

## **Valorization of Sea Urchins Waste for Innovative Products and Diversified Supply Chains. A Multidisciplinary Research Project**

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### **Abstract**

Waste recycling and valorization are main societal challenges and two of the pillars of the Circular Economy approach. In this framework, the recently launched CIRCULAR and BRITEs projects aim at completely recycling a food by-product, namely sea urchin wastes originating from food industry (restaurants and seafood enterprises) and transforming them into innovative products, addressed to specific application fields:

- innovative collagen-made biomaterial for skin regeneration;
- alternative calcium and antioxidant rich supplement feed for animals.

In this contribute we will present an overview of the main aspects of these on-going multidisciplinary projects, which will be detailed in other more specific talks/posters. Around 75,000 tons of wild sea urchins are sold annually worldwide; however, their consumption is limited to their gonads, so that most part of the animal ends up in waste. The CIRCULAR and BRITEs projects aim to use part of the sea urchin wastes to extract

highly valuable marine collagen and produce tailored medical devices (skin substitute) for skin wound healing and regeneration. These bilayered membranes will be assessed for their regeneration efficiency in animal models that mimic human conditions. The remaining part of the waste will be dedicated to the production of a bioactive calcium-rich flour (containing antioxidants) to be used as supplement feed for layer hen or sea urchins. The former need high amount of Ca to produce high quality eggs, the latter to rapidly grow and reach the market size. Normally the major source of Ca in animal feeding is limestone which, however, has the considerable disadvantage of variability of Ca content; furthermore, as inorganic material, it cannot provide other bioactive molecules which can be useful to further support animal welfare and productivity. The development of an optimal feed for sea urchins will allow to completely close the “waste circle” while promoting sea urchin aquaculture and reducing the impacts on natural stocks. In this context, the juridical analysis is fundamental, because the “end of waste” regulation is unclear and based on case-by-case authorizations. Assessing the juridical requirements for the CIRCULAR and BRITe projects to be replied in the market, along with their economic sustainability and environmental impacts (Life Cycle Assessment), the interdisciplinary research team will try to set up new and reliable supply chains connecting sea urchin processing SMEs to the final end users (biopharmaceutical enterprises, feed mill companies, poultry farmers and aquaculture enterprises), allowing a true by-product valorisation.

**Keywords:** sea urchin, circular economy, marine collagen biomaterial, animal feed