Extraction of glycosaminoglycans from marine by-products using terpene-based deep eutectic solvents

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INTRODUCTION

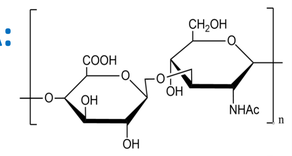
Deep eutectic solvents (DES) are prepared by heating and mixing two components at a specific molar ratio leading to a solvent with a lower melting point than that of the components used. DES are **novel, low-cost and green solvents** with simple production **for high purity extraction** applications to replace the time-consuming expensive conventional methods[1].

The extraction of bioactive polymers from **marine by-products** as a cost-effective and abundant sources is highly investigated due to its **economical and environmental benefits**. Glycosaminoglycans (GAGs), including **hyaluronic acid (HA)** and **chondroitin sulfate (CS)**, are polysaccharides used in **medicine, biotechnology and cosmetics** due to their **biocompatibility, viscoelasticity and immunostimulatory effects**[2]. Thus, it is essential to extract HA and CS **using natural green DES** while maintaining their **high quality and purity** to perform optimum exploitation of marine wastes.

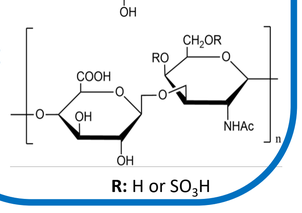
AIM

HA and **CS** isolation from codfish bones and mussels using terpene based-DES.

HA:



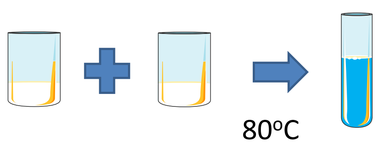
CS:



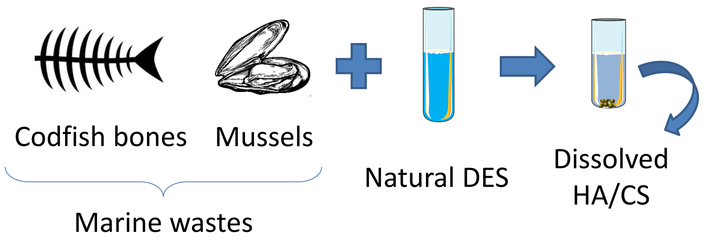
R: H or SO_3H

METHODS

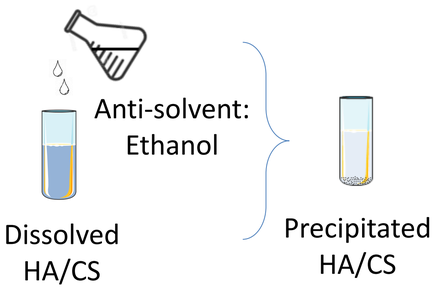
DES preparation



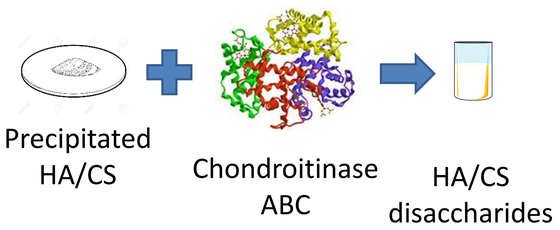
Extraction from marine by-products



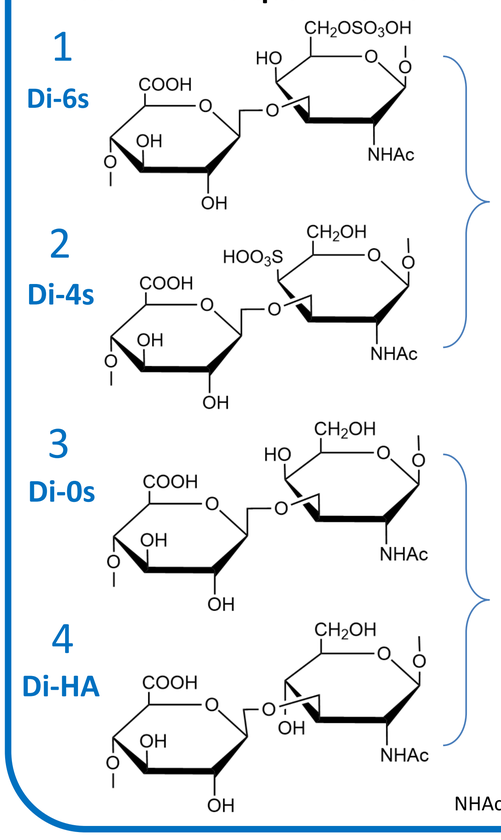
GAGs precipitation



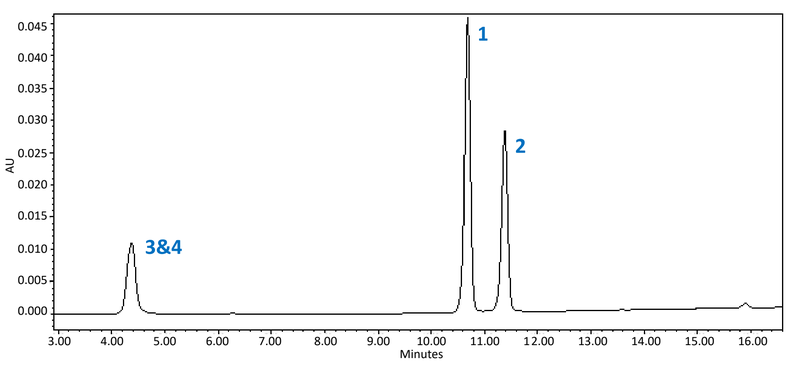
Enzymatic hydrolysis



Detection and quantification of the disaccharides



CS disaccharides with different sulfated positions → **HPLC analysis**



Disaccharides 3 & 4 overlap due to a similar chemical structure

Analysis using Capillary Electrophoresis

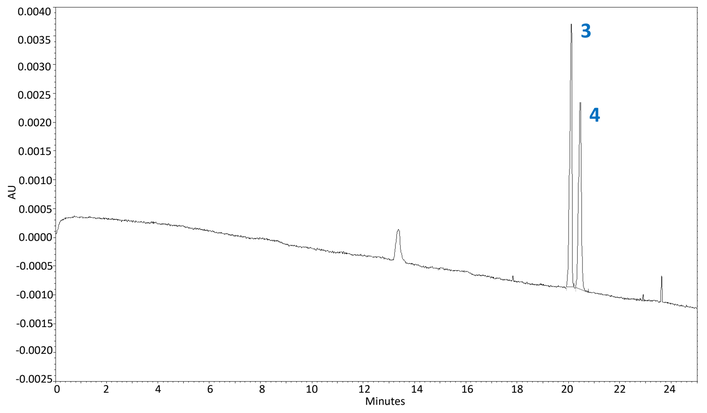
Non-sulfated **CS** disaccharide & **HA** disaccharide

Similar chemical structure:
OH function on carbon 4

Di-HA: Equatorial

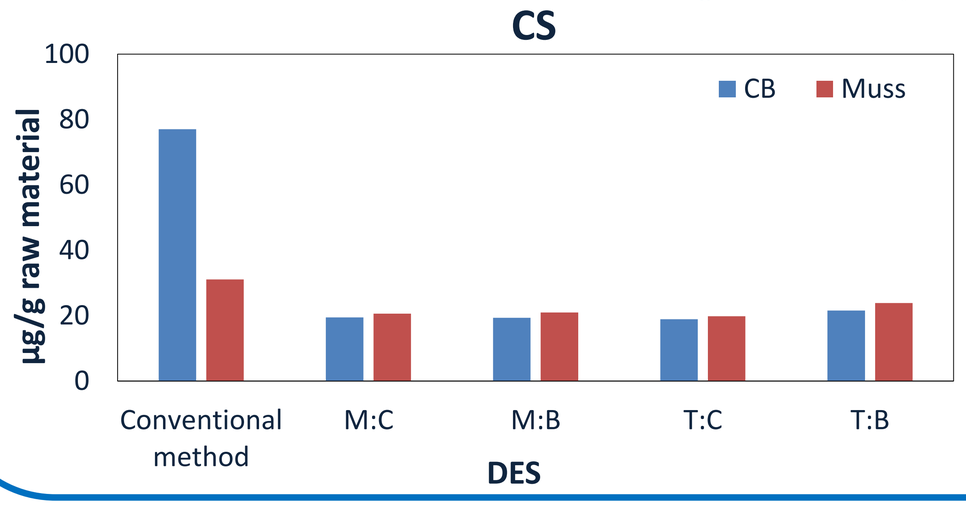
Di-0s: Axial

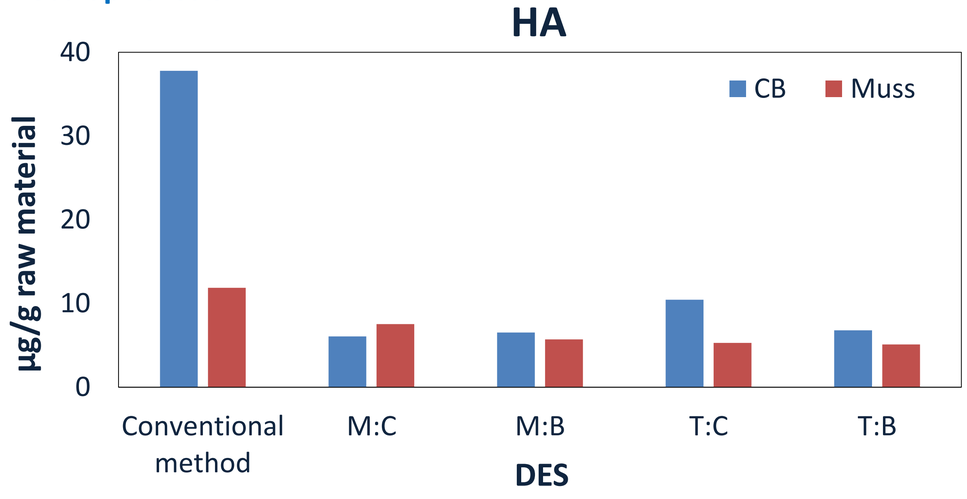
Capillary Electrophoresis analysis



RESULTS

Quantification of HA and CS disaccharides using HPLC and Capillary Electrophoresis





M:C
Menthol: Camphor (4:1)

M:B
Menthol: Borneol (3:1)

T:C
Thymol: Camphor (4:1)

T:B
Thymol: Borneol (3:1)

CONCLUSION

HA and CS are efficiently extracted from marine sources using a novel, green and low-cost technique by their dissolution in terpene-based solvent systems. HA and CS as well as the terpene solvent systems are currently being tested to assess their safety and applicability in the dry eye disease treatment.

REFERENCE

1. Tang B, Row KH. Recent developments in deep eutectic solvents in chemical sciences. Monatshefte für Chemie - Chem Mon. 2013;144: 1427–1454.
2. Kovensky J, Grand E, Uhrig ML. Applications of Glycosaminoglycans in the Medical, Veterinary, Pharmaceutical, and Cosmetic Fields. Ind Appl Renew Biomass Prod. 2017;135-64.

ACKNOWLEDGMENTS: The project IT-DED[3] is funded by the European Union's H2020 -MSCA program. Grant agreement: 765608 iNOVA4Health-UID/Multi/04462/2013, a program financially supported by Fundação para a Ciência e Tecnologia/ Ministério da Educação e Ciência, through national funds and co-funded by FEDER under the PT2020 Partnership Agreement. Funding from INTERFACE Programme, through the Innovation, Technology and Circular Economy Fund (FITEC), is gratefully acknowledged.

Financiado por: FITEC Fundo de Inovação, Tecnologia e Economia Circular; PROGRAMA INTERFACE; Programa Nacional de Reformas; REPÚBLICA PORTUGUESA