

Request for Industrial Partners (22/04/2021)

Project title: Lignin oil-based polyols for polyurethane applications

Acronym: LIBERTY

Project ID	
Type	ICON
Period	2-3 years
Starting date	1 April 2022
Total project budget	to be determined
Subsidy percentage	according to SBO and O&O regulations
Current industrial partners	confidential
Catalisti contact	Isabelle Monnaie (imonnaie@catalisti.be)

Project description

Introduction

Polyurethanes (PU) are a versatile class of polymers and can yield a wide range of products including rigid and flexible PU foams, adhesives, sealants, or coatings. A typical PU formulation includes one (or several) polyol(s), an isocyanate and additionally some additives. Traditionally, these building blocks are fossil-based. Yet, there is a strong market demand for greener PU with improved sustainability and environmental characteristics. In this context, the use of lignin, a renewable aromatic polyol, has several advantages: (1) the presence of hydroxyl functionalities to react towards isocyanates, (2) the lignin network structure can improve the mechanical properties and thermal stability, and (3) the natural properties can contribute to higher moisture and flame resistance of PU foams.

Several studies have already reported the direct incorporation of lignin (Kraft, Organosolv) in PU materials. However, despite the long history of lignin PU synthesis, several issues are still preventing the more widespread integration of lignin in PU products. The synthetic challenges for designing lignin PU are well known and are generally attributed to (1) the low solubility of lignin (in solvents or with the other PU precursors), resulting in its poor incorporation into the polymer matrix, in low reactivity with the co-reactants, and the impossibility to use common organic solvents, (2) the high molecular weight of lignin, (3) its high polydispersity, which leads to inconsistent performance, reactivities and solubilities, (4) its sulphur content that can generate odour problems and yellowing of final products, and (5) lignin's dark colour that prevents its use in certain applications including coatings.

In order to overcome these limitations and improve the lignin content in PU products, the use of depolymerised lignin (so called "lignin oils") is a promising option, because the lower molecular weight of the depolymerised lignin building blocks could allow a better reactivity and miscibility, thus enhancing the applicability of lignin and its derivatives as alternative to the fossil-based PU precursors. The crucial role of the lignin oil's molecular structure and functionality on the physical properties of the resulting PU materials has not been investigated so far and still needs to be fully elucidated in order to enable the rational design of a wide range of sustainable PU products such as foams, adhesives or coatings.

Goals

The goal of LIBERTY is:

- to develop lignin fractions (bio-polyols) produced by metal catalysed depolymerisation, fractionated, formulated, and possibly chemically modified, in order to achieve increased reactivity with isocyanates;
- to design a new generation of PU materials derived from sustainable polyols for different PU applications including two component insulation products, adhesives, sealants and one component foams;

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- to gain insight on the structure-activity relationship of the lignin fractions on the performance of the PU materials and fine-tuning of those lignin fractions to optimise performance.

Beyond increasing the renewable content in the PU products (and the important lower carbon footprint associated with it), the project will focus on designing innovative biopolymers with unique and tunable properties by leveraging on the unique molecular structures of lignin and lignin oil-based polyols. Overall, this project will further contribute to the establishment of a new lignin value chain in Flanders and to the development of a bio-circular economy, in accordance with the Catalisti innovation roadmap.

Request

The current consortium consists of a global producer of PU insulation materials and a global producer of PU adhesives, sealants and foams. **To complete the consortium, Catalisti is searching for:**

- an industrial partner that is interested in producing metal catalysed depolymerised lignin (oil)-based polyols for PU materials;
- additional industrial end-users interested in valorising metal catalysed depolymerised lignin (oil)-based polyols into PU materials towards specific PU applications (other than PU insulation materials, PU adhesives and sealants). Examples include, amongst others, thermoplastic PU, coatings, resins, or composites.

How to reply to this request

Please send an **email before 6 May 2021** to Isabelle Monnaie (imonnaie@catalisti.be) with nverdonck@catalisti.be in CC, and **briefly describe your interest and potential contribution** to the project. Based on all offers, the current industrial partners will determine together with Catalisti which partners can join the consortium. After submission of your offer, you can be contacted by phone to further elaborate your offer. The partner decision will be communicated on 21 May at the latest.

Important notice: Partners that wish to participate in Catalisti-supported projects are required to be member of Catalisti. For more information on membership and membership fees, please visit our [website](#) or contact Isabelle Monnaie (imonnaie@catalisti.be).

Contact

Please contact Isabelle Monnaie (imonnaie@catalisti.be, +32 471 506 833) if you have questions concerning this RfP.

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