ISGC 2022

N°405 / OC
TOPIC(s) : Polymers or composites

NANOCELLULOSE-BASED CRYOGELS FOR GREEN ABSORBANT MATERIALS

AUTHORS

Celine MOREAU / INRAE, IMPASSE YVETTE CAUCHOIS, NANTES
Loïc FOUCAT / INRAE, IMPASSE YVETTE CAUCHOIS, NANTES
Charlie ROUILLON / INRAE, IMPASSE YVETTE CAUCHOIS, NANTES
Bernard CATHALA / INRAE, IMPASSE YVETTE CAUCHOIS, NANTES
Ana VILLARES / INRAE, IMPASSE YVETTE CAUCHOIS, NANTES

PURPOSE OF THE ABSTRACT

Among all natural polysaccharides exploited for bio-aerogels elaboration, nanocelluloses, cellulose nanofibrils (CNF) and cellulose nanocrystals (CNC), are particularly attractive materials as they are biodegradable, non-toxic, and can be produced from sustainable and renewable sources. They also exhibit unique properties including relatively high specific surface area, excellent mechanical properties and numerous hydroxyl groups allowing chemical modification to produce nanocellulose with carboxyl/amino groups on their surface. Nevertheless, solvent exchange procedure or chemical cross-linking is usually required to compensate the inherent fragility of the CNF and CNC aerogels in terms of mechanical and solvent-resistant properties.

Recently, we showed that CNC and CNF-based aerogels could be promising biomaterials with tunable properties by changing their microstructure or their composition [1, 2]. With the aim of designing bio-based cryogels displaying high resistance to water or ionic solutions, ultralight CNF cryogels were prepared using different freeze-casting procedure. Different pore morphologies were obtained by varying the ice crystals growth rates and direction. Absorption capacity of CNF aerogels were determined and cyclic compression tests were performed on swelled aerogels to assess their mechanical and shape recovery properties (Figure 1). Mechanism of pH-sensitive swelled aerogels was also explored by characterizing water dynamics using low-field nuclear magnetic resonance (LF-NMR) in cryogels. These bio-based cryogels are promising materials for applications in agricultural or biomedical field.

FIGURES

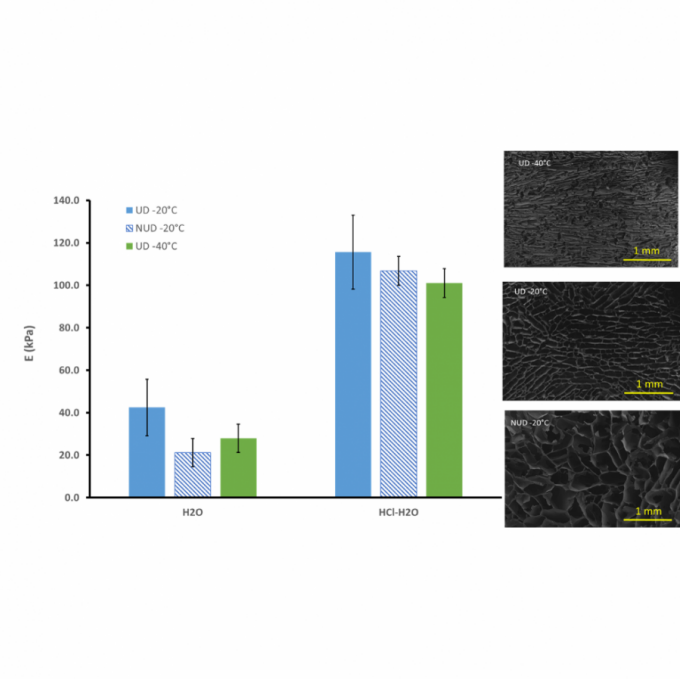

FIGURE 1

Figure 1

Compressive modulus (kPa) of CNF cryogels after unidirectional (UD) or non-unidirectional (NUD) freezing at -40°C or -20°C after swelling in water or in acidic solution. At right, SEM images of UD and NUD cryogels

FIGURE 2

KEYWORDS

nanocellulose | cryogel | absorbant capacity | shape recovery

BIBLIOGRAPHY

[1] Jaafar Z., Quelennec B., Moreau C., Lourdin D., Maigret J.-E., Pontoire B., D'Orlando A., Coradin T., Duchemin B., Fernandes F.M., and Cathala B. Carbohydrate Polymers, 247, 116642, 2020

[2] Mandin S., Moreau S., Talantikite M., Novalès B., Maigret J.-E., Cathala B. and Moreau C., Gels, 7, 1-13, 2021