PREPARATION OF BIOETHYLENE AND BIOPROPYLENE FROM WASTE FAT AND RAPESEED OIL

Babor M.[1], Tišler Z.[1], Skálová R.[1], Hidalgo Herrador J. M.[1]

[1]*ORLEN UniCRE, a.s., Revoluční 1521/84, 400 01 Ústí nad Labem, Czech Republic*

High consumption of plastics, the limited amount of fossil resources and global clime changes lead to the need for renewable sources for plastic production. Production of bioethylene and biopropylene is a promising way how to reduce the environmental impact of plastic industry. We studied promising bio-feedstocks rapeseed oil and inedible waste rendering fat. The aim was to study the complete process of transformation of these feedstocks to ethylene and propylene. First, the feedstock was pretreated to be usable in standard ethylene units for the production of ethylene and propylene with high yields. The pretreatment was the catalytic hydrodeoxygenation avoiding the potential formation of CO_2 and unwanted oxygenate derivatives in standard ethylene unit. The hydrodeoxygenation was fine-tuned in a temperature range of 365 °C – 445 °C to provide also the hydrocracking. We used Ni(17.5%)W(6.4%)/SiO_2–Al_2O_3 catalyst. Quantitative hydrodeoxygenation was observed at all temperatures. Significant hydrocracking was observed only at temperature higher than 425 °C. All reactions were made in a batch reactor in hydrogen atmosphere (starting pressure 70 bar at 20 °C). Gas products were analyzed using the Refinery Gas Analysis. Liquid products were analyzed using FTIR ATR, simulated distillation, and GCxGC MS. The liquid organic products were treated in a microscale batch pyrolysis reactor at 815 °C with direct detection of products via gas chromatography to evaluate yields of required products. The lowest yields of ethylene and propylene were with reaction products after reaction at 365 °C (waste rendering fat) and 445 °C (rapeseed oil). The highest yield of propylene (rendering fat 6.57 % and rapeseed oil 7.44 %) and ethylene (rendering fat 17.53 % and rapeseed oil 20.42 %) was with products of reaction at 425 °C for both feedstocks. This results indicate that waste rendering fat and rapeseed oil are reasonable candidate for production of bioethylene and biopropylene.

Acknowledgment:
This presentation is a result of the project CACTU, Reg. No. CZ.02.1.01/0.0/0.0/17_049/0008397, which has been co-financed by European Union from the European Regional Development Fund through the Operational Programme Research, Development and Education. The result was achieved using the infrastructure of the project Efficient Use of Energy Resources Using Catalytic Processes (LM2018119) which has been financially supported by MEYS within the targeted support of large infrastructures.