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Making a bridge between biomass and hydrocarbon in a standard refinery

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A conventional refinery is based on mature processes that obtain standard products from a large variety of non- renewable feeds. Despite enormous benefits to modern civilization, the adopted production and consumption patterns paradoxically put us at environmental risk. Therefore it is mandatory a paradigm shift to decrease the carbon footprint without reducing the energy access to people. Biomass is composed of functionalized biopolymers (lignin-cellulose) based on sugars- and phenol-derivatives. On the other hand, refinery processes have been designed to operate on poorly reactive compounds like hydrocarbons. The bridge between these two remarkable worlds was archived in two steps: 1- by transforming the biomass into a bio-crude, which was produced by ketalyzation in acetone and acetylation reactions in acetic anhydride under mild temperature conditions (around 100°C). This black bio-crude (density around 1.0-1.3 gmL^{-1} and CHO composition of 60, 8 and 32 respectively) is chemically distinct of any other bio-feed so far. 2 -The transformation of bio-crude and model compounds by the fluid catalytic cracking and hydrotreatment into monoaromatic and saturated hydrocarbons respectively. Here in the results of the fluidized bed pilot plant in laboratory scale of both model test and bio-crude are presented. For instance, a representative ketal-derivative, 1,2:5,6-di-O- isopropylidene-α-D-glucofuranose (DX) mixture up to 50% in n-hexane achieved three main goals: small coke formation, remarkable selectivity to hydrocarbons and slight improvement in n-hexane conversion as presented in Table 1. Moreover, no oxygenated compounds were observed in the liquid phase, thus resulting in a drop-in fraction in the fuel pool. The bio-base economy derived from this concept fits the requirements to be produced, transported and processed like wise to the up- to downstream in the oil industry. Finally, as a consequence the bio-crude behaves like hydrocarbons under realistic refinery process, oil could be partially substituted by bio-crude or, in the future; an entirely green refinery could operate using renewable feeds.

	Coke cat.	Yield			Sel. Ar.	n-C6 conv.
		Gas	Liquid	Coke		
n-C6	4.8	20	68	16	13	10
30% DX	6.4	22	66	19	52	11

Table1: *FCC test with a feed of 30 wt.% of DX in n- hexane cracking and pristine n-hexane in the presence of 20 g of a commercial FCC catalyst, 10 mL min temperature 420-500oC. All data in %*

Biography

Marcelo Maciel Pereira is an Associate Professor at the Chemistry Institute of Federal University of Rio de Janeiro (UFRJ - Brazil). He obtained the MSc and the Ph.D. in Chemical Engineering at Federal University of Rio de Janeiro. His research interests focus on kinetics and catalysis, hydrocarbons, biomass conversion, zeolites, CO_2, greenhouse gas emissions and sequestration.

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