Advanced functional polymers via multicomponent reactions and emulsion templates

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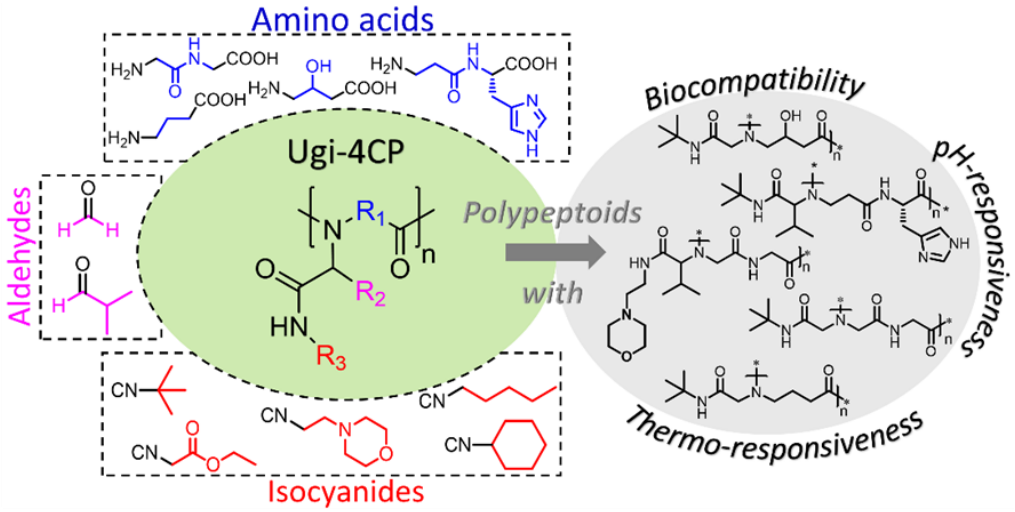
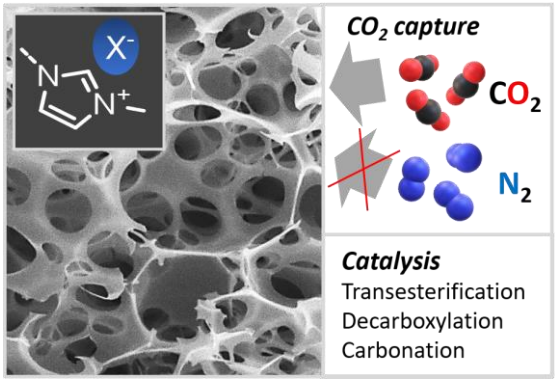
Multicomponent reactions (MCRs) are highly efficient reactions involving more than two compounds which react together and form complex chemical structures containing essentially all atoms of the starting reagents. Due to their combinatorial character, ease of implementation and atom economy, MCRs recently emerged as promising and powerful tools for the design of structurally complex macromolecules.[1] This communication aims to emphasize the potential of MCRs, in particular of the Ugi and Radziszewski reactions, for the design of novel functional polymers and porous materials. In a combinatorial approach, the Ugi four-component polymerization of amino acid derivatives was notably exploited for the synthesis of a library of biocompatible and stimuli responsive peptoid analogues.[2,3]



Scheme 1. Ugi-4 polymerization of amino acids towards valuable polypeptoids.

Moreover, the benefits of combining MCRs and high internal phase emulsion (HIPE) templates will be demonstrated for the preparation of interconnected imidazolium-based porous supports of interest for both catalysis and CO_2 capture

applications (Scheme 2).[4-5] This approach combines the great availability of the starting reagents and efficiency of one-pot MCRs with the ease of implementation of emulsion templating polymerization and the excellent flow through properties of the resulting macroporous polymers. These materials showed great efficiency as heterogeneous catalysts for transesterification, decarboxylation and carbonation reactions.[4] Bifunctional imidazolium/amine porous supports were also produced via a one-pot procedure involving Radziszewski and HIPEs.[5] Owing to a synergistic effect of imidazolium and amine functions, these porous networks showed excellent CO_2 capture performance, selectivity, recyclibility and consistent performance under humidity.



Scheme 2. Emulsion templated macroporous poly(ionic liquid)s for catalysis and CO_2 capture application.

References

[1] P. Stiernet, A. Debuigne, *Prog. Polym. Sci.*, **2022**, 101528; [2] A. Al Samad, J. De Winter, P. Gerbaux, C. Jérôme and A. Debuigne, *Chem. Commun.*, **2017**, 53, 12240–12243. [3] P. Stiernet, B. Couturaud, V. Bertrand, G. Eppe, J. De Winter, A. Debuigne, *Polym Chem* **2021**, *12(14)*, 2141-2151. [4] P. Stiernet, A. Aqil, X. Zhu, A. Debuigne, *ACS Macro Letters*, **2020**, *9*, 134-139. [5] P. Stiernet, M. Mazaj, S. Kovačič, A. Debuigne, *Chem. Eng. J.* **2022**, 137012.