

Cellulose conversion into bio-oil and cellulose-citrate: the role of citric acid in a solvent free reaction



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Abstract

Lignocellulosic materials are widespread in nature and cellulose represents the main component.¹ Due to the high stability of this natural polymer, the depolymerisation and/or conversion into useful materials, under mild conditions, is still a challenge today.^{2,3} Our research group recently developed a new approach for the contemporary cellulose depolymerisation and fictionalization into bio-oil and cellulose-citrate, under short times, solvent free conditions and atmospheric pressure.⁴ Cellulose is mixed with citric acid at the melting point of the acid. After the reaction time, bio-oil is extracted with a common organic solvent, while esterified cellulose is collected as a solid. The open air system and the three acidic functionalities of citric acid lead cellulose depolymerisation. The obtained oil is composed mainly of furan compounds, recovered in excellent yields. Chemical characterization of this bio-oil was carried out. Cellulose hydrolysis is accompanied by an etherification reaction and the product in the form of cellulose-citrate was also collected in high yields and characterized. A computational study of the mechanism was also investigated. This reaction represents an important breakthrough in the field of biomass conversion, because two useful materials are produced from cellulose, by a green, fast and safe approach. Citric acid is a mild organic acid that is widely abundant in nature. Bio-oil can be converted into fuel additives while cellulose citrate with its thermoplastic properties can be used as a biodegradable material for many purposes.

the second year of his PhD at the University of California, Davis, under the supervision of Prof. Mark Mascal.

Speaker Publications:

1. "Synthesis and preliminary evaluation of the anti-cancer activity on A549 lung cancer cells of a series of unsaturated disulfides"; *Journal of MedChemComm*, Vol - 10, 2018.
2. "Efficient Synthesis of Organic Thioacetates in Water"; *Journal of Organic Electronics*, *Journal of MedChemComm*, Vol - 10, 2018.
3. "Water excellent solvent for the synthesis of bifunctionalized cyclopentenones from furfural"; *Journal of Greenchem*, Vol -19, 2017.

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Biography:

Fabrizio Olivito is Postdoctoral researcher at the University of Calabria, Italy, under the supervision of Prof. Antonio De Nino. He obtained the Master's degree in chemistry at the University of Calabria in 2015 and, after that, he completed his PhD studies in 2019 at the University Magna Graecia of Catanzaro, Italy, under the supervision of Prof. Antonio Procopio. He spent