P3.088 Development of a sustainable membrane fabrication process using biobased materials

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Abstract

The current membrane fabrication methods mainly require the use of fossil derived polymers and toxic solvents. Hence, because of the rising environmental issues, new strategies to develop greener membrane processes are emerging and the use of renewable and non-toxic materials are part of them [1,2]. It is herein proposed a new sustainable membrane fabrication approach by combining the use of a polyhydroxyalkanoate (PHA) as biopolymer matrix and Cyrene™ as biosolvent by phase inversion.

The membranes were made by dissolving poly(hydroxybutyrate-co-hydroxyvalerate) (PHBHV) into Cyrene™ and inducing the phase inversion by a first partial evaporation (EIPS) followed by a non-solvent bath (NIPS). The influence of the evaporation time and dope solution composition were studied. The mechanical properties and microstructures of the membranes were analysed and linked to the process conditions. Pure water permeability and pervaporation tests were carried out to highlight the membranes application areas (Figure 1).

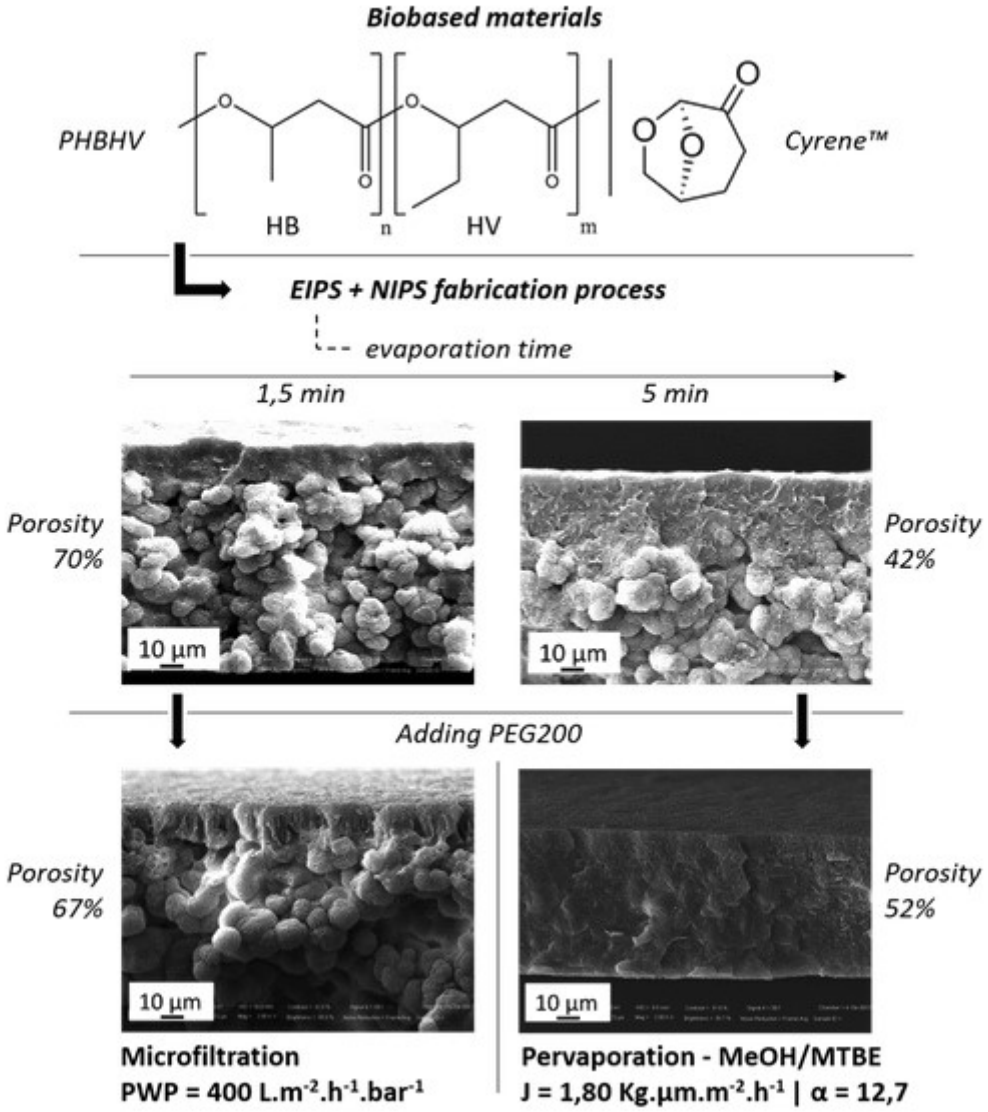

Figure 1: Overview of the sustainable process development. With the biomaterials chemical structures, membranes SEM cross-section images and porosities. PWP: pure water permeability, J: thickness normalized total flux and α: methanol selectivity.

By increasing the evaporation time, the membrane porosity was decreased but the tensile strength was

improved. While an evaporation time of 1.5 min led to porous membranes intended for microfiltration, a time of 5 min led to dense asymmetric membranes for pervaporation. The addition of polyvinylpyrrolidone (PVP) or polyethylene glycol (PEG) as pore forming additives was also evaluated.

By acting on polymer composition and preparation conditions, new biobased membranes were successfully produced. The membranes demonstrated promising results for microfiltration and pervaporation applications. This process has proven its potential to make greener membranes.

[1] A.G. Livingston *et al.*, Green Chem. 16 (2014) 4440.

[2] F. Galiano *et al.*, J. Memb. Sci. 564 (2018) 562–586.