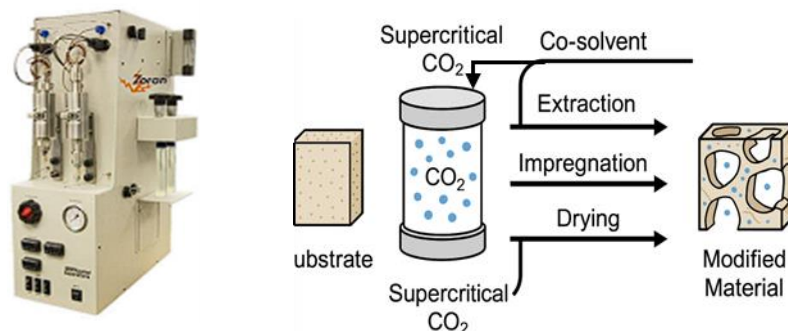


Master's Thesis
Characterization of Substrate–Solvent Interactions and Functionalization Processes Using Supercritical CO₂

Supercritical carbon dioxide (scCO₂) is an environmentally friendly solvent with tunable density, diffusivity, and solvation power, which make it suitable for applications in material processing, extraction, impregnation, and drying. To effectively utilize these unique properties, it is crucial to understand how different co-solvents and substrates, such as natural polymers, gels, or particulate systems, interact with scCO₂ under varying pressure and temperature conditions. Such interactions determine key process outcomes, including solubility, swelling, gel formation, and mass transfer efficiency. A systematic investigation of these phenomena provides the foundation for designing sustainable and precisely controllable supercritical processes for material modification and functionalization.

The thesis focuses on the experimental characterization of substrate–solvent interactions in supercritical CO₂ systems. Emphasis will be placed on the influence of pressure, temperature, and co-solvents on the solubility, swelling, and gelation behavior of various (bio)polymeric and particulate substrates. The student will also investigate solvent exchange processes in porous materials and conduct initial impregnation and drying trials to evaluate the feasibility and performance of supercritical treatment routes.

The outcomes will contribute to a deeper understanding of how to optimize extraction, impregnation, and drying operations in supercritical systems.



Methods and devices:

- High-pressure unit
- Gravimetric and spectroscopic solubility measurements
- Microscopy and porosity characterization (BET, SEM)
- Chromatographic analysis (GC, HPLC)

Requirements:

The student should be highly motivated, organized, and able to work independently. Prior experience in SC-CO₂ technology is not required.

Start: Immediately

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