International thesis project (funding possibility with Erasmus Traineeship)

Polysaccharide based bio-aerogels

Bio-aerogels are a fascinating class of dry, highly porous, nanostructured polysaccharide materials with a low density and a high internal surface area. They can be prepared by removing the liquid from a polysaccharide gel by drying it with supercritical (sc) CO2. The latter avoids the development of capillary stresses and, theoretically, preserves network morphology. In hydrated form, bio-aerogels resemble bio-based hydrogels and, accordingly, display advantageous properties including biomimicry. Furthermore, the specificities of preparing aerogels allow their properties and structure to be varied more widely. In addition, thanks to their dry nature, bio-aerogels retain their shape better than hydrogels during long-time storage, and bacterial contamination is avoided. In the last decade, bio-aerogels have attracted increasing interest as biomaterials in view of their unique properties, but the field is still in its infancy. For example, bio-aerogels have tremendous potential as drug delivery systems thanks to their high internal surface area, potentially allowing for high drug loading capacities, and their capacity to facilitate tunable, sustained release.

In this project, polysaccharide aerogels will be prepared via gelation of polymer solutions followed by solvent exchange and supercritical CO_2 drying. A drug will be incorporated via impregnation of the aerogel precursor in a drug solution. The loading and release of the drug will be assessed, and processing-structure-properties relationships will be established.

Cellulose aerogel precursor | Cellulose aerogel | Cellulose cryogel | Cellulose xerogel

Where?

The Center for Materials Forming (CEMEF) is a research center studying the formation, physico-chemical properties and mechanics of materials, focusing on both experimental work and numerical simulation. CEMEF is dealing with all types of polymers, with a strong focus on biomass-based materials. CEMEF is a pioneer in the development of bio-aerogels and recently started to investigate these fascinating materials for use in biomedical applications. CEMEF is part of the Paris School of Mines (MINES Paris), one of the oldest and most prestigious engineering schools in France, but is located in Sophia Antipolis on the Côte d'Azur in the south of France.

Contact people

Prof. Carlo Antonini carlo.antonini@unimib.it – Department of Materials Science, UNIMIB

Dr. Irene Tagliaro irene.tagliaro@unimib.it - – Department of Materials Science, UNIMIB

Dr. Tatiana Budtova tatiana.budtova@minesparis.psl.eu - CEMEF

Background

Chemistry or Materials Science