

Membrane separation technology as a valuable and efficient tool in the value chain of wood towards chemicals and materials

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Bio-based chemicals are expected to grow significantly and increase their share of the global chemical production in the coming years. Today nearly all aromatic chemicals and building blocks originate from fossil oil, whereas lignin – nature's second most abundant polymer after cellulose – could provide a valuable renewable aromatic resource for the chemical industry. Conversion of presently underutilized lignin by-products (e.g. from pulp and paper industries) into high performance biomaterials calls for development of new and/or optimized process technologies. In this respect, cost-effective downstream separation and purification processes are of utmost importance. Generally, membrane processes can be considered a "natural" technology for separation of complex biomass streams. Thanks to their low energy requirements, mild processing conditions, scalability, moderate cost to performance ratio and flexibility in equipment design, membranes are a highly attractive separation technology for tomorrow's lignocellulosic biorefineries.

VITO's research activities are dedicated to valorization of biomass through conversion of lignocellulose into value-added bio-aromatics, primarily for use as building blocks within the chemical industry. Depolymerization of lignin typically results in complex mixtures comprising a wide array of phenolics, bearing a variety of oxygen-based functionalities and covering a broad range of molecular weights. However, in many cases, valorization of these lignols can only be pursued from well-defined fractions. In this context, the principal focus is the development and demonstration of membrane processes for fractionation and purification of lignins and lignin degradation fragments to enable the use of these molecules in chemical and materials applications.

VITO is co-initiator of Biorizon, an industry driven Shared Research Center, focusing on technology development for the production of functionalized biobased aromatics for performance materials, chemicals & coatings supported by a Roadmap, inspired by an industry driven community. As the leading institute, VITO coordinates the development of lignin derived bioaromatics by its own technology and collaboration with many different technology providers (www.biorizon.eu).

Being involved in various national (e.g. ArboRef, MAIA) and international (e.g. BIO-HaRT) running initiatives in which different depolymerization processes of wood/lignin are envisaged, more insight is gained in the potential of membrane processes in the value chain of wood/lignin towards bio-based aromatics. The separation efficiency of commercial polymeric and ceramic membranes as well as in-house developed functionalized ceramic membranes with carefully selected molecular weight cut-offs is evaluated and demonstrated at a larger scale aiming at a proof-of-concept of the membrane-based fractionation/purification. In this talk, the potential of membrane processes in different aspects of the wood-to-aromatics value chain will be illustrated through some recent case studies. The potential applicability of the resulting fractions of lignin derivatives in polymer applications will be discussed.