Evaluation of the variability of fucoidan extracted from brown seaweed and its anti-inflammatory and anti-tumor activity

A. R. Inácio[1,2], R. O. Sousa[1,2], R. L. Reis[1,2,3], T. H. Silva[1,2]

[1]3B's Research Group, I3Bs – Research Institute on Biomaterials, Biodegradables and Biomimetics, University of Minho, Headquarters of the European Institute of Excellence on Tissue Engineering and Regenerative Medicine, AvePark, Parque de Ciência e Tecnologia, Zona Industrial da Gandra, 4805-017 Barco, Guimarães, Portugal;

[2]ICVS/3B's–PT Government Associate Laboratory, Braga/Guimarães, Portugal;

[3] The Discoveries Centre for Regenerative and Precision Medicine, Headquarters at University of Minho, Avepark, 4805-017 Barco, Guimarães, Portugal;

INTRODUCTION

In recent years there has been growing interest in the scientific areas that study the applications of marine-derived biomaterials. Fucoidan is a class of sulfate fucose rich polysaccharides found in brown seaweed. Fucoidan presents a variety of bioactive properties of enormous interest, such as: anti-tumoral, antithrombotic, antioxidante, anti-inflammatory, anticoagulante, antiviral and others. The properties of this polysaccharide are of interest for many industrial applications, being in the development of pharmaceuticals and nutraceuticals compounds or in the design of innovative biomedical applications [1, 2].

The structure of this polysaccharide depends on the biology of macroalgae (species, maturity / stage of algae, part of algae), geographic, seasonal and environmental conditions (water temperature, nutrients, sunlight), collection and extraction / purification techniques [3]. Since the biological activity of fucoidan is affected by the structure of the polysaccharide, from the type of glycosidic bonding, molecular weight, sulfate content, monosaccharide composition and conformations, and the isolation procedure should avoid sulfate loss and structural alteration of the target compound [4].

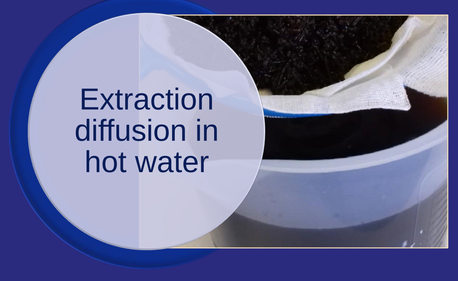
The seasonal variation of fucoidan is often mentioned in the literatures, although there is very little published data on the subject at present and the few references cover only a few months of the year. A study by Mak *et al.* investigated the variation in fucoidan between July and October for *Undaria pinnatifida*. They found that the fucoidan content almost quadrupled between July and September (3.6-13.7 wt%) and only dropped slightly in October. Other than the study mentioned, the authors were unable to find other published literature on the seasonal variation of fucoidan. Considering the change in biomedical properties due to the varying composition of fucoidan, understanding the seasonal variation of the chemical content of fucoidan is very important [3].

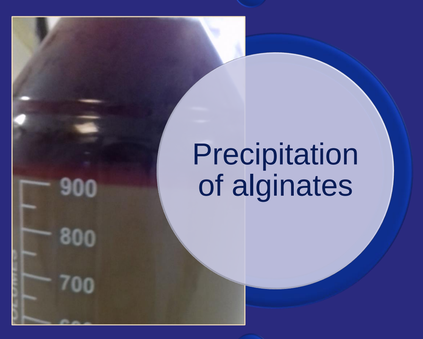
AIMS

The present work is addressing the extraction of fucoidan from selected samples of brown alga *Bifurcaria bifurcata*, based in water extraction methodologies, and further evaluating the variability of the produced extract throughout the year on the yield of extraction and the chemical properties that contemplate the biological activities and its further biomedical application, more concretely as antitumor and anti-inflammatory agent.

METHODS

1. Polysaccharide extraction





2. Characterization

Fucoidan extracted from *Bifurcaria bifurcata* will be characterized attending to different properties:

- Yield of extraction - determined as the ratio between the weight of extracted fucoidan and the weight of dry seaweeds biomass.
- Presence of characteristic chemical bonds/groups, by FTIR spectroscopy and NMR;
- The fucose content
- The sulfate content
- Quantification of proteins
- Total sugar and carbohydrates composition
- Molecular weight determination: using size-exclusive chromatography (GPC-SEC)

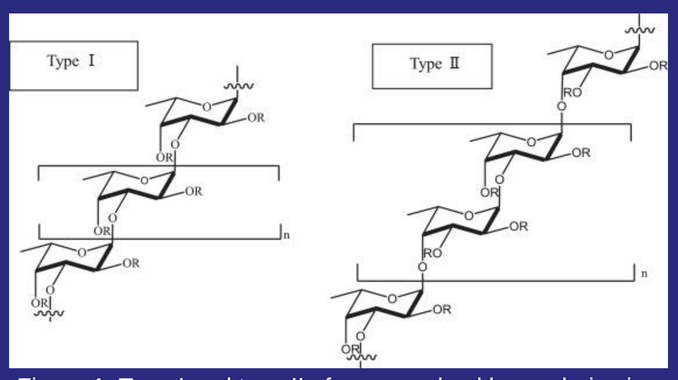


Figure 1: Type I and type II of common backbone chains in Brown seaweed fucoidan. R can be α-L-fucopyranose, α-D-glucuronic acid, and sulfate groups, while the location of galactose, mannose, xylose, rhamnose, arabinose and glucose in several kinds of seaweed species remains unknown (Wu et al., 2016).

Biological performance

- Cytotoxicity – MTS assay
- Anti-inflammatory
- Anti-tumoral

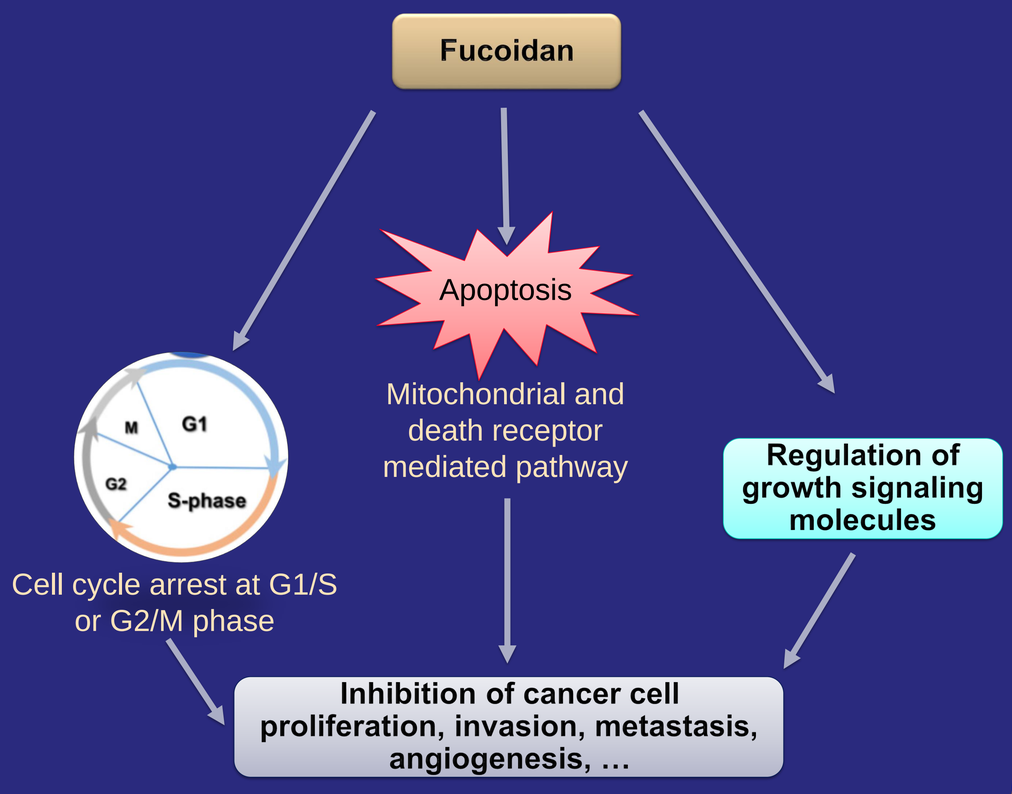


Figure 2: Overview of fucoidan regulation.

Future Perspectives

- The optimization of effective and reproducible method for fucoidan extraction
- Understand the seasonal variation of fucoidan throughout the year
- The isolated fucoidan can be an alternative to chemical compounds, finding application in high added-value sectors like the development of anti-inflammatory and anti-tumoral biomaterials

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