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SEA URCHIN-DERIVED COLLAGEN AND ITS POTENTIAL IN SKIN REGENERATION APPLICATIONS

Humans have always exploited marine ecosystems as source of inspiration, food, bioactive compounds and biomaterials. Marine organisms are interesting for their huge potential in both basic research and applied biotechnology/biomedicine. ~~For instance~~, Sea urchins are currently actively investigated as eco-friendly source of valuable biomaterials, mainly collagen. This is one of the most used material/molecule to produce devices for different biomedical applications. For instance, collagen-based skin substitutes (SS) are currently considered promising in the skin injury care field to solve ulcers, burns and chronic wounds with tools alternative to skin grafts. However, the existing SS are mainly produced with mammalian collagen and lack important features that impair their overall performances. Hence, new sources of collagen as well as new SS design are largely explored.

In this study, fibrillar collagen was extracted from sea urchin food industry wastes and employed to produce bi-layered SS (2D layer + 3D scaffold) that were characterised to evaluate their suitability for regenerative medicine in terms of aminoacid composition, ultrastructure, mechanical stability, permeability to water and bacteria, and cell viability, proliferation and infiltration.

Our results indicate that the aminoacid composition and relative abundance of sea urchin collagen is rather similar to the human one. Furthermore the thin and dense 2D layer, developed to resemble the skin epidermal layer, shows a high mechanical resistance, blocks water evaporation and bacteria infiltration. The sponge-like 3D scaffold, developed to resemble the skin dermis layer, shows good mechanical stability in wet conditions and it is biocompatible since mammalian cells are viable, proliferate and infiltrate within the scaffold. Preliminary *in vivo* tests with sheep skin models suggest a good biocompatibility and efficacy of the produced devices, although further studies must be addressed to carefully verify these results.

Overall, marine skin substitute might be innovative and effective tools for future tissue regenerative medicine applications. Moreover, sea urchins might be considered an eco-friendly source of a high-value by-product and a pilot recycling food waste chain at a national level should be started to test the actual feasibility of this circular economy approach.