

# Past and Present Research Systems of Green Chemistry

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## Novel lignocellulosic hydrolysate detoxification using pyrochar from digestate: Application for bioethanol fermentation

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Lignocellulosic biomasses have been widely investigated for bioethanol production through biological processes. The recalcitrant structure of lignocellulosic biomass required a pretreatment step before enzymatic hydrolysis and/or bioethanol fermentation and the most current pretreatment technology used are thermo-chemical pretreatment. Nonetheless, besides the production of accessible sugars, such pretreatments could also generate inhibitory compounds like furans (i.e. furfural and 5-HMF). Thus, a detoxification process is often required to avoid inhibition of biological processes. To date, several costly processes, including evaporation, adsorption or extraction, have been investigated. In this study, the use of two pyrochars, obtained through pyrolysis (at 600°C) of solid anaerobic digestate, was investigated as alternative of detoxification of a synthetic medium (glucose 10 g L<sup>-1</sup>, 5-HMF 1 g L<sup>-1</sup>, furfural 1 g L<sup>-1</sup>). Accessible surface areas of pyrochars ranged between 49 and 88 m<sup>2</sup> g<sup>-1</sup>. With a pyrochar concentration of 40 g L<sup>-1</sup>, more than 94% of 5-HMF and 99% of furfural were removed. Furfural was adsorbed at a faster rate than 5-HMF, and totally removed after 3h of contact. Both pyrochars were found selective towards furans compounds, as the soluble sugar concentrations remained unchanged. Moreover, pyrochars were found efficient in the detoxification of a corn stalks hydrolysate (i.e. soluble sugars: 8.76 g L<sup>-1</sup>, furans: 3 g L<sup>-1</sup>) with more than 90% of furans removal, without affecting sugar concentrations. Finally, both pyrochars were applied for bioethanol production, according to various configurations: i) raw hydrolysate, ii) hydrolysate detoxification prior to fermentation, iii) hydrolysate detoxification simultaneously with fermentation.

### Biography

Monlau Florian has completed his PhD in 2012 at the Laboratory of Environmental Biotechnology in Narbonne (France) and his Postdoctoral researches (2013-2014) within the European Project "Star Agroenergy" part of the 7th Framework. During his research carrier, he worked on the application of pretreatments for enhancing biofuels production (i.e. biohydrogen, methane, bioethanol). He is currently a Post-doctoral researcher at the French National Institute for Agricultural Research (INRA, UMR IATE) in Montpellier (France). He is author and co-author of more than 12 papers published in reputed journals.

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