

## Article

# Marine and Agro-Industrial By-Products Valorization Intended for Topical Formulations in Wound Healing Applications

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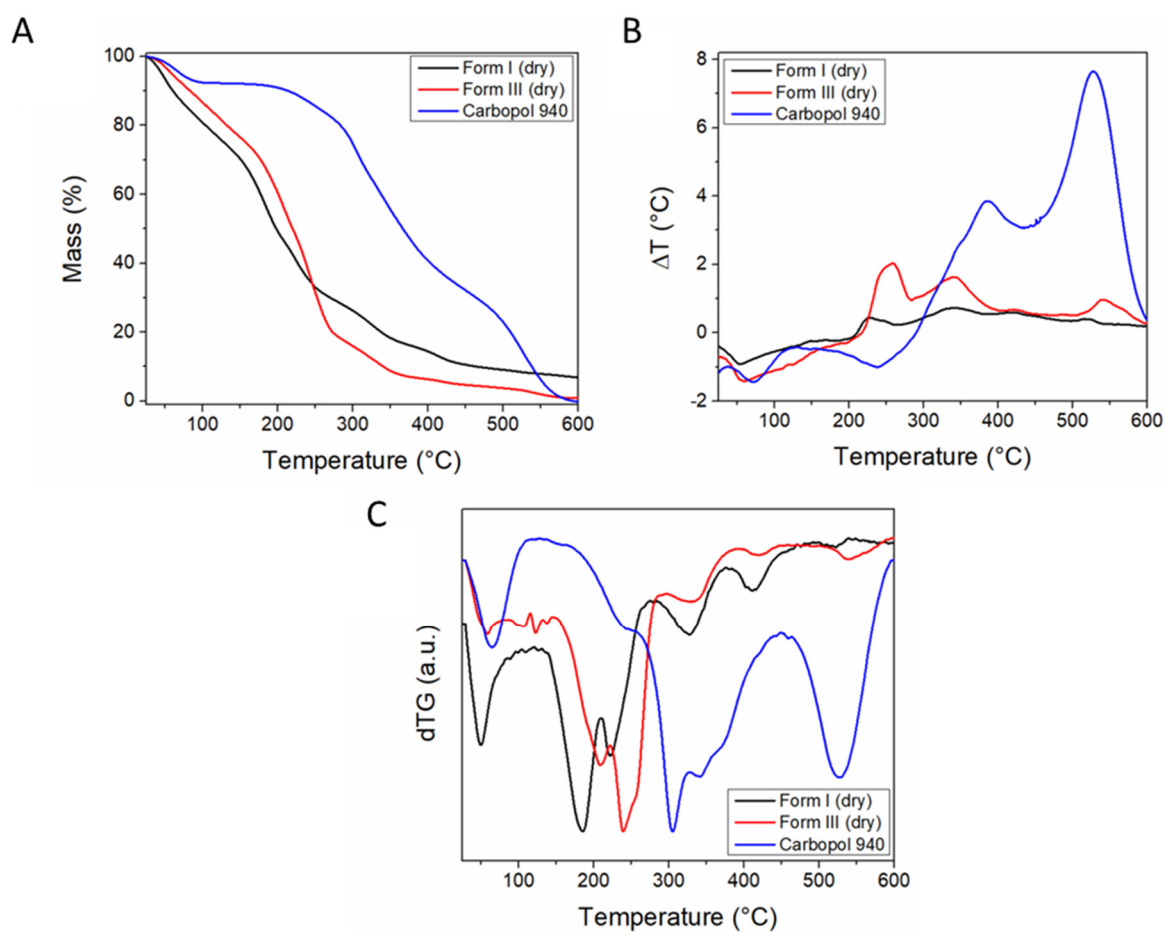
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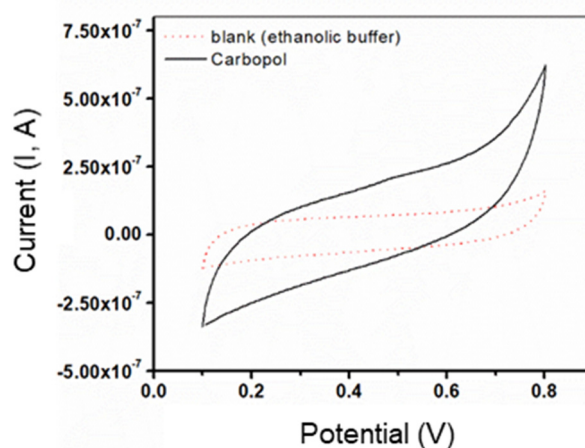
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**Abstract:** Over the past years, the research attention has been more focusing on waste-derived, naturally-derived and renewable materials, in the view of a more sustainable economy. In this work, different topical formulations were obtained from the valorization of marine and agro-industrial by-products and the use of Carbopol 940 as gelling agent. In particular, the combination of extracts obtained from the marine snail, *Rapana venosa*, with *Cladophora vagabunda* and grape pomace extracts, was investigated for wound healing purposes. *Rapana venosa* has demonstrated wound healing properties and antioxidant activity. Similarly, grape pomace extracts have showed to accelerate the healing process. However, their synergic use has not been explored yet. To this aim, four different formulations were produced. Three formulations differed for the presence of a different extract of *Rapana venosa*: marine collagen, marine gelatin and collagen hydrolysate, while another formulation used mammalian gelatin, as further control. Physico-chemical properties of the extracts as well as of the formulations were analyzed. Furthermore, thermal stability was evaluated by thermogravimetric analysis. Antioxidant capacity and biological behavior, in terms of cytocompatibility, wound healing and antimicrobial potential were assessed. The results highlighted for all the formulations (i) a good conservation and thermal stability in time, (ii) a neutralizing activity against free radicals, (iii) and high degree of cytocompatibility and tissue regeneration potential. In particular, collagen, gelatin and collagen hydrolysate obtained from the *Rapana venosa* marine snail represent an important, valuable alternative to mammalian products.

**Keywords:** *Rapana venosa* compounds; *Cladophora vagabunda*; grape pomace; marine and agro-industrial by-products valorisation; wound healing; topical formulations



**Figure S1.** Results from (A) Thermogravimetric Analysis (TGA), (B) Differential Thermal Analyses (DTA) and (C) the first derivative of the TGA signal (dTG) of the Carbopol 940, formulation I and III, dried at 40 °C for 14 days.



**Figure S2.** Cyclic Voltammetry (CV) of Carbopol 940.