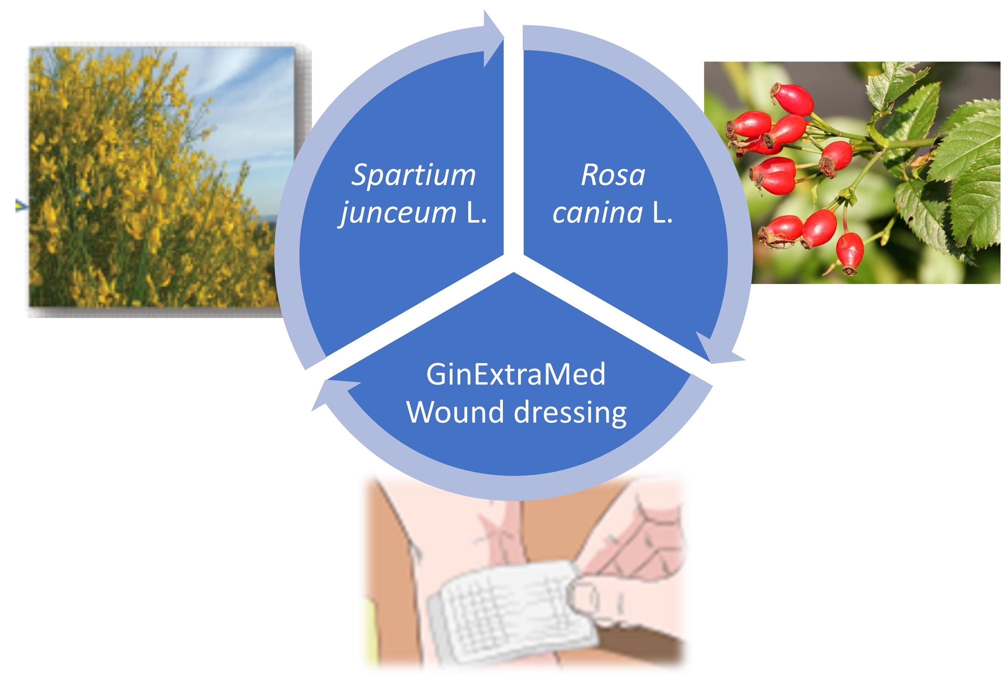
Introduction

Wound management has a substantial impact on the National Health System imposing considerable costs on society. Despite recent advances in wound-care, wound management still remains a major challenge [1]. In addition, increasing ecological consciousness stimulates the development of new sustainable wound dressings with low environmental impact [2]. In the context of bio-renewable, health-beneficial, and environmentally friendly products, Spanish broom (*Spartium junceum* L.) fibre is a viable alternative to the use of cotton to prepare wound dressings. Unlike cotton, Spanish broom grows spontaneously in all countries of the Mediterranean area; its cultivation does not require fertilizers, pesticides, herbicides and, moreover, it can be grown in soils unsuitable for food cultivation [3].
Rosa canina L. has been known since ancient times for its high ascorbic acid content and its antioxidant and anti-inflammatory properties [2].
The aim of this work was the development an innovative, environmentally friendly and biocompatible dressing based on Spanish broom impregnated with encapsulated rosehips extract (GinExtraMed) for the treatment of superficial wounds and skin lesions.



Encapsulation of rosehips extract

Hydroalcoholic rosehips extract (2 mg/mL) was encapsulated into glycethosomes (GlyEts) containing 10% of glycerol and 20% ethanol by the *solvent injection* method (**Figure 1**). Subsequently, a chemical-physical characterisation of the vesicles was carried out, specifically the pH, size, ζ potential and loading capacity were evaluated. Stability of GlyEts were assessed over a period of five months.

Figure 1. Rosehips extraction and encapsulation

GlyEts Characterization

GlyEts showed a size of 144.0 ± 9.7 and 207.6 ± 13.0 nm for unloaded and loaded nanovesicles, respectively. The extract encapsulation efficiency (EE) was up to 90% (**Table 1**). The vesicles characterization showed a good stability for up to five months (**Figure 2**), in agreement with the measurement of the ζ-potential witch was -29.24 ± 4.66 mV for the loaded nanovesicles.

Table 1. GlyEts characterization

	Size (nm) unloaded	Size (nm) Loaded	PDI Unloaded	PDI Loaded	ζ (mV) unloaded	ζ (mV) loaded	EE%	pH unloaded	pH loaded RC
GlyEts	144.0 ± 9.7	207.6 ± 13.0	0.174 ± 0.028	0.173 ± 0.041	-14.73 ± 4.46	-29.24 ± 4.66	91.0 ± 3.5	4.27 ± 0.01	4.18 ± 0.07

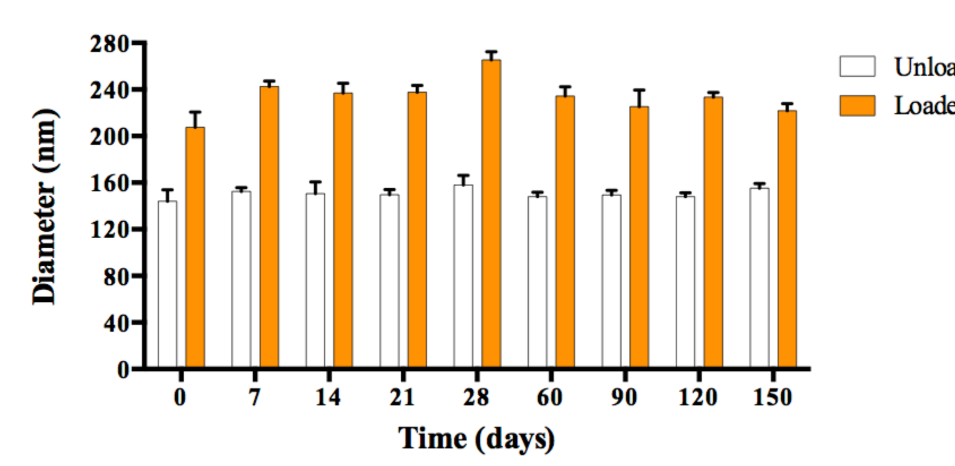


Figure 2. GlyEts stability at 4.0 ± 1.0°C

Biocompatibility studies

The biocompatibility of GlyEts was evaluated on a human dermal fibroblast cell line (WS1) through a MTT assay. All tested concentrations of encapsulated extract (0.1, 0.05 and 0.025 mg/mL) showed a high biocompatibility as no cell toxicity was observed (**Figure 3**).

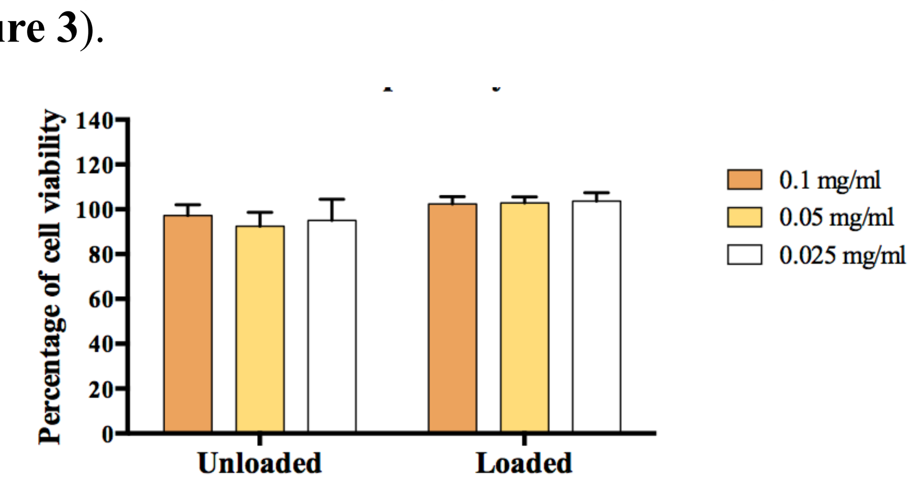


Figure 3. GlyEts biocompatibility on a human dermal fibroblast cell line.

Wound dressings impregnation

Spanish broom dressings were soaked with glycethosomal suspension of rosehip extract (**Figure 4A**). Before impregnation, loaded glycethosomes were stained with a green fluorescence dye (DiO) and observed through confocal microscopy to visualize them. As shown in **Figure 4B** it is possible to observe nanovesicles localization between the Spanish broom fibers.

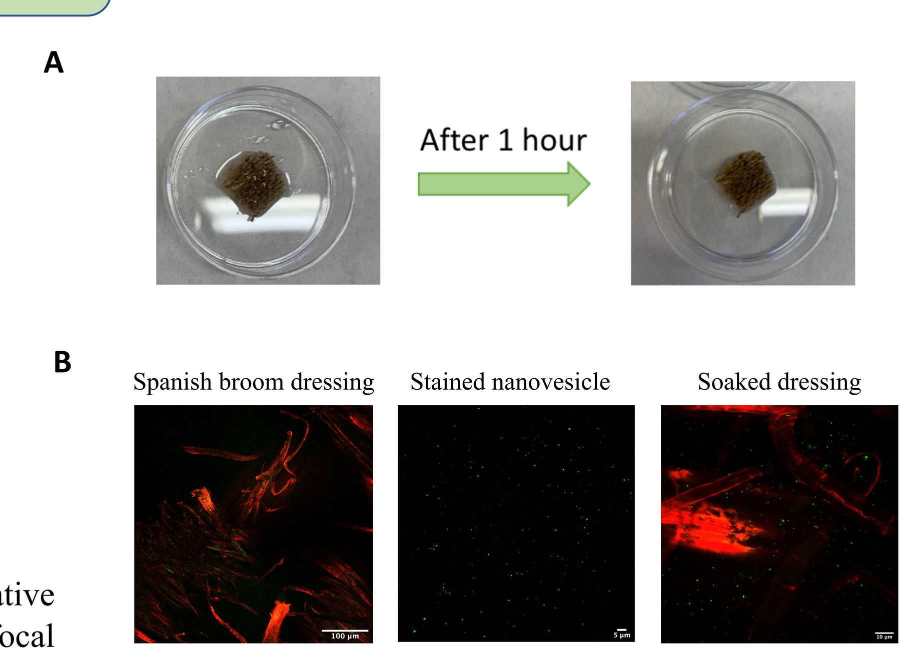


Figure 4. Spanish broom dressing impregnation. A) Representative images of impregnation at different times. B) Representative confocal images (10 and 40X). In red are acquired Spanish broom fibers and GlyEts are stained in green.

Scratch assay

Impregnation of the Spanish broom dressings with the nanovesicular systems was performed and its effect on migration capacity was assessed. The loaded GlyEts compared to the unloaded demonstrates the ability to reduce the healing. Indeed, as showed in **Figure 5**, the loaded formulation leads to complete closure of the scratch after about 32 hours compared to the 40 of the unloaded.

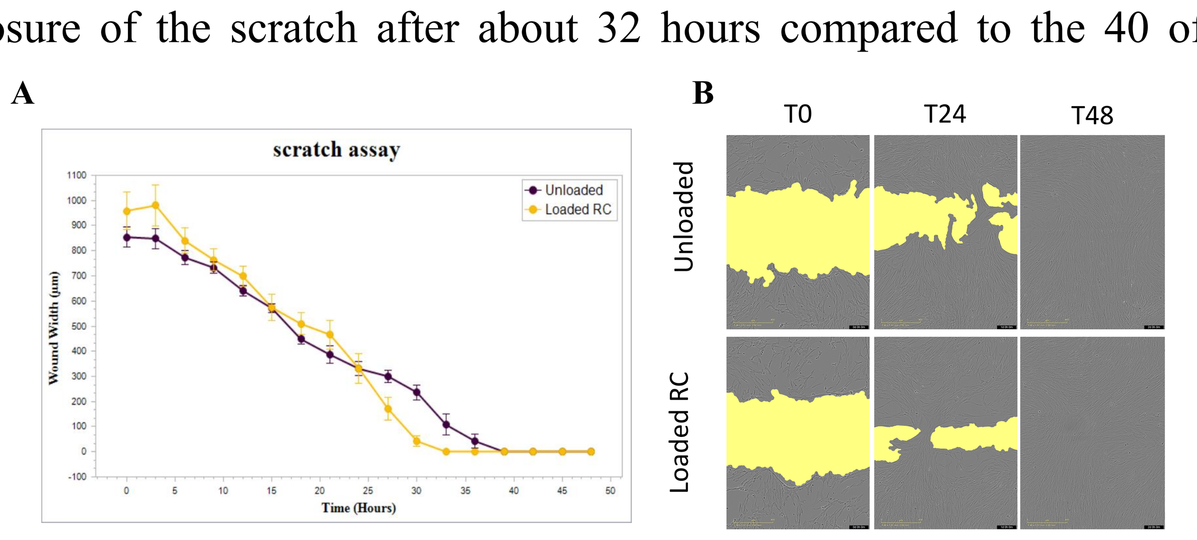


Figure 5. Healing capacity. A) Monitoring of wound width for 48 h. B) Representative phase imaging showing the uncovered area at 0, 24, and 48 h after wounding.

Conclusions

GinExtraMed dressings were prepared by impregnation with GlyEts loaded with hydroalcoholic rosehips extract. These innovative wound dressings showed a high biocompatibility and were able to favour the closure of the wound. Taking into account these results, GinExtraMed could represent an interesting alternative to cotton dressing for the treatment of skin wounds.

References

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