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DIALKYL CARBONATES AS GREEN SOLVENTS FOR MEMBRANES

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Abstract

Dialkyl carbonates (DACs) are well-known green solvents and reagents that are extensively investigated as safe alternatives to chlorine reagents. In fact, they can replace alkyl halides and dimethyl sulfate in alkylation and carbonylation reactions as well as phosgene and its derivatives in the alkoxy-carbonylation ones [1,2]. In this talk, I will be presenting our latest results in the high yielding scale-up synthesis of non-commercially available or expensive DACs via transcobonylation reactions of an alcohol with DMC promoted by the nitrogen-based organocatalyst, 1,5,7-triazabicyclo[4.4.0]dec-5-ene (TBD). Compared to previously published works [3,4], the proposed procedure has been customized for DACs large scale production (up to 100 mL of product obtained). Purification of these compounds has been achieved by fractional distillation and the exceeding reagents have been recovered and recycled. The selected DACs for this study include both symmetrical and unsymmetrical compounds, incorporating several alkyl, alkoxyalkyl, alkylamino and alkylthio functional groups. Chemical-physical properties of the new DACs have been also evaluated, as well as their water solubility. Furthermore, biodegradability and cytotoxicity tests have been carried out to investigate the effects of the different substituents on the greenness of these potential solvents and reagents. Finally, both commercially available cyclic carbonates (namely ethylene carbonate – EC and propylene carbonate – PC) and selected samples of the newly synthesized DACs, have been investigated as green solvents for membrane preparation, using non-solvent induced phase separation (NIPS) and vapor induced inverse phase separation (VIPS) techniques, achieving both porous and plain membranes. Physical-chemical, morphology, mechanical properties and the performance in terms of water permeability and rejection of these new membranes have been also evaluated.

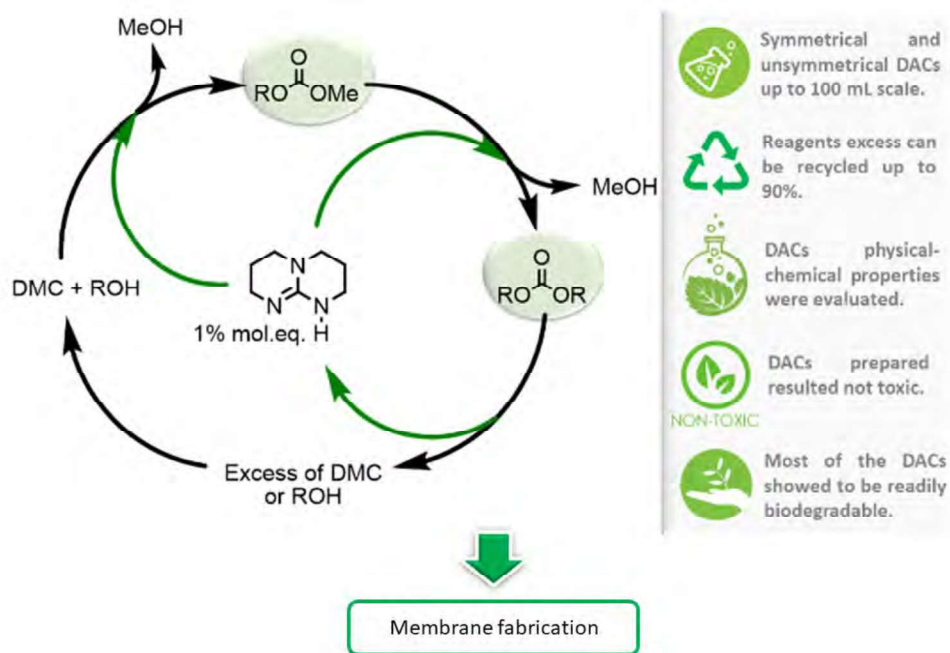


Figure 1. Dialkyl carbonates (DACs) as green solvents for membrane preparation: synthesis, cytotoxicity and biodegradability.

References

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