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Master work

Topic: ***Rheological characterization of alginate based hydrogels for bio-printing application***

Bio-printing is a promising tissue engineering strategy that is currently under constant development. The technique consists of 3D-printing living cells mixed with a biomaterial, usually a hydrogel. Mixtures of living cells and biopolymers, such as gelatin, fibrin, collagen and alginate, belong to the most commonly used bio-inks due to the high biocompatibility of such polymers. During bio-printing, high shear stress conditions of the process are known to damage the cells and decrease the final cell viability. Several parameters may play a role in the cell viability matter, including material properties. Our aim is to investigate rheological properties of alginate hydrogels used as carrier material of the bio-ink. Alginate can be physically cross-linked using divalent cation salts, such as $CaSO_4$, $CaCl_2$ or $CaCO_3$.

In order to study the influence of the cross-linker, the gels will be systematically prepared with varying concentrations and ratio of alginate and Ca^{2+} salt. Experiments performed in a rotational rheometer will show the rheological properties dependency on the sample components. From the deformation vs shear stress curve, it is possible to determine the yield stress of the gels, which brings information about the shear force necessary for the flow to begin. The effect of the shear-induced degradation, as well as the thixotropic behavior of the sample, can both be investigated varying abruptly the shear rate applied. Additionally, rotational rheometry experiments with different fixtures materials will be performed to evaluate the wall slip effect. At last, the rheological properties results will be analyzed and correlated to the hydrogel composition.

Die Ergebnisse der Arbeit sind in schriftlicher Form zu dokumentieren und in einem Seminarvortrag darzustellen.

Beginn: zum nächstmöglichen Zeitpunkt
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