Exploring new pathways to valorize carbon dioxide by means of bio-based substrates.

Luis Miguel Nuñez Tapia [1], Fabrice Burel [1], Laurent Bischoff [2], Alain Ledoux [3].

[1] *INSA Rouen Normandie – Université de Rouen Normandie - Laboratoire PBS, Polymères, Biopolymères, Surfaces (UMR-6270)*

[2] *Université de Rouen Normandie - Laboratoire COBRA, Chimie Organique Bioorganique : Réactivité et Analyse (UMR-6014)*

[3] *INSA Rouen Normandie – Université de Rouen Normandie - Laboratoire LSPC, Laboratoire Sécurité des Procédés Chimiques (EA 4704)*

luis.nunez@insa-rouen.fr, fabrice.burel@insa-rouen.fr

Keywords: Carbon dioxide, Poly(hydroxy urethane), Isocyanate-free, Biobased, Cyclocarbonate.

Abstract: CO_2 emissions have become a global risk in environmental terms, reaching 36 Gt in 2021[1]. Chemical transformation of CO_2 is presented as a potential option for reducing emissions and for a further integration of carbon into industry and economy. In the other hand, polyurethanes (PUs) are a special group of polymeric materials that stand out because of their versatility. They can be incorporated into many different articles, such as paints, liquid coatings, elastomers, insulators, elastic fibers, foams, medical articles, etc. In general, PUs are synthesized by the reaction between a di-isocyanate and a diol [2] but the problem with this synthesis route is that isocyanates are highly toxic. To avoid this concern non-isocyanate polyurethanes (NIPU) are synthesized by alternatives routes, one of these routes is the polymerization of bi-cyclocarbonates with amines [3]. Herein, this work is focused on the utilization of CO_2 and biobased substances for the synthesis of organic cyclocarbonates monomers, which were subsequently used in the synthesis of novel NIPU materials.

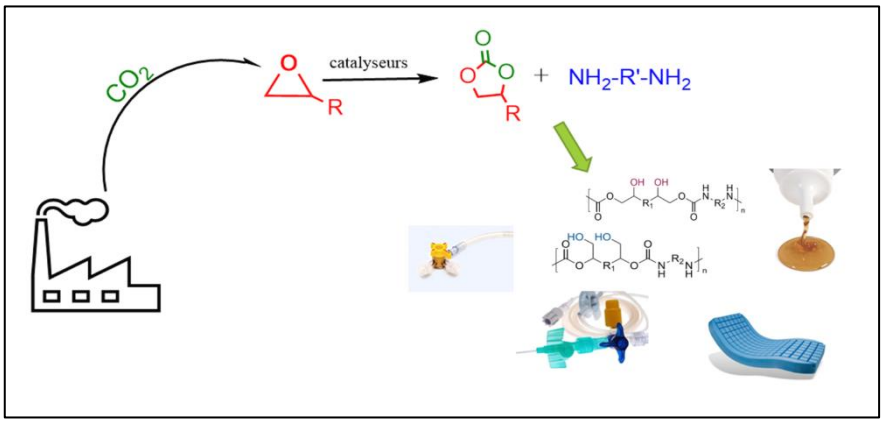

Figure 1: General view of the CO_2 valorization by NIPU synthesis.

References

[1] Energy Agency, I. *Review 2021 Assessing the Effects of Economic Recoveries on Global Energy Demand and CO 2 Emissions in 2021 Global Energy*; 2021.

[2] Akindoyo, J. O.; Beg, M. D. H.; Ghazali, S.; Islam, M. R.; Jeyaratnam, N.; Yuvaraj, A. R. Polyurethane Types, Synthesis and Applications-a Review. *RSC Advances*. Royal Society of Chemistry 2016, pp 114453–114482. https://doi.org/10.1039/c6ra14525f.

[3] Maisonneuve, L.; Lamarzelle, O.; Rix, E.; Grau, E.; Cramail, H. Isocyanate-Free Routes to Polyurethanes and Poly(Hydroxy Urethane)s. *Chemical Reviews*. ACS November 25, 2015, pp 12407–12439. https://doi.org/10.1021/acs.chemrev.5b00355.