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Unveiling the physicochemical properties of a sulfated polysaccharide based on Ulvan with high biomedical potential

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Introduction: Ulvan, extracted from the green algae *Ulva lactuca* displays physico-chemical and biological features of potential interest for biomedical applications[1]. This sulfated polysaccharide is mainly built on disaccharides repeating sequences composed of sulphated rhamnose and glucuronic acid, iduronic acid or xylose[2]. In this work, structural, chemical degradation and rheological studies were performed in order to complement *in vitro* and *in vivo* performance studies and to screen its potential biomedical interest.
Materials and methods: Ulvan extraction process was performed as referred elsewhere[3]. The rheological measurements were carried out through a Paar Physica MCR 300 modular compact rheometer (Anton Paar). ^{1}H-NMR spectra were recorded on a Varian Unity Plus (Varian) spectrometer, at 60°C. HPLC analysis was performed using a Knauer apparatus with a Sugar-Pak 1 column (Waters). Several enzymes were tested to hydrolyze ulvan.
Results: From ^{1}H-NMR spectra was observed that the main repeating unit of the extracted ulvan is A3S (Fig. 1). Moreover, with the ^{1}H-NMR spectra was possible to develop a new method to determine the relative percentage of sulfur (4–6%). From the HPLC results the presence of a slight quantity of glucose (<0.1%) was detected and the monomers quantified. Ulvan was resistant to hyaluronidase, β-glucuronidase collagenase and specific MMP-1. Rheological studies revealed that ulvan (3% w/V) has a viscosity of 8.91 ± 0.88 mPa/s (at 1000/s of shear rate), as well as its viscous character (G″>G′).
Discussion and conclusions: Ulvan has a great potential for being used in the treatment of several pathologies due to its intrinsic biological properties that include biocompatibility, anti-inflammatory or anti-coagulant properties. In the present work, ulvan was demonstrated to be chemically reproducible. When dissolved, ulvan forms shear thinning solutions which exhibit enhanced degradation resistance to relevant enzymes. Its native composition renders it similar to chondroitin sulfate structure, which makes this polymer a promising biomaterial. Ulvan viscosity coupled with its resistance to enzymatic degradation (by collagenase for example) may enable its use as an alternative to other polysaccharides like hyaluronic acid (HA) different in application contexts.
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References
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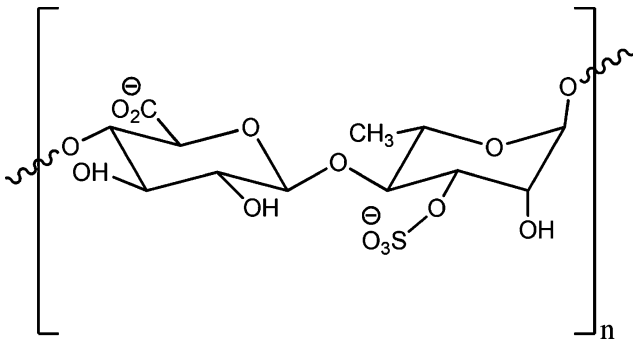

Figure 1. Most common main repeating unit of ulvan, disaccharide composed by glucuronic acid and sulphated rhamnose (A3S).