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A HYDROPHOBICALLY-MODIFIED ALGINATE GEL SYSTEM: UTILITY IN THE REPAIR OF ARTICULAR CARTILAGE DEFECTS

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Alginates are a family of natural polysaccharides, widely used in industry and medicine for many applications. With its non toxic nature, gentle sol/gel transition procedure and low cost, alginate inferior biomechanical properties have limited its utility especially in tissue engineering. Additionally, ionically cross-linked alginate hydrogels generally lose most of their initial mechanical and swelling properties within a few hours in physiological solution.

In order to overcome these limitations, the referenced alginate was treated by covalent fixation of octadecyl chains onto the polysaccharide backbone by esterifacation.

In semi dilute solution, intermolecular hydrophobic interactions of long alkyl chains result in the formation of physical hydrogels, which can then be reinforced by the addition of calcium chloride.

FTIR studies clearly showed the presence of ester bonds at 1612 and 1730 cm^{-1} indicating that the alkyl groups are incorporated in the backbone of resulting polymer. The endothermic peak and exothermic peak present in the DSC thermogram of Alg-C18 had shifted to lower temperatures comparing to native alginate (from 106 to 83 ◦C and from 250 to 245 ◦C, respectively) due to the estrifecation reaction that leads to high hydrophobic nature of the modified sample. From rheological experiments, it can be inferred that the combination of both calcium bridges and intermolecular hydrophobic interaction in the treated alginate leads to enhanced gel strength accompanied by more stable structure in physiological solution comparing to native sodium alginate hydrogel.

Finally, it also proved that the modified alginate was not toxic toward MSCs, and that they favored the cellular proliferation and expression of cartilage specific genes.