PUReSmart

PolyUrethane Recycling Towards a Smart Circular Economy

Deliverable

D1.3 0.1-0.2 kg of at least three TAD-indole CAPU co-monomers for foam tests

WP1 – CAPU co-monomers

Project Information

Grant Agreement n°	814543
Dates	1st January 2019 – 31st December 2022

Publishable summary

This deliverable report details the scalable synthesis of six new comonomers which can be used to incorporate triazolinedione (TAD) and indole based reversible click chemistry into polyurethane materials. Previously available comonomers, which have been published in the literature, required lengthy synthetic protocols and chromatographic separation. Mainly for this reason, these comonomers were only available in limited amounts, which precluded their further studies in polyurethane materials, such as polyurethane foams.

In order to show potential industrial relevance, a range of selected and redesigned comonomers can now be readily produced on larger scales, in the order of 0.1 -0.5 kg. The main scientific challenge here was to balance synthetic feasibility with overall performance, while aiming for maximum compatibility with existing polyurethane formulations and monomers.

Physicochemical compatibility of these new TAD-indole PU comonomers is addressed *via* an industrially known technique. Other synthetic procedures developed herein rely on standard chemical industrial processes, and do not require difficult purification steps. Preliminary safety assessments of these procedures, indicative of their further scalability have also been performed.

In summary, the deliverable report discloses six new TAD and indole based comonomers for the production of polyurethane foams that would constitute a covalent adaptable network. The study of such covalent adaptable polyurethane (CAPU) networks is now enabled by resolving the synthetic issues, and further offers options for structural refinements to achieve optimal physicochemical compatibility with various PU formulations.

Four of the six new CAPU comonomers have been produced on batches of at least 100 gram, while two others have been demonstrated on 10-20 gram batches, and can be readily scaled according to the needs of further material synthesis trials (activities planned in WP4).