

Research Group Fluidized Bed Systems and Refinery Technology

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Bio-FCC

Catalytic Cracking of vegetable and pyrolysis oils to hydrocarbons in a continuous FCC-pilot plant



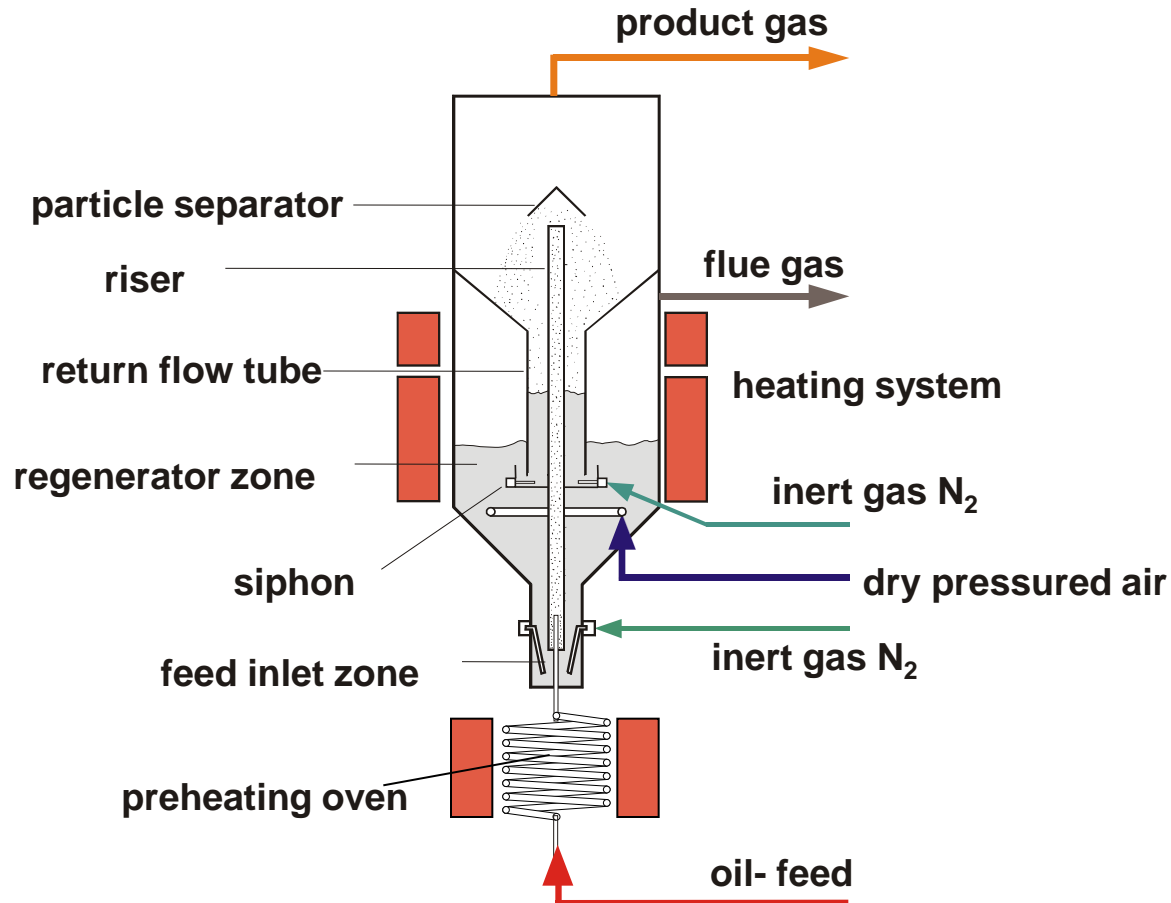
Mid and long term:

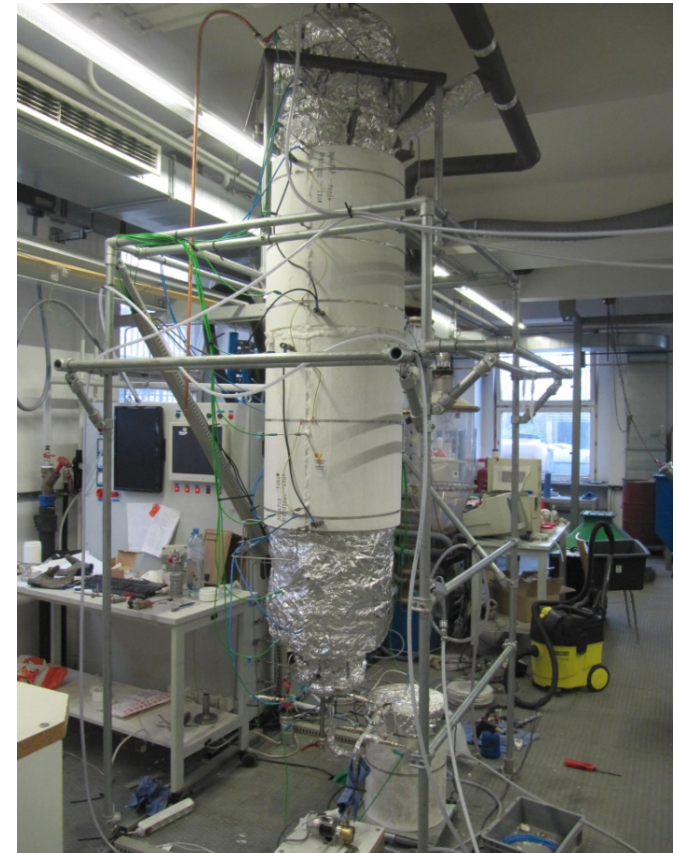
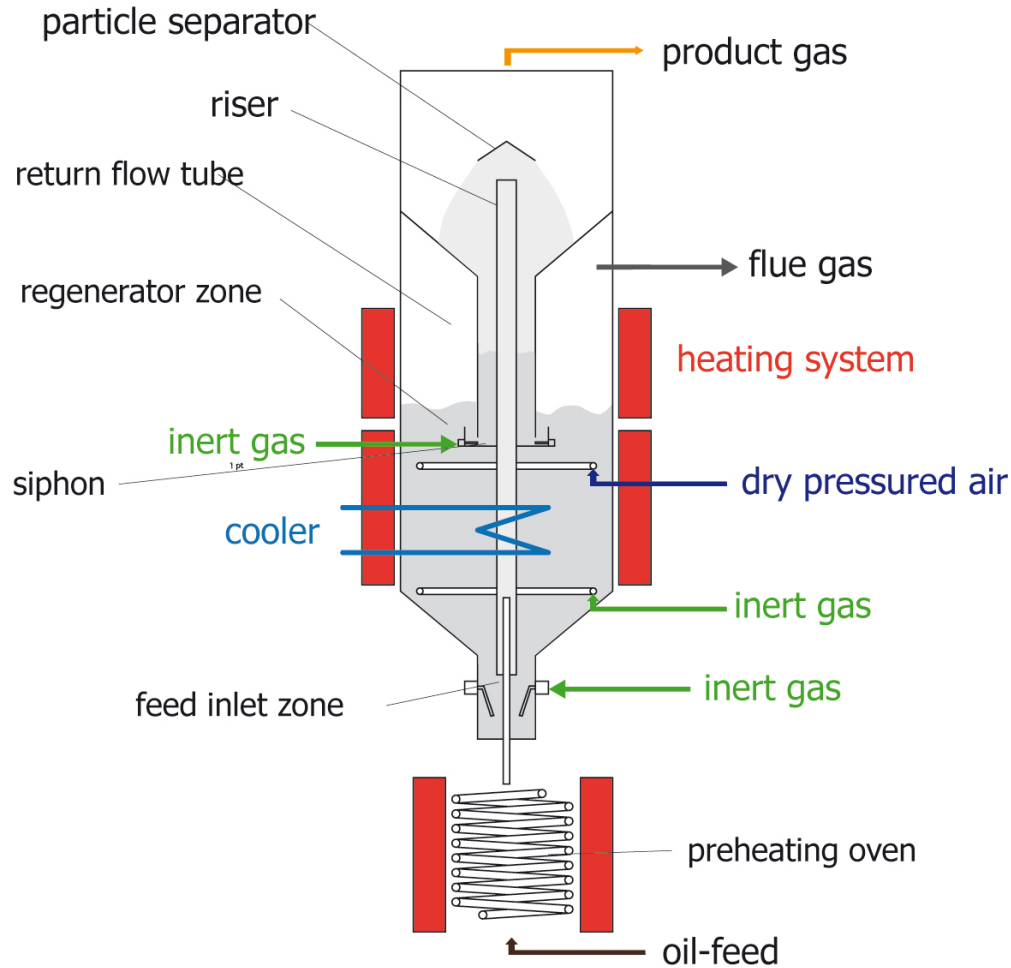
- Limited supply of crude oil
- CO₂-accumulation in the atmosphere due to open carbon cycles

Immediately (short term):

- Autarky efforts of European Union
- EU-directive 2009/28:
Blending of conventional fuels with up to 10% biofuels by 2020

- Cracking of petroleum hydrocarbons was originally done by thermal cracking
- Due to the production of more gasoline with a higher octane rating thermal cracking was replaced by catalytic cracking
- Most important conversion process used in petroleum refineries
- Conversion of high boiling hydrocarbon fractions of petroleum crude oils to more valuable gasoline, olefinic gases and other products
- Adaption of the FCC-process for the use of vegetable- and pyrolysis-oils





Improvements

- Thermal decoupling by the implementation of a catalyst cooler
- Enlargement of the regenerator diameter
- Adjustability of the catalyst – oil ratio
- Catalyst sampling during operation

Crack gas

Gasoline

LCO +
Residue

Water

Coke

Gas Fraction

Gas Chromatography

- C₁ - C₄

Liquid Fraction

Gas Chromatography
(SimDist)

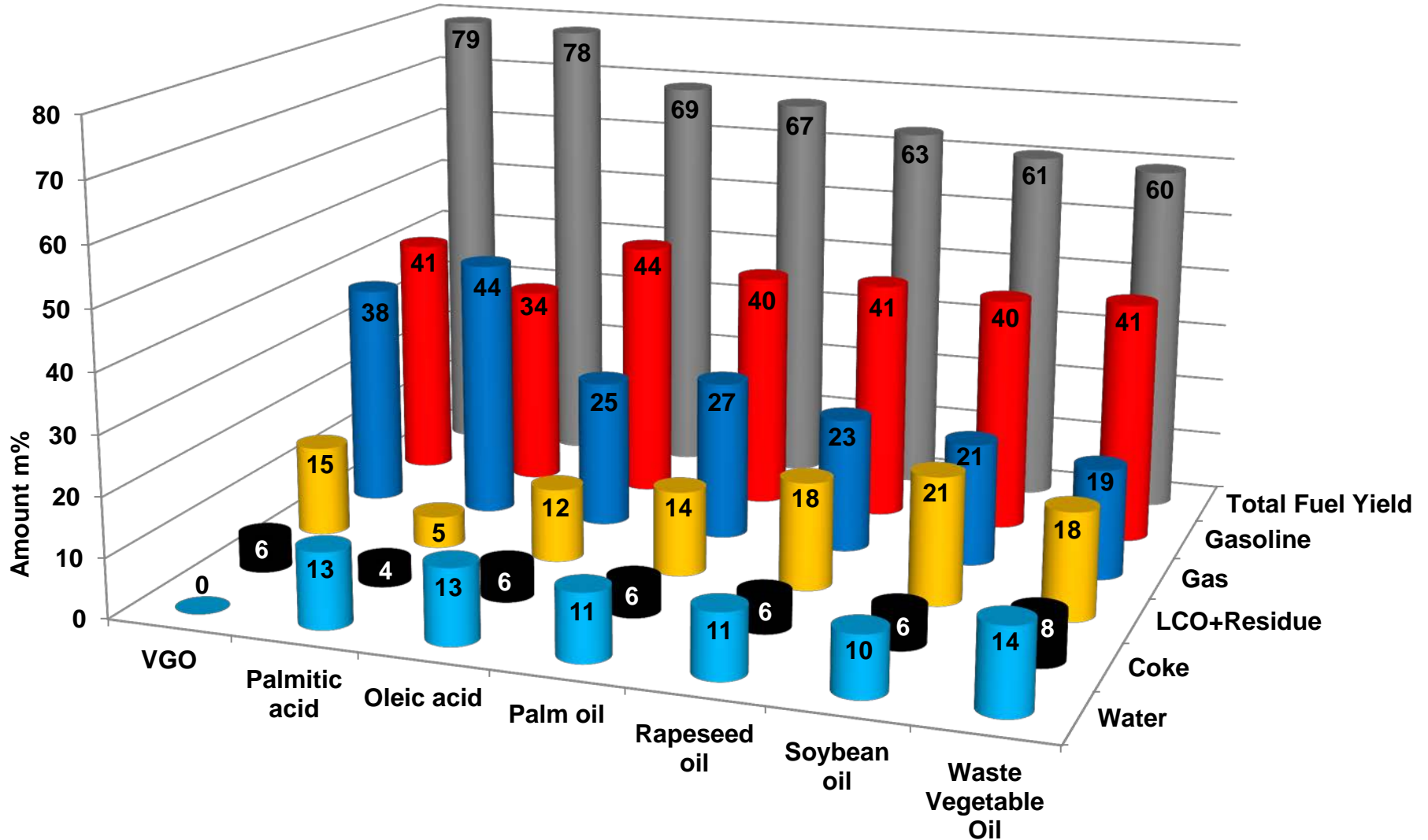
- Gasoline (FBP 215°C)
- LCO (215°C - 350°C) + Residue (IBP 350°C)
- Water (IBP 100°C) (add. Bio Oil to VGO)

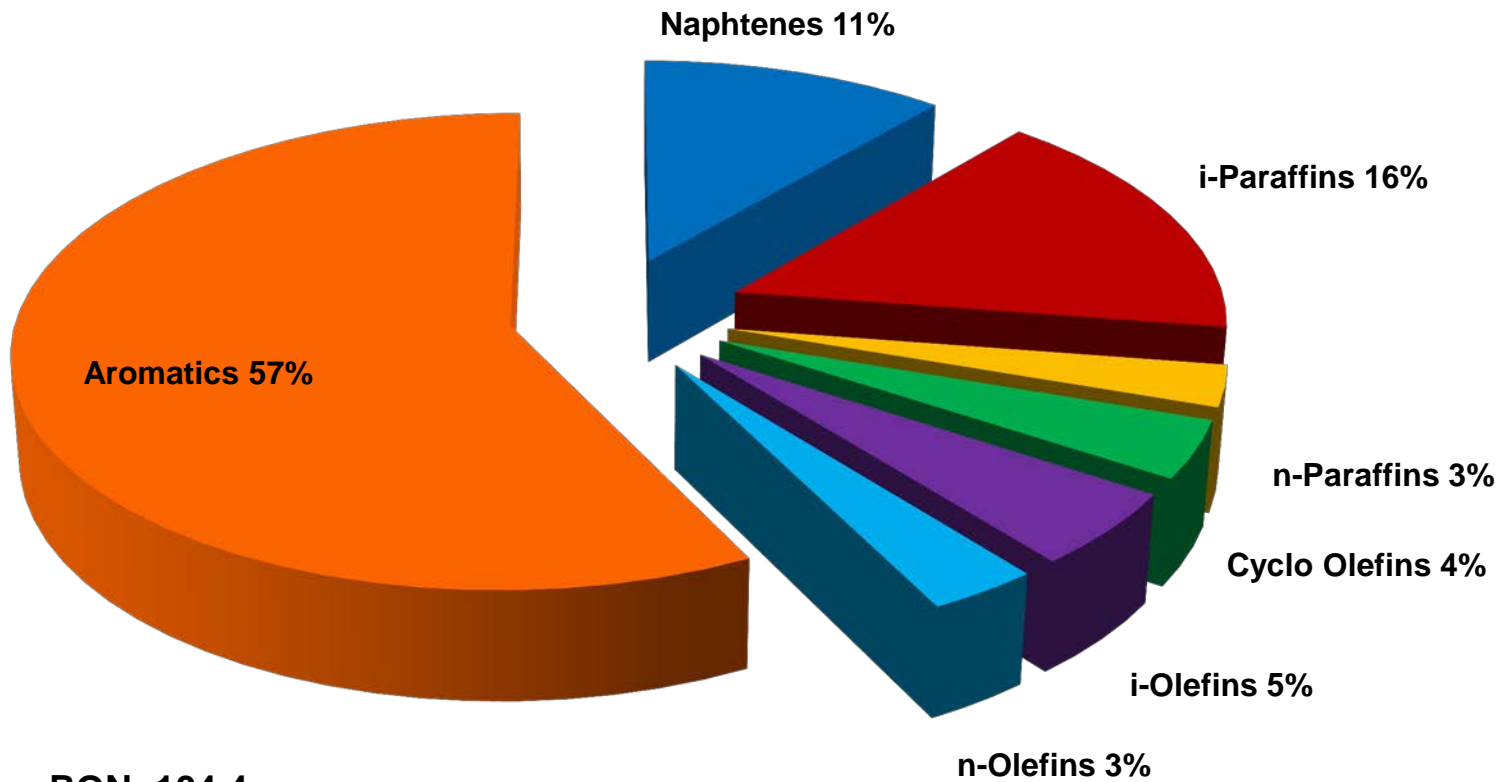
Solid Fraction

- Coke (polyaromates)

Conversion

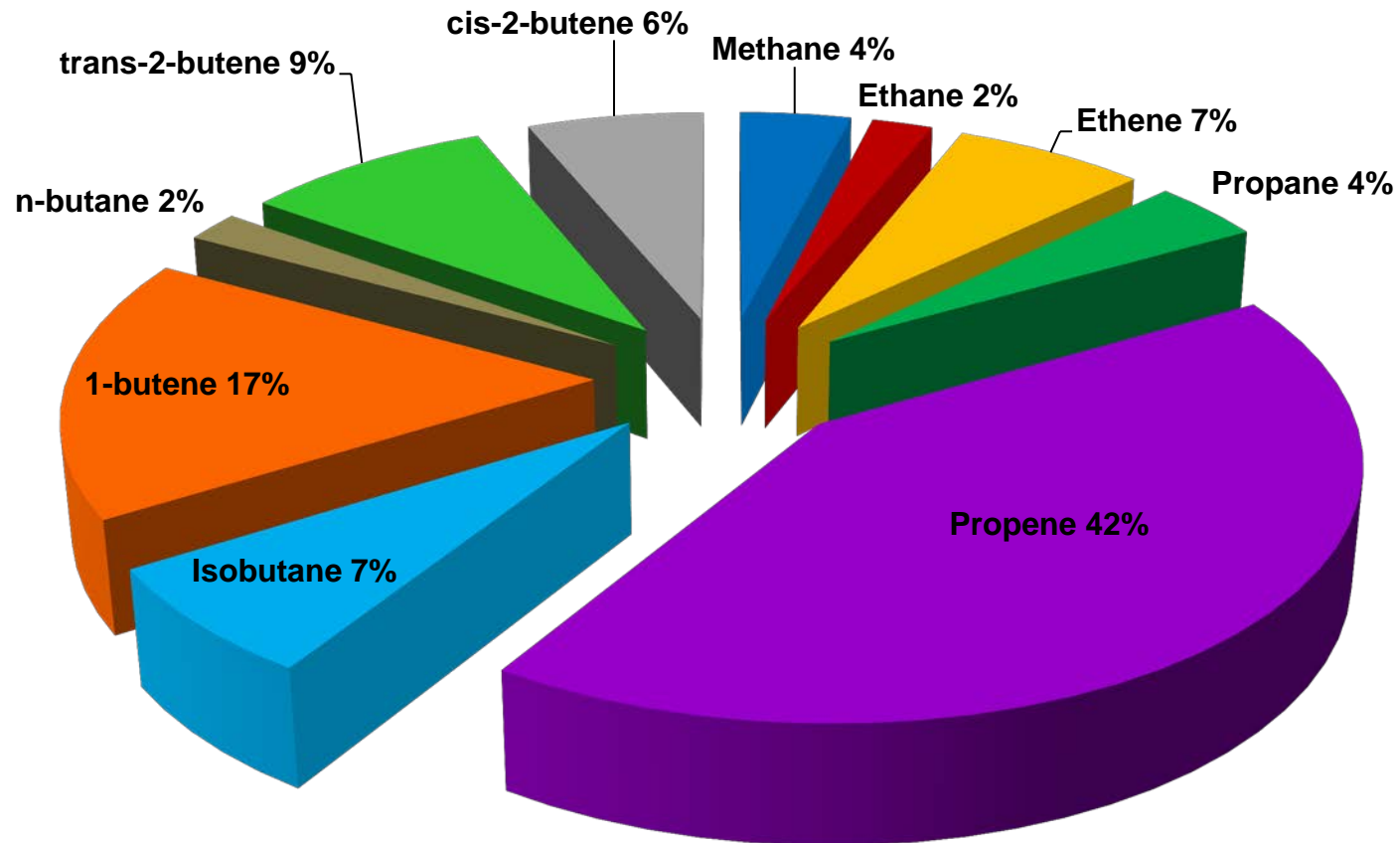
$$K = \frac{m_g + m_{l,FBP=215}}{m_{Feed}}$$





RON: 104,4
MON: 91,7

Typical Gas Fraction



Further Research

- Reactor design
- Process design / modeling
- Process optimization

- Alternative feeds (liquid / solid)
- Catalyst tests
- Plant optimization

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