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Biomass valorization by means of catalytical and biological processes

Woody biomass is an abundant raw material, vastly available in nature. Each of the three main components of woody biomass, namely lignin, hemicelluloses and celluloses are themselves valuable resources, if being selectively transformed in valuable compounds. In this study, nut shell biomass was hydrolyzed with water assisted by microwave and the products were biologically treated without any separation process. Thus, the hydrolyzed product, xylose (from hemicellulose) was fermented by the appropriate microorganism for the production of lactic acid, the monomer of polylactic acid, a biodegradable plastic. Pure cellulose was also hydrolyzed to glucose and then fermented to lactic acid, as well. We obtained a high conversion to optically pure lactic acid through a non-petrochemical pathway. On the other hand, cellulose was hydrolyzed using basic catalysts, such as hydrotalcites, also assisted by microwave. Although the conversion was lower compared to acidic hydrolysis, alkali hydrolysis gave directly smaller molecules (C_2-C_3) with higher functional group densities. In conclusion, we propose a multidisciplinary study for the combination of catalytical and biological processes for the valorization of residual biomass, which makes the process more sustainable in the current society.

Recent Publications

1. Güell E J, Maru B T, Chimentao R J, Gispert-Girado F, Constantí M and Medina F (2015) Combined heterogeneous catalysis and dark fermentation systems for the conversion of cellulose into biohydrogen. Biochemical Engineering Journal 101:209-219.
2. Gavilà L, Constantí M and Medina F (2015) D-lactic acid production from cellulose: dilute acid treatment of cellulose assisted by microwave followed by microbial fermentation. Cellulose 22:3089-3098.
3. Gavilà L, Güell E J, Maru B T, Medina F and Constantí M (2017) Combining catalytical and biological processes to transform cellulose into high value-added products. Physical Sciences Reviews DOI: 10.1515/psr-2017-0026.
4. Gavilà L, Constantí M, Medina F, Pezoa-Conte R, Anufwom I, Mikkola J P An integrated biomass to lactic acid process. Submitted to Advanced Sustainable Systems.
5. Guarin C, Gavilà L, Constantí M, Medina F Impact of cellulose treatment with hydrotalcites in hidrothermal catalytic conversion. Submitted to Chemical Engineering Science.

Biography

Magda Constanti is an Associate Professor at the Department of Chemical Engineering at the University Rovira i Virgili, in Catalonia, Spain, and belongs to the Interfibio research group. She has expertise on the use of microorganisms and enzymes to different technological applications, which gives her a broad research vision. She has supervised several Doctoral and Master's theses related to biodegradation of toxic chemicals, biomass transformation to value added chemicals or bioenergy using microorganisms and enzymes, among others. She publishes in journals of biotechnology and chemical engineering areas. Currently, she co-directs with Dr. Francisco Medina (Director of the Catheter Research Group) a research project based on the bioproduction of value-added compounds from the residual lignocellulosic biomass.

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