



Fabrication of 3D Cell Scaffolds for the Cultivation of Meat and Fish

Master Project/Thesis

Motivation

Producing enough food for a growing world population while reducing environmental damage is a huge challenge. The cultivation of meat has great potential to significantly reduce the use of energy, water, and land. Currently, only the production of thin layers of cultivated meat is possible, which limits the offering to minced or processed meat. To cultivate more desirable and natural whole cut meat, the development of novel 3D cell scaffolds is essential. Sallea's (start-up at the Complex Materials group at ETH Zürich) indirect additive manufacturing technology enables the manufacturing of such scaffolds addressing the limitations of current systems by providing open, hierarchical porosity and free choice of material to potentially enable greatly enhanced nutrient transport during the cultivation of meat. (see Figure 1 and [1])

Project Aim

The aim of the master project/thesis is to prepare scaffolds from biologically relevant materials (e.g. cellulose, alginate, chitosan, plant proteins, ...) and adapt the surface characteristics to improve cell adhesion, distribution and spreading. This is particularly important to ensure proper cell differentiation. The preparation of the scaffolds will take place at sallea (ETH Hönggerberg) where the focus will be on how to infiltrate the scaffold material into the salt template (with vacuum, hydraulic press, injection moulding or casting). The scaffolds will be tested in cell studies conducted at ZHAW Wädenswil.

The tasks may change due to changes in the project progression and/ or because of varying interests of the student. Ideas/ Interests etc from the student are highly appreciated.

Methods you will learn/use

- Literature research on scaffold materials
- 3D printing of NaCl (stereolithography)
- ev. CAD drawing
- vacuum infiltration, casting, injection moulding (depends on material)
- optical and electron microscopy
- mechanical testing

⇒ more upon desire/ course of project

Contact

Do not hesitate to contact us for more details or questions about the project, we are happy chat!

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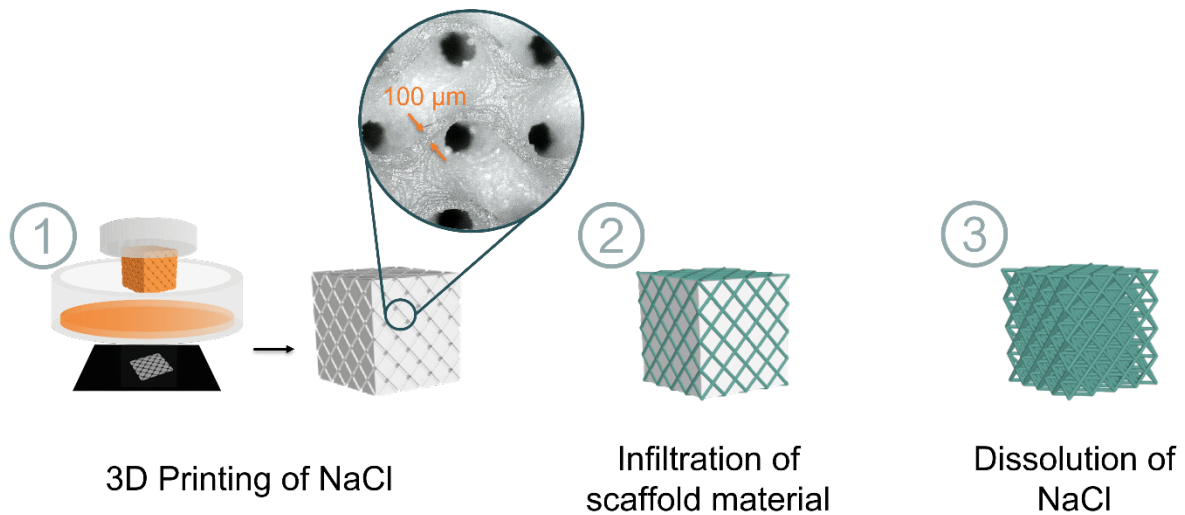


Figure 1 sallea's process to manufacture 3D cell scaffolds.

Literature

1. Kleger, N., Fehlmann, S., Lee, S. S., Dénéreáz, C., Cihova, M., Paunović, N., Bao, Y., Leroux, J.-C., Ferguson, S. J., Masania, K., Studart, A. R., Light-Based Printing of Leachable Salt Molds for Facile Shaping of Complex Structures. *Adv. Mater.* 2022, 34, 2203878.
2. Ben-Arye, Tom, et al. "Textured soy protein scaffolds enable the generation of three-dimensional bovine skeletal muscle tissue for cell-based meat." *Nature Food* 1.4 (2020): 210-220
3. Ianovici, Iris, et al. "3D-printable plant protein-enriched scaffolds for cultivated meat development." *Biomaterials* 284 (2022): 121487.