Green diesel through continuous catalytic hydrotreating of high oleic sunflower oil

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The optimization of the hydrotreatment of high oleic sunflower oil towards green diesel fraction yield (C15-C20) under reduced $NiMo/Al_2O_3$ catalyst was investigated.
The catalytic hydrotreatment was performed in a fixed-bed tubular reactor (Parr 5402, 24 mL).
Optimization was based on three operative parameters: reaction temperature (300-400°C), pressure of H_2 (35-80bar) and liquid hourly space velocity (LHSV: 0.16-0.53 h^{-1}), using a central composite design and a response surface methodology.

When the reactor was operated at 367 ºC, 65 bar and LHSV 0.37 h^{-1}, a 96 % conversion to hydrocarbons was achieved, of which 93 % matched the chain length corresponding to green diesel.
At identical pressure and LHSV but lowering the temperature to 325 ºC, the hydrocarbon yield decreased to 60 %, while reducing the LHSV to 0.16 h^{-1} the conversion increased to 78 %. In both cases, 100 % of the hydrocarbon fraction in the products had chain lengths inside the diesel fuel range.
The complete conversion to hydrocarbons was achieved when the reactor was operated at 350 ºC, 80 bar and LHSV 0.26 h^{-1}. Additionally, almost all the hydrocarbons chain lengths (99.2 %) matched the green diesel range.

Results demonstrated that operating the reactor at a moderate temperature and with a relatively low oil flow enhanced the conversion to hydrocarbons with minimal occurrence of cracking, thus maximizing the yield in the green diesel fraction.