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High Throughput Experimentation in Catalytic Sugar Conversion

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PURPOSE OF THE ABSTRACT

As a response to the rapid changes in the global oil market accompanied with Covid-19 Crisis, the market of biomass conversion and the synthesis of new biochemicals is continuously growing and many industries are looking into new products and sustainable alternatives to fossils [Ref, 1]. In this regards, numerous industrial players are starting to conduct R&D programs in the field of bio renewables. High throughput technology (HT) has distinguished itself to be the ideal tool to accelerate R&D and innovation with high degree of reliability and credibility [Ref, 2].

The production of chemicals starting from sugars is highly interesting topic as sugars, nowadays, are not only accessible from 1st generation biomass but also from lignocellulosic material. Regardless if sugar-based chemicals are accessible from bio- or catalytic route, process integration, short reaction time and economical conversion is the core of any commercialization process. Herein, we, at hte (the high throughput experimentation company), report the use of a micro down flow unit (MDU) in sugar cracking towards C2 and C3 aldehydes and highlight the importance of reaction temperature and contact time by comparing MDU to batch system [REF 3].

Sugar cracking tests were conducted using the micro down flow unit (MDU), a newly developed laboratory equipment for cracking processes that enables high temperatures applications within short contact times. The catalyst (confidential commercial hydrocarbon cracking catalyst) or the inert heat carrier was loaded in the catalyst hopper and heated at 700 °C prior starting the cracking process. 30 wt.% aqueous glucose solution was used as a feed in the process. The feed has been preheated before injection into an entrained flow of catalyst to allow the cracking of glucose at high inlet temperature (>500°C) and short contact time (<0.5 sec). At these conditions, glucose will be converted quantitively to C2 and C3 aldehydes and alcohols. Mass balance as well as product distribution were conducted using advance online GC analytic technique coupled with offline HPLC.

In comparison to MDU, Sugar conversion was carried out using different technology namely batch system. An 8-folds batch unit with reactors size of 300 mL (8 reactors x 300 mL) was used to conduct the comparability tests for the different substrates, catalysts, and atmosphere. using Glucose or Fructose as starting material and commercially available Ru/C or Ru/ Al2O3 as a catalyst and in H2 or N2 atmosphere show only isomerization and hydrogenation reactions.

FIGURES

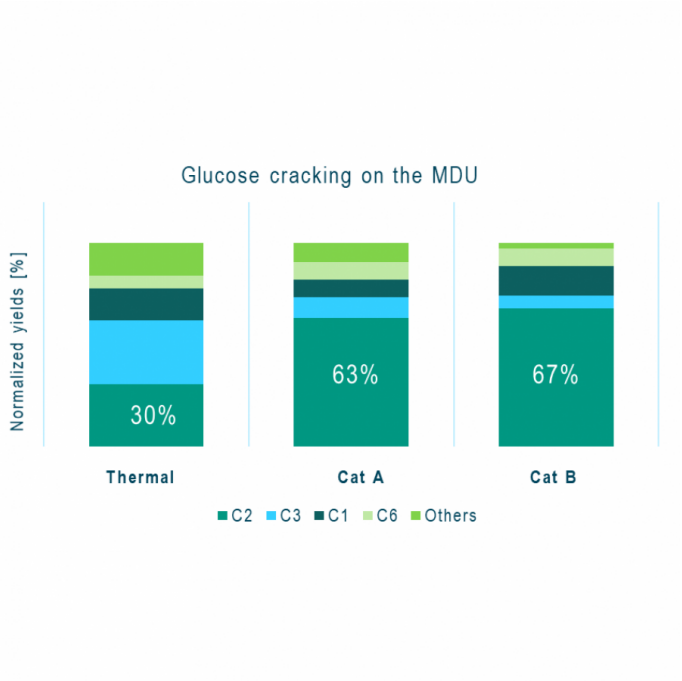

FIGURE 1

Glucose cracking on the MDU

MDU in Glucose cracking. Thermal vs. catalytical cracking over FCC catalysts (Cat A and Cat B)

FIGURE 2

KEYWORDS

Sugar conversion | High throughput experimentation | on step conversion | Cracking

BIBLIOGRAPHY