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SEAFOOD WASTE-BASED MATERIALS FOR SUSTAINABLE FOOD PACKING: FROM WASTE TO WEALTH

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ABSTRACT Sustainable development is a global goal that involves an interdisciplinary approach to addressing current and future challenges related to the environment, climate change, economic limitations and resource efficiency. In this context, the recovery of available and high-potential waste for the manufacture of value-added products that facilitate the recycling of resources and energy fulfills the significant objectives of a circular economy.

Renewable and biodegradable biopolymers from seafood waste are recognized as promising alternatives for developing sustainable food packaging materials and increasing resource efficiency.

• Introduction

Recently, it was shown that fish gelatin and chitosan extracted from seafood waste with antioxidant and antimicrobial properties could be considered suitable alternatives to plastic products for food packaging to reduce food spoilage, post-processing operations and to long period of validity

• Material and method

- The crustacean carapace is the predominant source of chitin, which is the richest polysaccharide in nature, following cellulose. Chitin is chemically a cellulose-like polysaccharide chemically, where the hydroxyl group at the C2 position is replaced by an acetamide group, which makes chitin an insoluble polymer and restricts its application. However, the chitosan obtained after the deacetylation of chitin is soluble in acidic solutions, which enhances the processability and other functional characteristics, such as antibacterial properties associated with the presence of amine groups. Chitosan's antimicrobial properties, non-toxicity, ability to bond with metal oxides, and biodegradability make it a desirable material for a variety of food.

• Results and discussions

Although new biodegradable food packaging materials using chitosan and/or gelatin-based films and coatings are available, more constructive research is needed on the valorization of seafood waste. Future research directions may involve considering the following points: (i) The functional components derived from seafood by-products need to be further integrated into the entire food packaging cycle, including the following: low complexity synthetic routes, low cost component materials, robust application properties such as excellent moisture exchange properties and low oxygen permeability, and greater ductility, tensile strength, and flexibility. (ii) Further developments with respect to edible packaging films based on natural biopolymers should be explored via the selection of biodegradable biomaterials, which is conducted on the basis of establishing favorable quality safety measures and reducing consumer concerns about potential allergenicity.

FIGURE 1. Distribution of published papers over the last two decades.

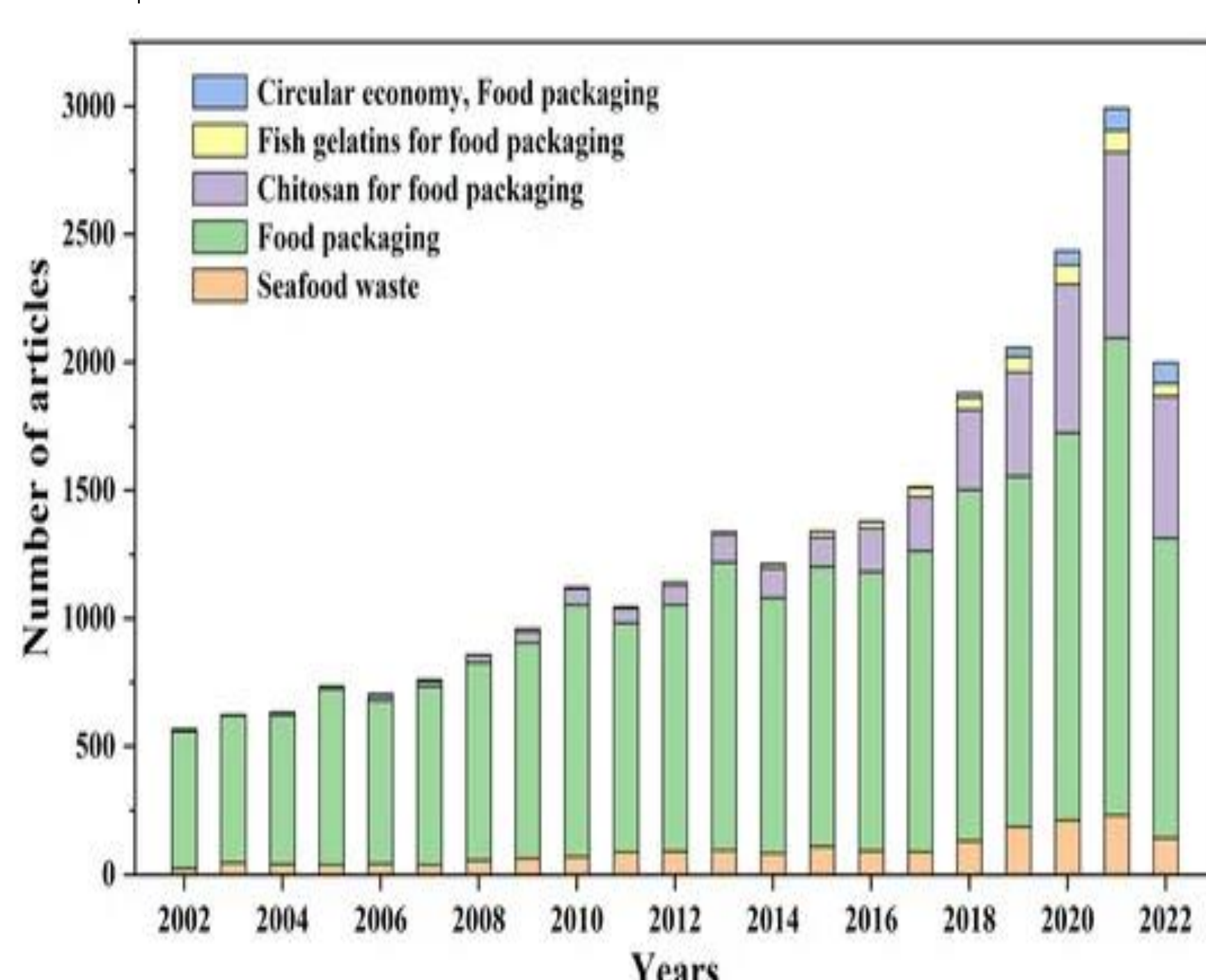


FIGURE 3. Number of fishes discarded in recent decades

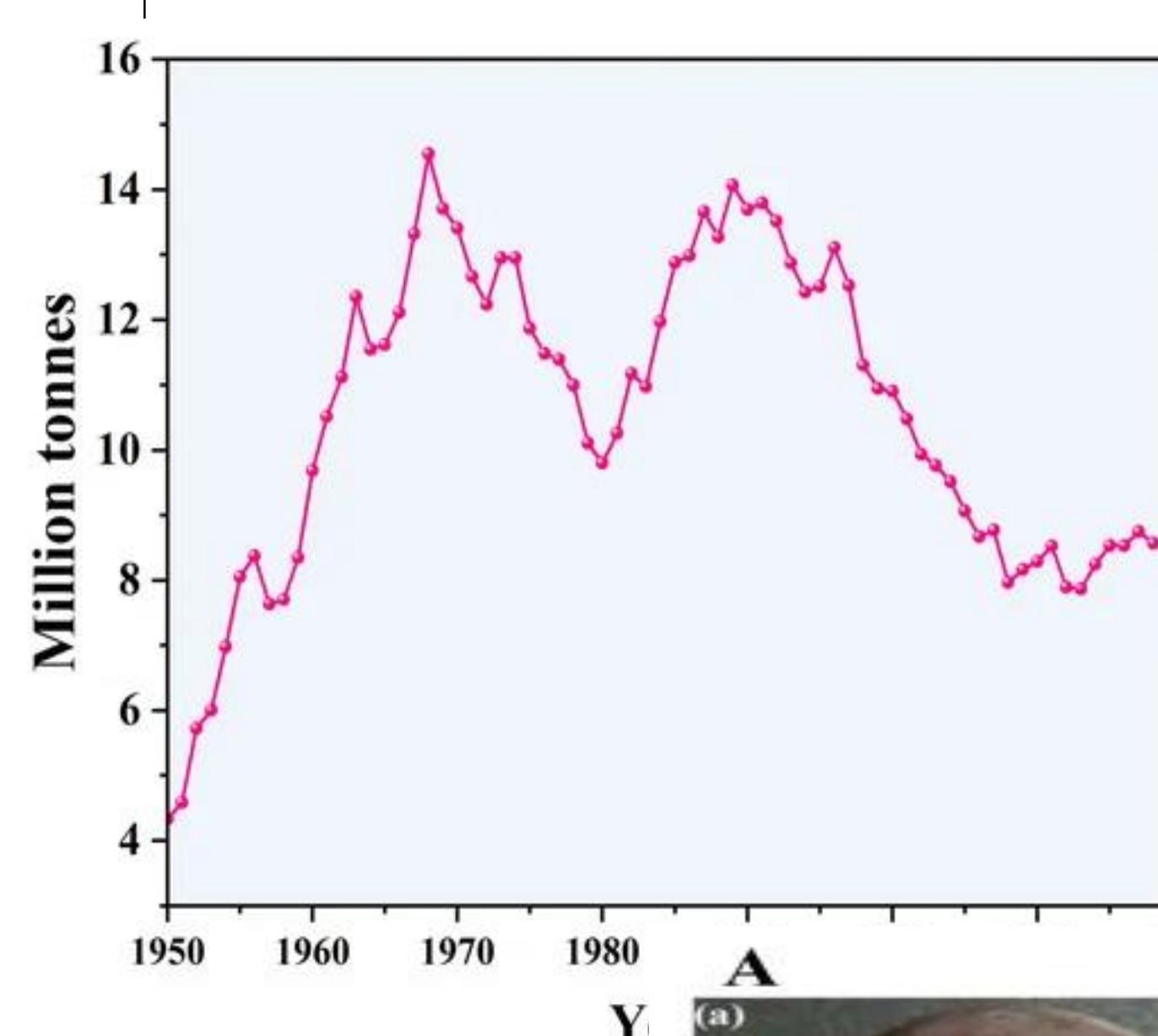


FIGURE 2. The world production of capture fisheries and aquaculture in 2020.

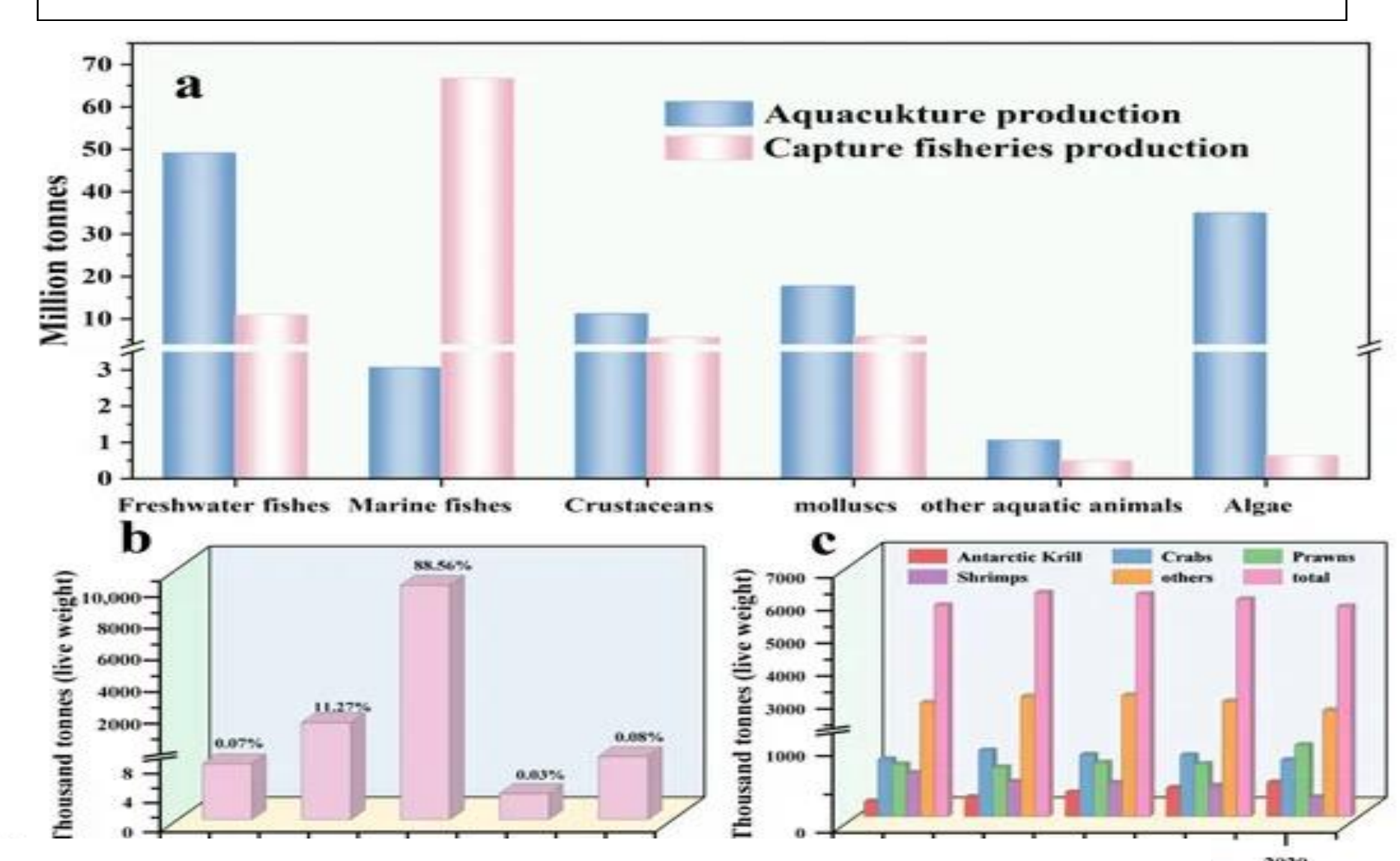
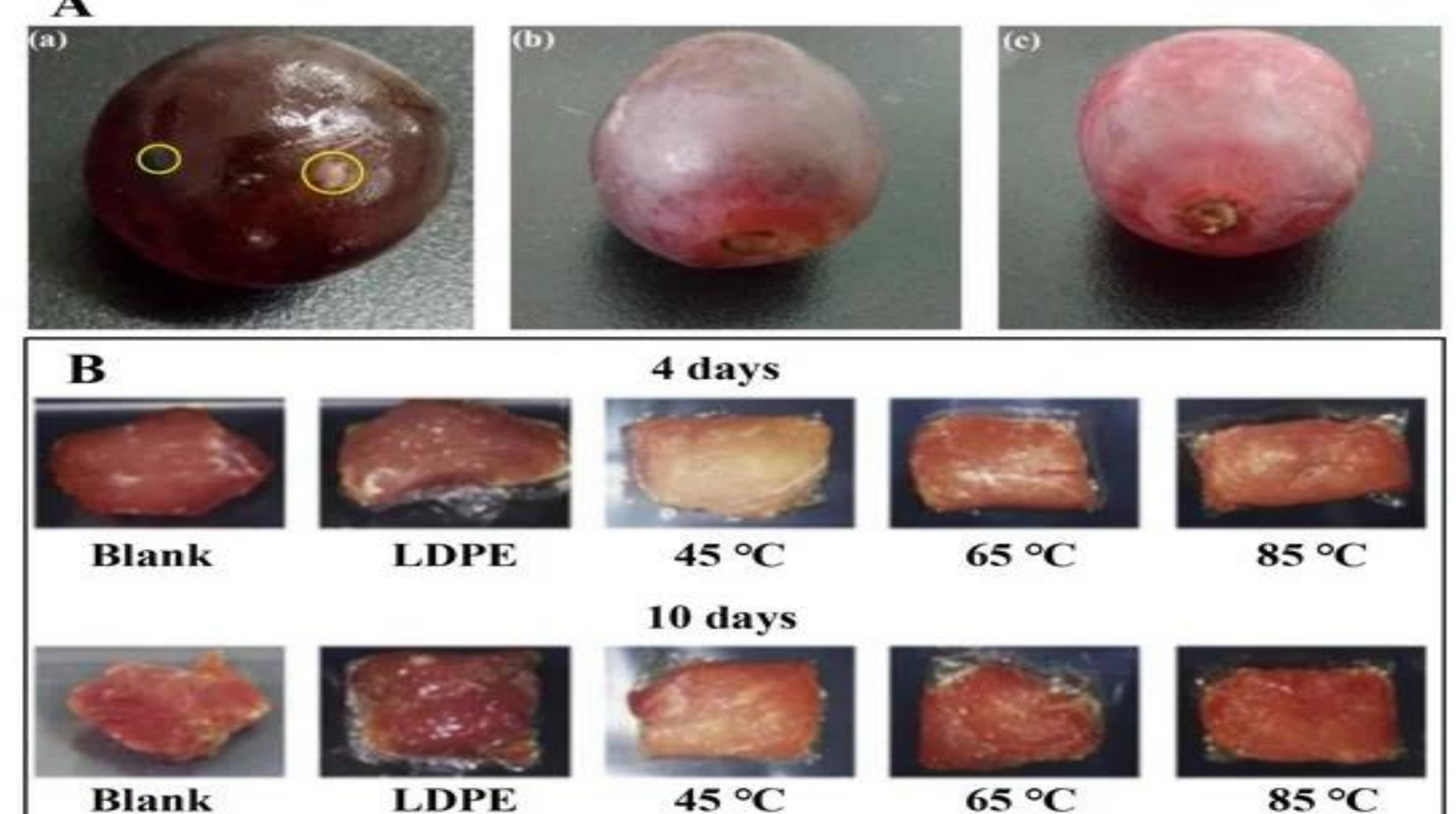


FIGURE 4. Chitosan-based films for food packaging. (A) Preservation of red grape packed in different materials at 37 °C for 6 days: (a) plastic wrap; (b) pure chitosan film; (c) chitosan-TiO₂ film, reprinted from [84] with permission. (B) The appearance of chilled meat packaged with chitosan films dried at different temperatures samples during 10 d storage at 4 °C.



- Conclusion.** In conclusion, utilizing seafood byproducts to produce food packaging materials is potentially environmentally sustainable and economically viable, as it saves energy and resources, reduces waste generation, and prevents littering. Importantly, the behavior of biodegradable packaging materials at different end-of-life scenarios should be tested to determine the best disposal route, which is an important indicator associated with the reduction in plastic waste.
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