Recovering inorganic biomaterials from seafood industry wastes: properties and applications of soft calcite extracted from mussel shells

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Global fisheries and aquaculture production reached an all-time record of 214 million tonnes (MT) in 2020, and they will play an increasingly important role in providing food and nutrition in our future. The world's consumption of aquatic foods will continue to rise with the world's population, but growth must be sustainable. Aquatic animal production is forecast to grow another 14% by 2030 and of the total production molluscs comprised 13%, about 17 MT every year. That is to say discarded shells with high disposal costs and considerable environmental impacts. Here we focus on mussel shells waste as a valuable raw material to be biorefined, to obtain $CaCO_3$-based products with an established market or even innovative materials for advanced applications. *Mytilus galloprovincialis* sp. shells are a renewable source of biogenic $CaCO_3$, currently obtained by mineral extraction from rocks, containing up to 99.9% of calcite and aragonite. Recovering shells will relieve strain on landfills and represents a sustainable strategy to implement the blue economy by obtaining high value-added products. We are investigating the intriguing properties of soft calcite, an inorganic biomaterial with a high specific surface, as confirmed by morphological analyses. We are currently improving its preparation method to make the process more sustainable and scalable and we are testing a potential application of calcite as substitute of other high impact and non-renewable materials for the removal of aqueous contaminants. Specifically, the results relevant to the adsorption of a new emerging pollutant (Tetracycline) will be presented.