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Title of the doctoral thesis	Tailoring the properties of polysaccharides-based hydrogels: from cell interactions to biomedical applications
Content of the doctoral thesis	The design of novel polysaccharides-based hydrogels can potentially improve cell culture and enhance biomedical applications

Innovative solutions are required to address the rising and urgent demand for tissue and organ regeneration. The challenges intensify with an aging population and the progression of pathologies affecting vital organ functions. Additionally, the reliance on animal models for drug toxicity testing is limited due to excessive cost, ethical concerns, and low accuracy in replicating in vivo responses.

As a valuable solution, tissue engineering utilizes 3D scaffolds combining cells and biomimetic matrices to restore or replace biological functions in tissues and organs. Moreover, tissue engineering holds the potential to develop in vitro 3D cell cultures which closely replicate in vivo systems, enabling more reliable drug screening without the need for animal models.

This thesis explores innovative strategies for 3D fabrication of high-performance functional materials, with a focus on advancing biomedical research by developing polysaccharides-based hydrogels designed to closely mimic the properties of the human extracellular matrix (Papers I-III). Nanocellulose hydrogels, while promising, face challenges related to poor mechanical properties and limited 3D printing resolution; hence, a strategic combination with heteropolysaccharides (tragacanth gum, xanthan gum, and quince seed mucilage) improves the processability of the hydrogels.

Furthermore, the study explores controlled drug delivery, particularly the development of chitosan hydrogels enriched with the phenolic compound phloroglucinol (Paper IV). These hydrogels exhibited versatility, as they could be prepared with varying porosities and morphologies, resulting in distinct release kinetics. This versatility positions them as suitable biocompatible scaffolds and drug delivery systems, particularly for applications such as wound dressing.

Finally, the thesis also seeks to understand interactions at the interface of cellulose-based materials and living human cells in biomedical research, aiming to discern the impact of material properties on cell behavior and draw insights to develop more efficient materials (Paper V). These meticulously designed materials help to consolidate the field of biomimetic plant-based hydrogels, which have tremendous potential to improve cell culturing and enhance biomedical applications.

Field of the doctoral thesis	Bioproduct Technology
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Remote defence	https://aalto.zoom.us/j/66146115305
Place of public defence	Lecture hall Ke2
Opponent(s)	Professor Aji Mathew, Stockholm University, Sweden
Custos	Professor Monika Österberg, Aalto University, Finland
Link to electronic thesis	https://aaltodoc.aalto.fi/items/947dc4de-7a69-4e8f-9faa-79a62a0e219f
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