

Lignocellulose as a fundamental resource for a sustainable development

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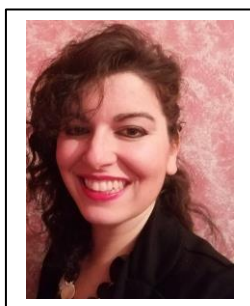
Abstract

Nowadays, the topic of environmental preservation and remediation plays an important role within the activities of the scientific community. Indeed, the procrastination of effective measures to mitigate the environmental damages caused by human activities is no longer possible. In particular, the use of non-fossil substances should be promoted for different reasons: to reduce the environmental disequilibria of the areas involved in the fossil fuel extraction; to decrease the impact of emissions and by-products related to the industrial transformation of fossil-based products; possibly, to exploit biomasses as sources of organic carbon with net zero carbon emission. As regards the type of biomass, herein, a focus on the use of lignocellulose biomass (LCB) will be presented, in particular when it is in the form of waste, often non-correctly disposed or incinerated, representing a biohazard. Waste-LCB are low-cost, easy-available and green raw material. Despite of the variability among different lignocellulose biomasses, in general, they present convenient chemical-physical features that make them suitable compounds for several purposes. An overview of the multiple functions of lignocellulose biomass in the broad field of green chemistry and green catalysis will be explored. Thanks to the versatility of LCB, it has found application as an adsorbent for aqueous pollutant removal, as a precursor of bio-carbons with multi-purpose applications and reinforcing agent for plastics and construction materials. Within the catalysis field, LCB can be the substrate of catalytic transformation, when their constituting biopolymers (cellulose, hemicellulose, lignin) are converted to platform molecules and strategic building blocks, which can substitute some petroleum derivatives for the production of biochemicals and biofuels, in a perspective of lessening the petroleum dependence. Strong efforts have to be made to make this kind of processes sustainable, i.e. the employment of heterogeneous catalysts able to catalyze one or multi-step sequences, as well as the choice of solvent that, in most of the cases, plays a significant role for the reaction evolution. LCB can be considered also as a precursor for humic-like substances, isolated from waste-LCB, which are photocatalytically active compounds, able to degrade water contaminants under light irradiation, through the production of excited species and whose activity is strictly related by their origin and chemical structure. Lastly, LCB has been recently considered also as a support for metal/metal oxide catalysts and in other high-technological applications. Given the wide scenario involving lignocellulose-based compounds, this presentation is aimed to propose food for thought about a multifunctional approach on the valorization of waste-LCB for an eco-sustainable development.

Keywords: Lignocellulosic biomass, waste valorization, environmental remediation, biorefinery

Short biography

Maria Laura Tummino is a Permanent Researcher at STIIMA Biella of the Italian National Research Council. She received her Master's Degree in Industrial Chemistry in 2013 and the PhD in Chemical and Material Sciences in 2017 at Università di Torino (North-West of Italy). Maria Laura has devoted her career to green chemistry research, developing different materials for energy and environmental remediation. Her research was focused on photocatalysts for water depuration, biomass-based adsorbents for organic and inorganic aqueous pollutant removal and cathodes for electrochemical devices. She has combined the basic research on national and international levels with job experiences in different companies. She is (co-)author of more than 30 works (papers, congress presentations and publications in a database) and she is involved in scientific dissemination projects and outreach events.



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