# GLYCOSAMINOGLYCAN-MIMETIC INFERNAN AS THERMORESPONSIVE POLYSACCHARIDE FOR TISSUE ENGINEERING APPLICATIONS

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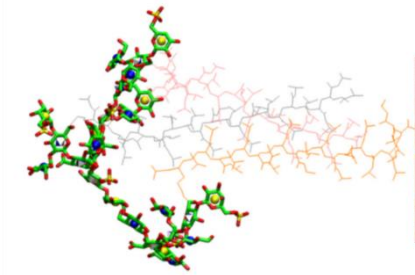
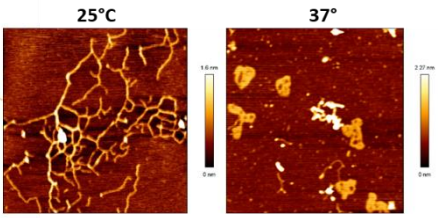
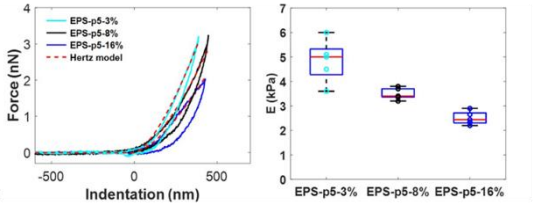
Bacteria have developed a unique strategy to survive in extreme conditions through a synthesis of an extracellular polymeric matrix conferring to the cells a protecting microenvironment. The main structural component of this complex network constitutes exopolysaccharides (EPS), high-molecular weight hydrophilic macromolecules. Deep-sea hydrothermal vent bacteria have been shown to produce EPS rich in hexosamines and uronic acids, frequently substituted by sulfate groups. Such a particular composition ensures interesting functional properties, including biological activities mimicking those known for glycosaminoglycans (GAGs) of mammalian tissues [1]. The aim of the present study was to exploit GAG-mimetic properties of infernan, a high-molecular weight slightly sulfated EPS produced by the deep-sea hydrothermal vent bacterium *Alteromonas infernus* from Ifremer collection, and develop EPS-based hydrogels for cartilage tissue engineering. For this purpose, infernan was grafted with poly(N-isopropylacrylamide) (pNIPAM), thus leading to a thermoresponsive polysaccharide [2]. The molecular characteristics of grafted polysaccharide (conformation, molecular weight, degree of grafting) and its thermosensitive properties were firstly determined at molecular scale using a multi-technique approach. Then, mechanical properties of EPS-pNIPAM hydrogels were assessed in their fully hydrated state by compression experiments using Atomic Force Microscopy. Finally, cytocompatibility of hydrogels was evaluated by incorporating model cells inside. The full characterization of the grafted EPS at both molecular and macromolecular scales remains crucial for its further optimal use as hydrogels in cartilage tissue engineering [3].



**MD simulations** of infernan partially grafted at GlcA residue in the side chain with three pNIPAM chains.




**AFM imaging** of infernan chains grafted with pNIPAM, showing the polysaccharide folding due to pNIPAM-pNIPAM interactions at 37°C.




**AFM** force-indentation curves measured in DMEM at 37°C on three infernan-pNIPAM hydrogels displaying three grafting densities.

**References:**
1. A. Zykwinska, L. Marchand, S. Bonnetot C. Sinquin, S. Colliec-Jouault, C. Delbarre-Ladrat. Deep-sea hydrothermal vent bacteria as a source of glycosaminoglycan-mimetic exopolysaccharides. *Molecules*, **2019**, *24*, 1703.
2. A. Fillaudeau, S. Cuenot, O. Makshakova, S. Traboni, C. Sinquin, M. Hennetier, E. Bedini, S. Perez, S. Colliec-Jouault, A. Zykwinska. *Carbohydrate Polymers*, **2024**, *326*, 121638.
3. A. Fillaudeau, M. Desdouits, C. Sinquin, S. Colliec-Jouault, A. Zykwinska, S. Cuenot. *Applied Materials Today*, **2025**, *42*, 102544.