17th International Conference on Inorganic Membranes
New Frontiers for Inorganic Membranes
July 1 - 5, 2024
Oceania Convention Center - Florianópolis - Brasil

Synergistic effect of UiO-66 directly grown on Kombucha-derived bacterial cellulose for adsorptive membrane applications

P. Plaza-Joly, A. Gallois, C. Charmette*, F. Bosc-Rouessac, M. Drobek and A. Julbe
Institut Européen des Membranes, CNRS, University of Montpellier, France
*christophe.charmette@umontpellier.fr

Metal-Organic Frameworks (MOFs) are recognized as attractive materials for the preparation of highly efficient adsorbers or selective membrane barriers. Whatever the considered application, uniform dispersion/growth of MOF particles on suitable substrates represents a key condition to guarantee their processability and tailor the overall adsorption/separation performance of the final functional material. Different types of supports, organic or inorganic, have been studied in the literature for the deposition of MOF particles on their surface. Although this approach is simple, versatile and robust, direct growth of MOFs on the support is often a preferred strategy to ensure uniform dispersion of particles and limit their aggregation.

In the present work, we focus on the development of a novel adsorptive membrane material potentially applicable to water or air purification by coupling membrane filtration with conventional adsorption. Natural Kombucha-derived bacterial cellulose (KBC) films were investigated as active functional supports for the growth and anchoring of MOF particles with UiO-66 structure. An original hierarchical microstructure was obtained for the as-developed Kombucha cellulose/UiO-66 (KBC-UiO) composite material, with small MOF crystals (~100 nm) covering the cellulose fibers. Indeed, due to its excellent structural and functional properties, bacterial cellulose (BC) is an attractive biopolymer for the growth of MOFs and their application in several areas. Promising adsorption performance was demonstrated for the KBC-UiO material. The obtained results were attributed to both the high accessibility and uniform dispersion of the MOF crystals on the KBC fibers, as well as the synergistic effects involving the attractive adsorbing properties of UiO-66 and the surface chemistry of KBC.

The outcomes of this study provide a simple and generic approach for the design of efficient bio-sourced adsorptive membranes confirming the potential of these systems as adsorbents for both liquid and gas phase applications.