

# ALIMAR Project: Valorization of Mediterranean jellyfish during summer blooms

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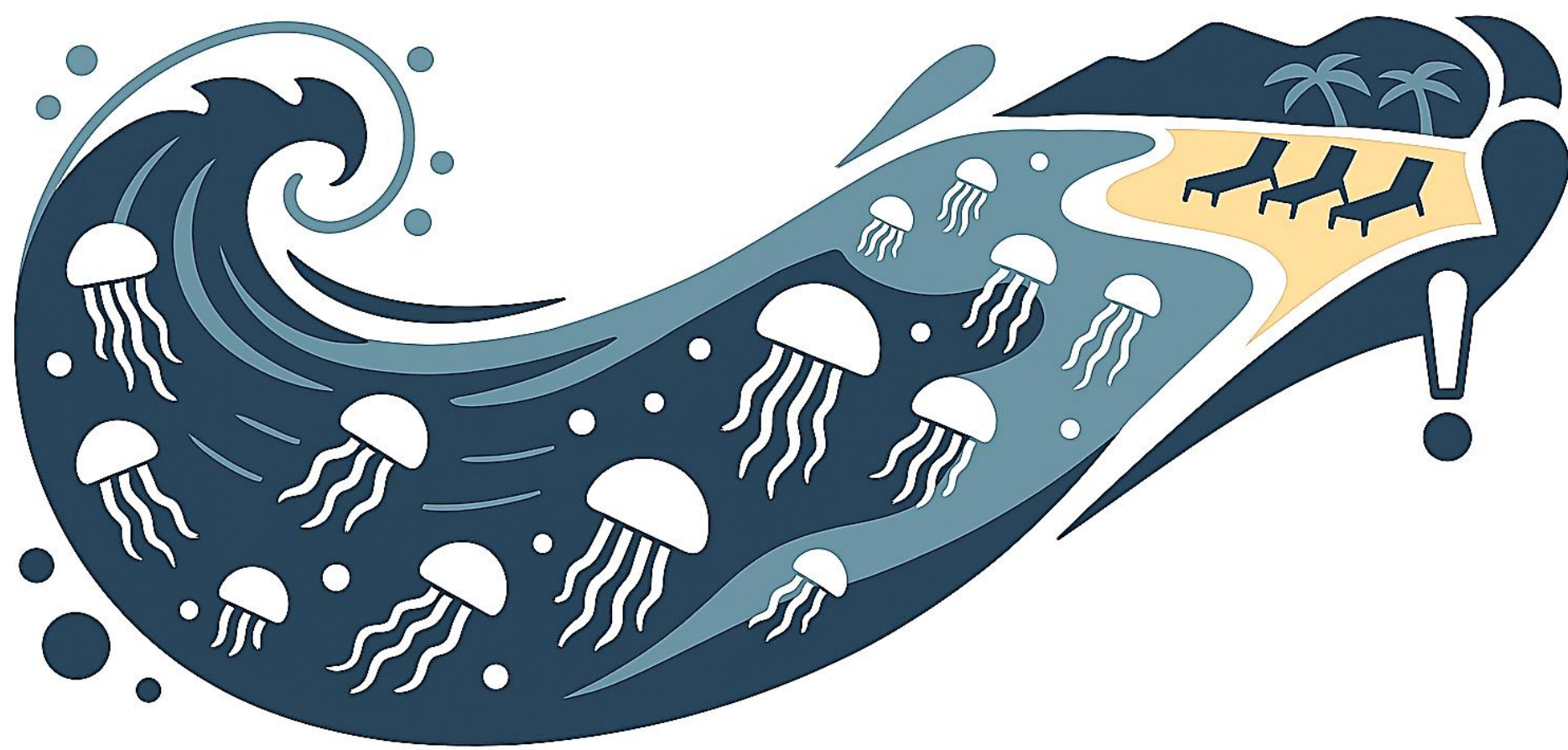
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## BACKGROUND AND OBJECTIVES



Since the mid-1990s, **jellyfish blooms**—mainly fried egg and barrel jellyfish—**have increased** in Spain's Mar Menor lagoon due to factors like **climate change, overfishing, and pollution**. These blooms pose **serious ecological and economic problems**, especially for tourism and fishing, leading authorities to regularly remove large amounts of jellyfish with no effective **waste treatment**. At the same time, the phenomenon has sparked **scientific interest** because jellyfish contain valuable compounds, such as **collagen**, with potential uses in cosmetic, pharmaceutical, and biomedical industries.

The **main objectives** of this project include:

- Explore how Mediterranean jellyfish can be managed and transformed into **valuable sources of collagen** using environmentally friendly extraction processes.
- Assess the potential of Mediterranean jellyfish (*Rhizostoma pulmo*, *Cotylorhiza tuberculata*) for collagen recovery through responsible extraction methods and to compare collagen extraction strategies as a more sustainable and higher-yield alternative.
- Characterize the extracted collagen to determine its suitability for cosmetic, biomedical, and nutritional applications.

## MATERIALS AND METHODS

Experimental work included drying trials and collagen extraction using different protocols for *R. pulmo* and for *C. tuberculata*, combining traditional acid/alkali treatments and SFE (CO<sub>2</sub>-based), implemented for the first time in jellyfish.

**Jellyfish drying tests:** Two drying tests were carried out, one in an oven at 60°C for 48 hours (A) and the other by freeze-drying at -80°C for 3–4 days (B). The samples obtained were weighed to determine their yield (Fig1).

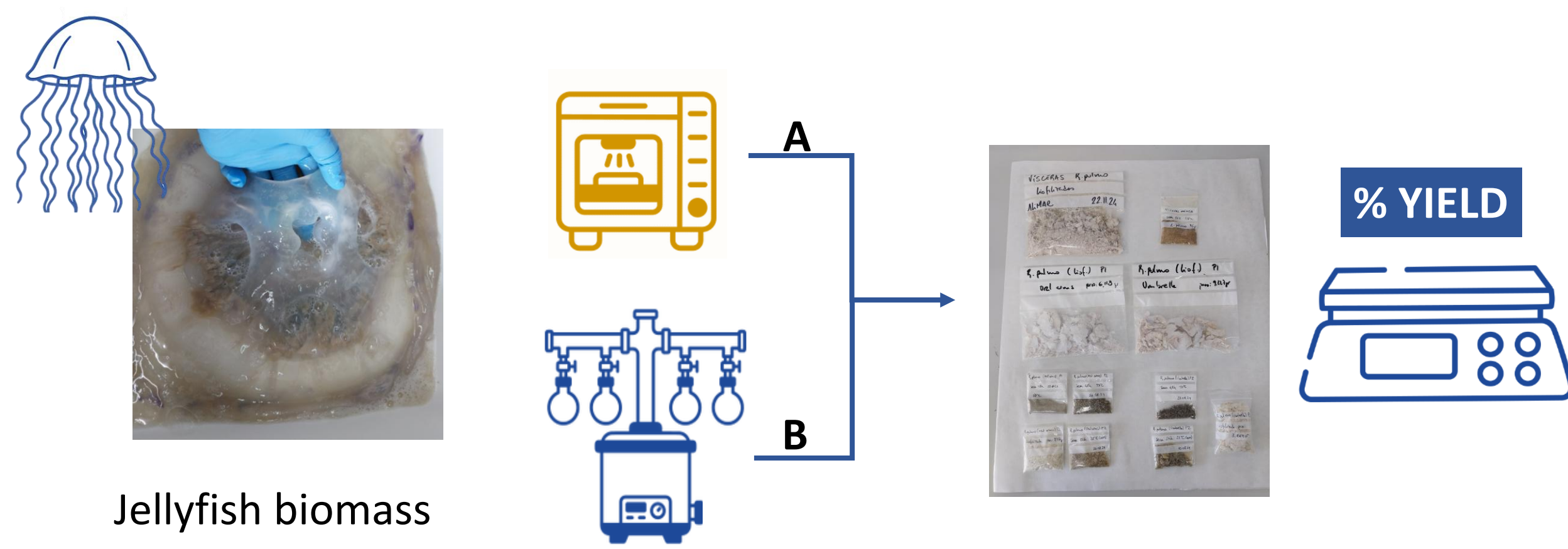


Fig 1. Drying methods for the jellyfish to be analysed.

**Collagen from jellyfish:** The isolation of collagen from jellyfish was studied using conventional methods (C) and by supercritical extraction (D). Likewise, the collagen obtained was characterized by SDS-PAGE electrophoresis and the amino acid profile. (Fig2).

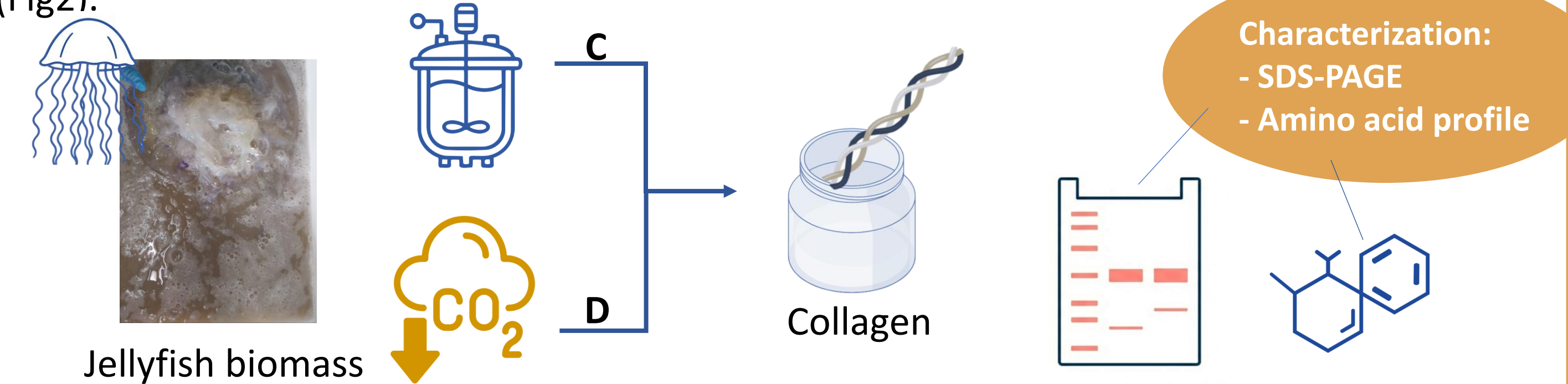
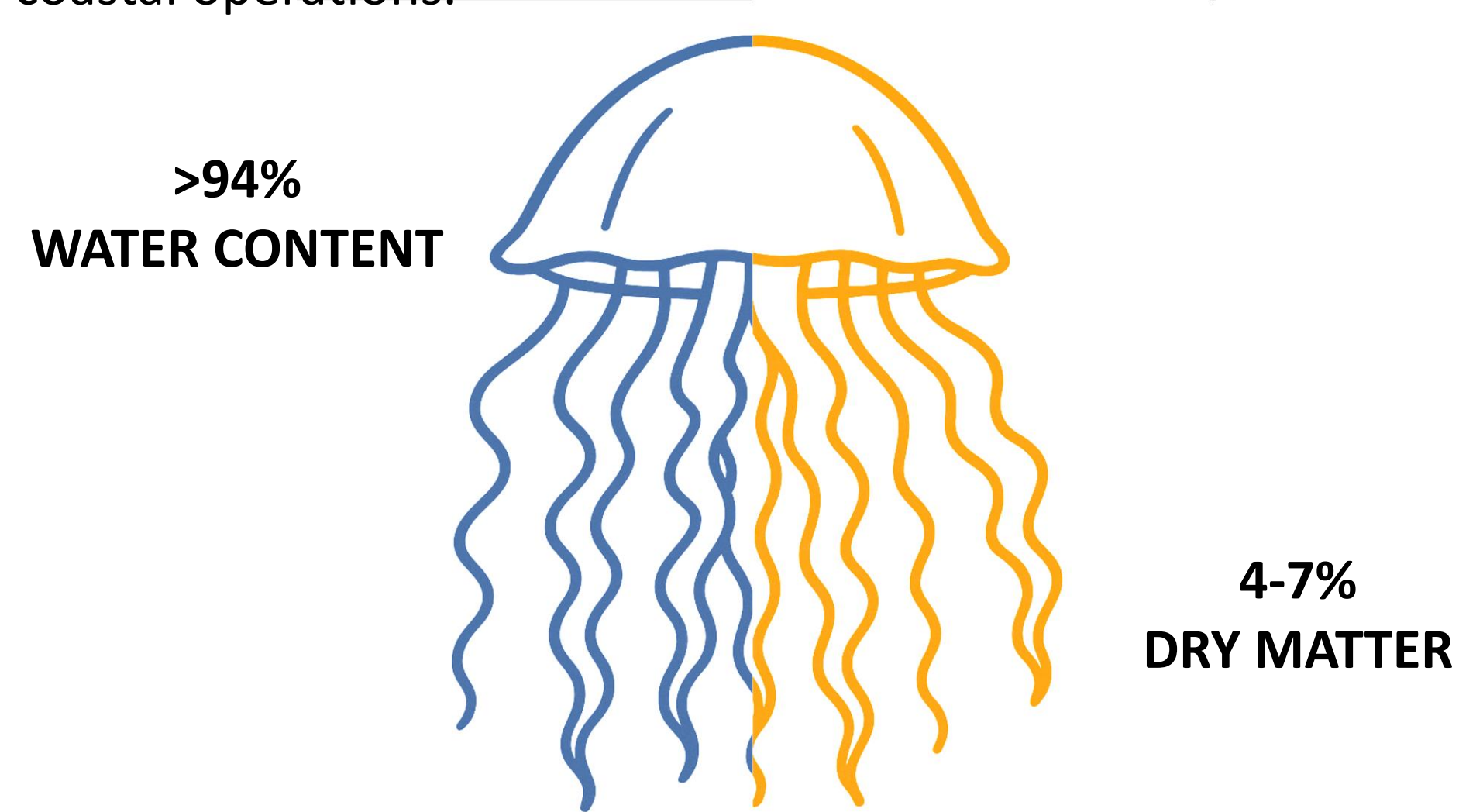


Fig 2. Methods for the isolation and characterization of collagen

The comparative study seeks not only technical feasibility, but also improvements in performance and environmental sustainability.

## RESULTS AND DISCUSSION

Drying experiments revealed that jellyfish biomass contains more than 94% water, with final dry matter yields ranging from approximately 4% to 7%. Freeze-drying improved sample recovery but is economically unfeasible for large-scale application, whereas air and oven drying were identified as more realistic options for coastal operations.



Collagen yields ranged from 2.5% to 18% on a dry basis using conventional methods and up to 30% using supercritical fluid extraction. (Fig 3)

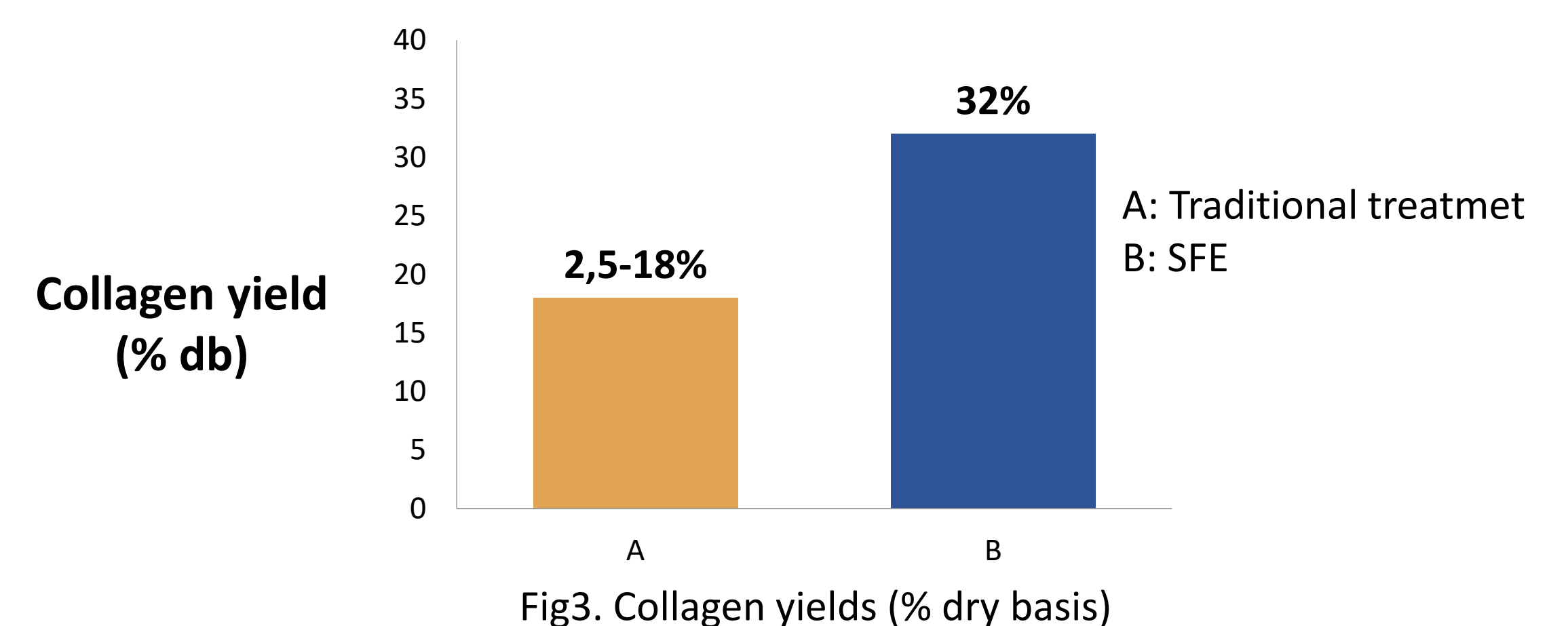


Fig3. Collagen yields (% dry basis)

Collagen characterized by SDS-PAGE showed band patterns corresponding to  $\alpha 1$ ,  $\alpha 2$  and  $\beta$  chains, consistent with the type I collagen structure. Amino acid analysis further confirmed the typical collagenous profile, with high proportions of glycine, proline, and hydroxyproline, which are essential for the stability of the triple-helix structure. (Fig 4)

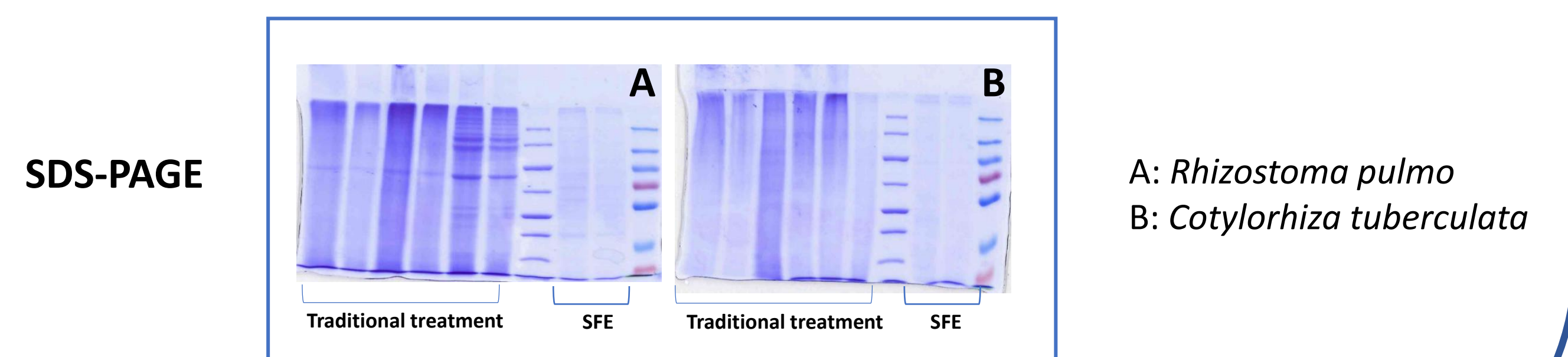


Fig4. 7.5% gel loaded with collagen samples from *R. pulmo* and *C. tuberculata*

## CONCLUSIONS

**Problem → Opportunity:** Mediterranean jellyfish blooms, traditionally considered an environmental nuisance, can be valorised as a sustainable marine bioresource.

**High-quality marine collagen source:** *Rhizostoma pulmo* jellyfish yield type I collagen with physicochemical properties comparable to mammalian and other marine collagens.

**Process optimisation is crucial:** supercritical fluid extraction offers higher yields but currently lacks sufficient purity, while acid-based methods produce cleaner collagen suitable for biomedical and cosmetic uses.

**Economic viability depends on added value:** commercial exploitation will only be justified if jellyfish collagen shows distinctive functional or bioactive advantages over collagens from other marine by-products.

**Finally,** the project contributes to the **sustainability and blue economy** objectives promoted by the European Union, demonstrating that Mediterranean marine resources (even those considered problematic or invasive) can be transformed into **high added-value** raw materials through targeted **biotechnological approaches**.

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