ULTRALIGHT, REUSABLE BIOPOLYMER AEROGELS: FORMATION MECHANISMS TO APPLICATIONS IN SELECTIVE FLUID SORPTION AND OIL SPILL REMEDIATION

Anurodh Tripathi, Department of Chemical & Biomolecular Engineering, North Carolina State University, USA
atripat2@ncsu.edu
Orlando J. Rojas, Department of Chemical & Biomolecular Engineering ; Department of Forest Biomaterials, North Carolina State University, USA
Saad A. Khan, Department of Chemical & Biomolecular Engineering, North Carolina State University, USA

Highly porous (99.7 %), ultra-light (4.3 mg/ml) and mechanically robust cellulose ester aerogels with tailored hydrophobicity are synthesized. The aerogels achieve maximum compression strain of 92 % without failure and reach a compressive stress of 350 kPa, which is 100 times higher than that reported for cellulosic aerogels. In its native, unmodified state, the aerogels are hydrophilic and display unprecedented water uptake (45-90 g/g) while affording wet strength. Further adjustment of the aerogels towards hydrophobicity and oleophilicity via chemical vapor deposition with an organo-silane species reveal them to exhibit high oil retention (20-30 g/g aerogel) while maintaining mechanical integrity for fast oil cleanup from aqueous media under marine conditions. The modified aerogels are reusable and durable as they retain their hydrophobicity for months under ambient conditions. The Zisman and Fowkes theoretical frameworks are used to identify the selectiveness of the aerogel and establish a criterion for separation of various non-polar fluids from water media.