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Pseudopeptide-polymer bioconjugates as additives for CO_2 separation membranes

Carbone dioxide is one of the main greenhouse gases having serious detrimental effects on climate and health. During the last COP21 meeting in Paris, the yearly costs related to the CO_2 atmospheric increase have been estimated as 104 billion US$. Therefore, his capture and storage are major issues and research in this area is very active. Nevertheless, the deployment of industrial CO_2 capture/storage processes still requires significant research progress. In this work, pseudopeptide-polymer bioconjugates were synthesized in a controlled way by a "grafting-to" strategy based on CuAAC "click" chemistry of alkyne-modified pseudopeptides with an azido-functionalized PEO-based oligomer obtained by controlled radical polymerization (SET-LRP). Peptide-polymer conjugates are brand new structures, which are currently being investigated in various fields;3 but, to the best of our knowledge, they have never been used as additives to membranes and their potential impact on molecular separation has never been investigated. These bioconjugates were assessed as original additives in a reference Pebax™ polymer membrane for CO_2 capture. Pebax™ is a Poly Ether Block Amide thermoplastic elastomer provided by the chemical company Arkema and already well known for its good performance for CO_2 separation for two important gas mixtures (CO_2/N_2 and CO_2/CH_4). The first separation relates to the major industrial challenge of CO_2 capture from combustion processes. The latter separation refers to the treatment of natural gas, which is another important issue for energy production. An analysis of the sorption and permeation results according to the solution-diffusion model revealed the key features of the new additives for improving membrane performances for these challenging CO_2 separations. Compared to pseudopeptides, the pseudopeptide-polymer bioconjugates greatly improved membrane permeability (×1.6) with a good constant selectivity for CO_2 capture.

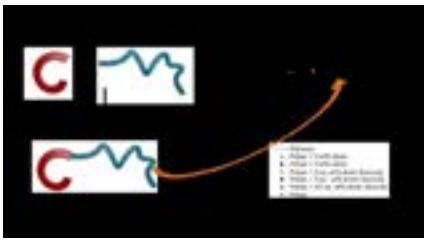

Figure1: *Strong improvement of the membrane properties by pseudopeptide-polymer bioconjugates for CO_2 capture*

Biography

Anne Jonquieres develops new approaches for high performance polymer membranes based on a multidisciplinary education in polymer chemistry and chemical engineering. After initial works on multi-blocks copolymers, she has recently proposed new polymer architectures to overcome the common permeability/selectivity trade-off for different liquid-liquid separations of interest in the bio-fuel industry. In particular, the controlled grafting of multi-block copolymers has led to very strong permeability improvement while maintaining very high selectivity for the purification of a major European bio-fuel (ETBE) by organoselective membranes. The extension of this strategy to original organophilic membranes has also led to outstanding performances with the simultaneous increase in permeability and selectivity for butanol bio-fuel recovery. Her research interests also include bio-based membranes obtained by the controlled modification of cellulosic derivatives and the design of new polymer membranes for CO_2 separations.

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