Country Report – Germany

IEA Task 34 Meeting, Hengelo, NL, May 20, 2014

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Pyrolysis activities (1/3) - Research

- TI
  - FNR: „Upgrading“ collaborative project with Fraunhofer UMSICHT, Oberhausen, Nov. 01, 2013 – Oct. 31, 2016, bio-oil upgrading by hydrotreatment
  - FNR: „LignoHTL“ ERA-Net/Wood Wisdom project with VTT, (FI), LIKAT (DE), and IRCE (FR), hydrothermal treatment of black liquor with subsequent hydrotreatment, July 01, 2014 – June 30,2017
  - Chemicals from bio-oil by scCO_2 gas extraction; PhD thesis

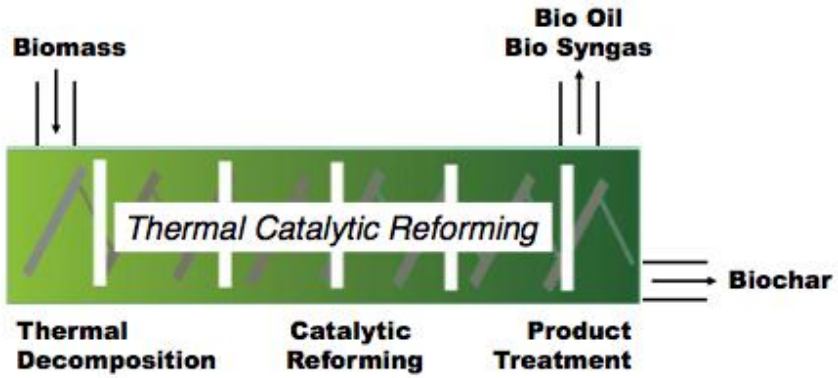
Pyrolysis activities (2/3) - Research

- TUHH, TI
  - Biorefinery 2021 (CFB pyrolysis of lignin)
- Fraunhofer UMSICHT
  - To be presented by Tim Schulzke
- KIT
  - To be presented by Axel Funke

Pyrolysis activities (3/3) – Pilot & Demonstration

- PYTEC
  - Ablative pyrolyzer (6tpd), dormant
- Fraunhofer UMSICHT
  - To be presented by Tim Schulzke
  - Sulzbach-Rosenberg: Intermediate pyrolysis, Thermal Catalytic Reforming (TCR), Andreas Hornung
- KIT
  - To be presented by Axel Funke

„Thermal Catalytic Reforming“ Technology (TCR)



- Processing of solid biomass with up to 30% water content
- Thermal decomposition of feedstock in auger reactor with controlled temperature zones
- Activated biochar facilitates cracking of long-chain organic compounds
- Integrated, catalytic steam reforming to optimize product yields and qualities in second reactor stage
- Simple product treatment stage
- Producing quality gas, oil, char and water phase

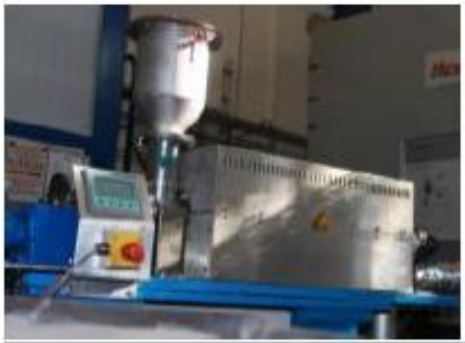
Advantages

- High feedstock and product flexibility
- Variation of product yields through process parameters
- Up to 30% of water content in feedstock
- Unique quality of products
- Gas and oil suitable for combined heat & power production
- Robust, fully continuous process

Lab unit with 2 kg/h feedstock capacity tested at Fraunhofer UMSICHT

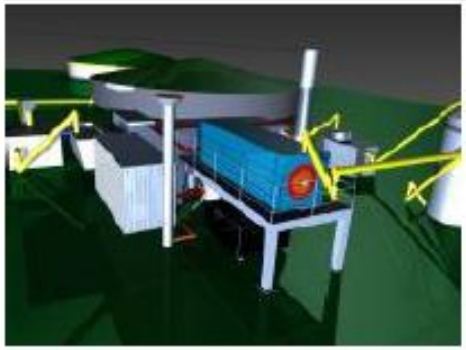
TCR status March 2015

https://tu-freiberg.de/fakult4/iec/pdf/symposium/1103VortragProfHorngFhGUMSICHT.pdf



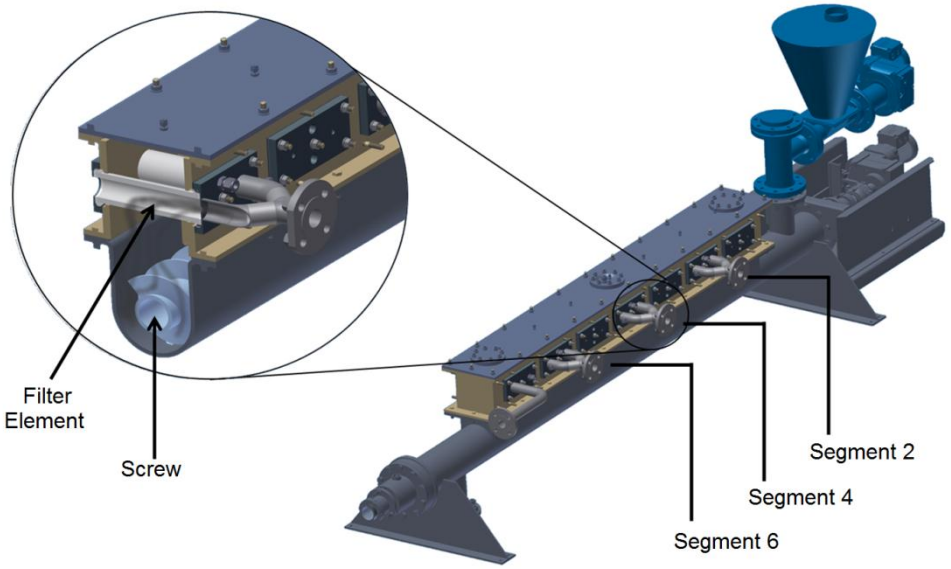
Durchsatz: 2 kg pro Stunde
Beheizung: Elektrisch
Design: Kompakt (experimenteller Maßstab)

Durchsatz: 30 kg pro Stunde
Beheizung: Elektrisch
Design: Pilot (Demonstrationsmaßstab)



Durchsatz: 300 kg pro Stunde
Beheizung: Thermisch (biogen)
Design: Industrieller Maßstab

STYX Integrated Pyrolysis Reactor



Reactor Data

Flow Rate	< 10	Kg/h
Temperature	< 600	°C
Residence Time	5 - 25	Min
Heated Length	2000	mm
Screw Diameter	150	mm

Filtration Data

N° Elements	2 – 14	
Length	200	mm
Diameter	60	mm
Material	SiC	

Operation Data

Time (2012-2014)	2500	h
Material (2012-2014)	6,5	tons
Main Feedstocks:		

Beech Wood, Wheat Straw, Coffee Dust, Chicken Manure, Oil Sand, etc.

STYX Upgrading of biogenic residues