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Lignin, an abundant feedstock for future recyclable bio-plastics

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PURPOSE OF THE ABSTRACT

Lignin, an abundant feedstock for future recyclable bio-plastics
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Aromatics are among the most important resources (40%) for the chemical industry. Many (especially construction and long lasting) materials are made from aromatics and lead to higher or better performance. In some cases safety or toxicity is still an issue (e.g. bisphenol A). Brand owners are on the search for more sustainable molecules (e.g. bio-based), but also for safer materials of higher performance.
Currently virtually all aromatic building blocks are made from fossil oil. This presentation is anticipating the potential changes of availability of aromatics from the petrochemical industry and the widely shared ambition to green the chemical industry. Nowadays there are several trends in the chemical industry. A change to C1/C2 gas as feedstock and a change to C1 chemicals as methane of methanol by catalytic conversion of CO2. Both approaches ask for strong catalytic conversion of these molecules into aromatic structures. Further there is a strong reliance on biomass as feedstock with a move toward cellulose and cellulose-derived sugars to convert into olefinic molecules. The scarcity in aromatics, however can be solved as in the extraction of cellulose 20-25% of lignin is released from trees, straw and other sources. This lignin is the ideal feedstock for the conversion to aromatic structures.
However, in order to use lignin, one of the big problems is its low reactivity, high polydispersity and heterogeneity which made it not very manageable. Efforts to fractionate, activate or depolymerize are under way by different consortia in order to solve these problems. In this respect, cost-effective downstream separation and purification processes are of utmost importance as well. State of the art of all these processes will be presented with special attention to the future markets and applications.
Special attention will be given to the in Belgium operational pilot plant, Lignovalue, able to depolymerize 250 kg of lignin per day. This pilot allows to provide large quantities of lignin-oil, monomer and oligomer fractions in order to make and develop new chemicals as dispersants, resins, adhesives, polymers, polyurethane, anti-oxidants, flame retardants, UV-resistant molecules, antibacterial compounds, plasticizers etc.
This lecture will give an overview of the problems linked to wood-based refineries and the availability of lignin sources. Next, it will give an overview of the different approaches worldwide to valorize lignin and to produce bio-based aromatic molecules. It will indicate the hurdles, challenges and needs for value chain approaches.
A large part of this work is done via the shared research center Biorizon. If interested you can join the community at: www.biorizon.eu/community

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS
Lignin | Aromatics | Depolymerization | Polymers

BIBLIOGRAPHY