CONVENTIONAL AND GREEN CHITIN EXTRACTION METHODS

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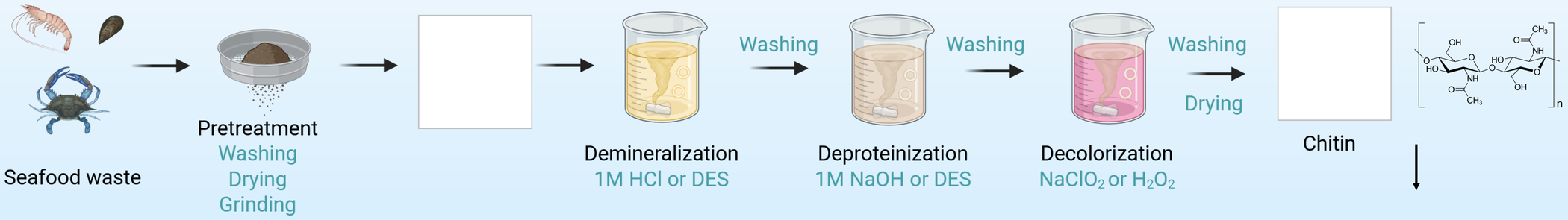
INTRODUCTION

Seafood production is rapidly increasing, generating large amounts of nutrient-rich waste, most of which is landfilled. This leads to resource loss and environmental pollution. Shellfish waste is a valuable source of chitin, the second most abundant biopolymer on Earth. It is non-toxic, biodegradable, and biocompatible, with high potential for applications in cosmetics, food packaging, textiles, biomedicine, and environmental engineering.

The key challenge is scaling up chitin extraction from lab to industry by developing greener, more efficient methods that preserve its quality and bioactivity.

AIM: To evaluate different chitin-rich seafood wastes from the northern Adriatic Sea (scampi, squid pen, cuttlefish bone, mussel shells) for chitin extraction using both conventional methods and deep eutectic solvents (DES).

METHODS - Extraction protocol



WORKFLOW

1. Collection of locally available chitin-rich seafood waste.
2. Extraction of chitin by conventional methods (acid-based).
3. Extraction of chitin by three DES methods (deep eutectic solvents).
4. Chemical characterization of extracted chitin.
5. Comparison between conventional and DES methods.

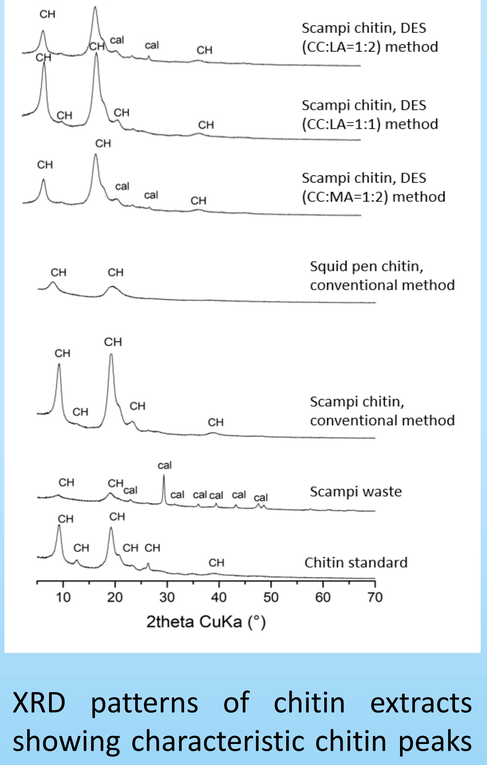
Conventional solvents			
1 M HCl		1 M NaOH	
DES (deep eutectic solvents)			
HBD (hydrogen bond donor)	HBA (hydrogen bond acceptor)	Molar ratio	Temp. & Time
Choline chloride	Lactic acid	1:1	70 °C, 3h
Choline chloride	Lactic acid	1:2	80 °C, 2h
Choline chloride	Malonic acid	1:2	50 °C, 2h

CHITIN ANALYSIS

Elemental analysis CHNS
Ash content (minerals)
Protein content
^{13}C NMR
FTIR
XRD
TGA
SEM

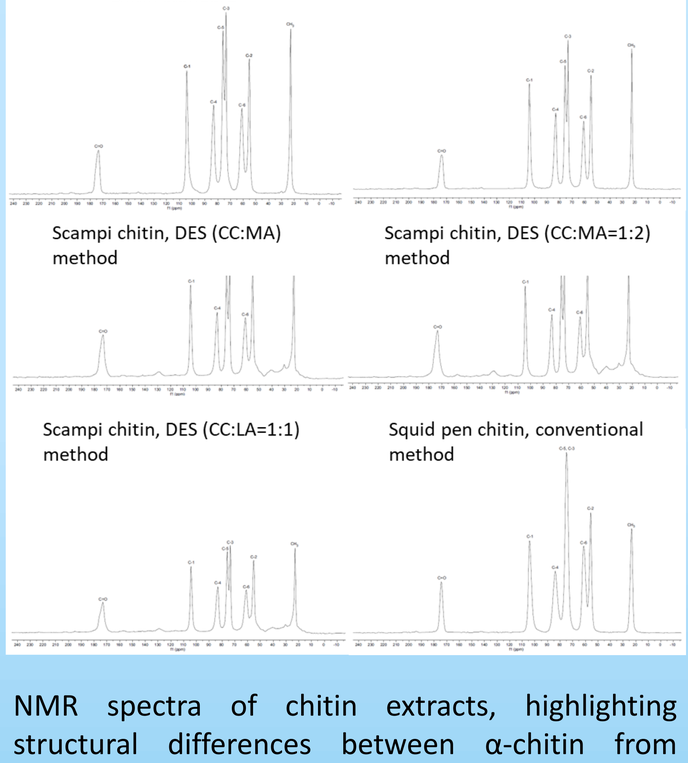
RESULTS

X-ray powder diffraction analysis (XRD)



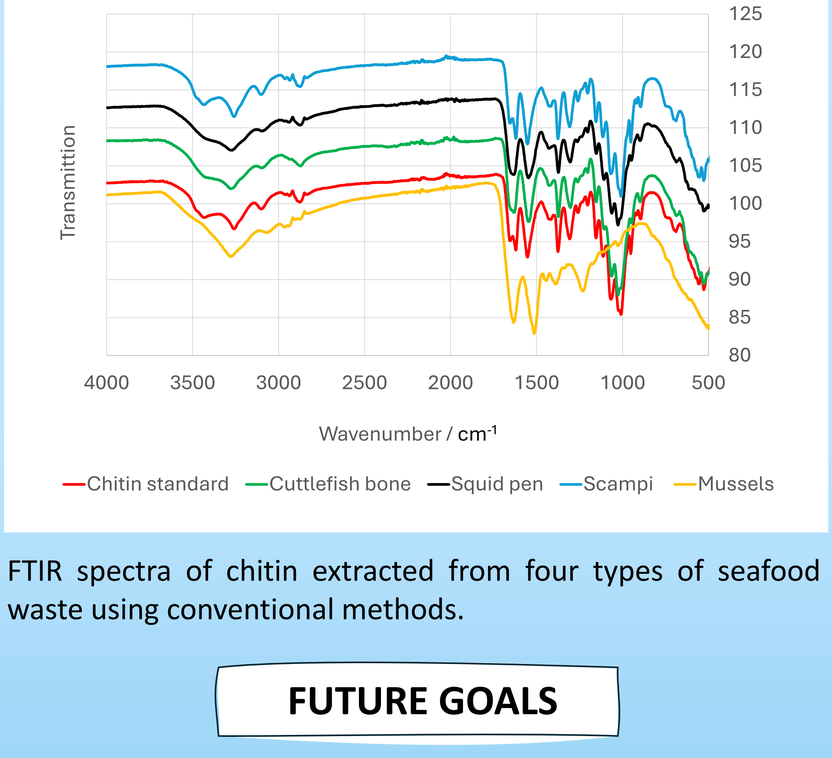
XRD patterns of chitin extracts showing characteristic chitin peaks (CH) and residual mineral signals (cal).

^{13}C solid-state NMR spectroscopy



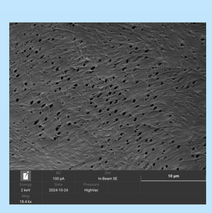
NMR spectra of chitin extracts, highlighting structural differences between α-chitin from scampi exoskeleton and β-chitin from squid pen.

FTIR spectroscopy

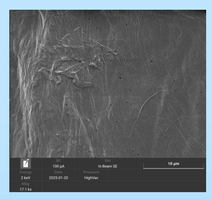


FTIR spectra of chitin extracted from four types of seafood waste using conventional methods.

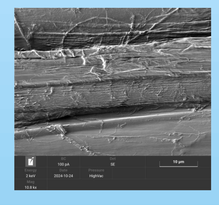
Scanning electron microscopy (SEM)



Scampi chitin, conventional method



Scampi chitin, DES method (CC:LA=1:1)



Squid pen chitin, conventional method

FUTURE GOALS

- Achieve higher purity of chitin.
- Tailor protocols to different seafood waste sources.
- Improve reproducibility of extraction methods.

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