

TWO DECADES OF INTERMEDIATE PYROLYSIS: A MAJOR STEP TOWARDS CHP APPLICABLE BIO-OILS

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INTRODUCTION

Over two decades of research focuses on the development of an intermediate pyrolysis technology to convert biogenic carbon based residues into valuable storable products, contributing to current energy, environmental, and resource challenges. Thermo-Catalytic Reforming (TCR[®]), developed at Fraunhofer UMSICHT, is a cutting edge technology for the conversion of biogenic residues into storable CHP applicable liquid fuels and gases, as well as solid energy carriers for energetic or material purposes.

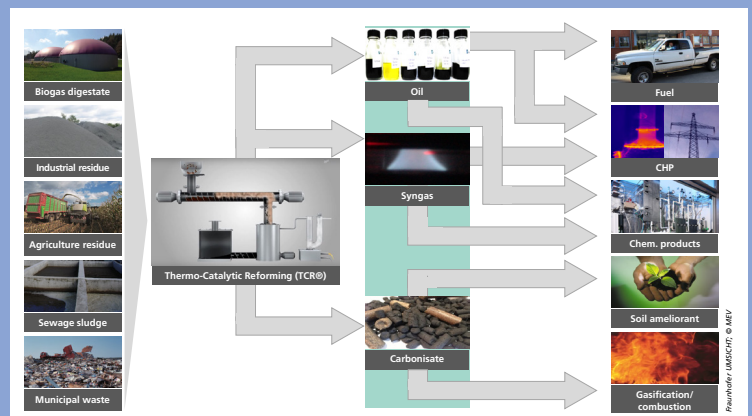
RESULTS

Over 50 different biogenic residues have been successfully converted by the TCR[®] technology into high quality storable energy carriers. Due to the limited data available of other of the intermediate pyrolysis technologies which have been successfully operated in demonstration scale the feedstock straw pellet was chosen to enable a direct comparison of the bio-oils.

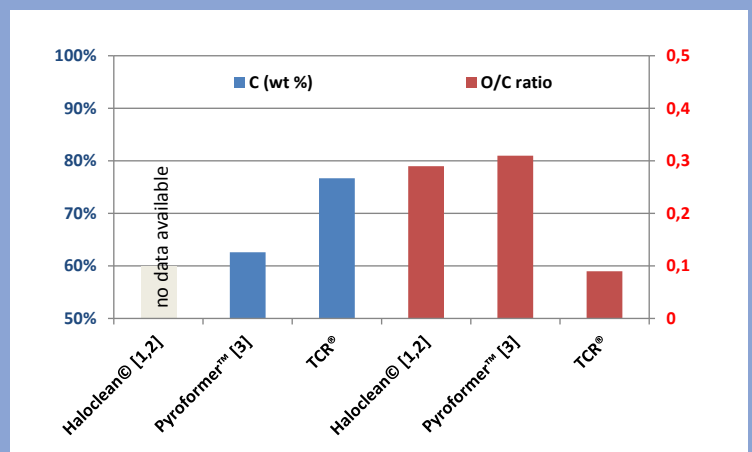
The quality of TCR[®] bio-oils is very different to other pyrolysis bio-oils. The molar O/C ratio of the TCR bio-oil was 0.09. In contrast, the O/C ratios of the other intermediate pyrolysis bio-oils are in the range of 0.29-0.31. This is in line to the lower carbon content of the Pyroformer bio-oil (62.6 wt%) in comparison to the TCR[®] bio-oil (76.7 wt%). Another unique value proposition of TCR[®] bio-oil is the thermal stability. Up to 80% of the TCR[®] bio-oil is distillable at atmospheric pressure and 350 °C, forming a highly viscous vacuum oil fraction and a low viscosity distillate fraction - no coking was observed. The TCR[®] bio-oil was processed by hydro-treatment (HDO) to remove the sulphur, nitrogen, and oxygen to produce green fuels that met standards EN 228 and EN 590.

CONCLUSION

- Unique value proposition of TCR[®] bio-oils
- Successful production, processing, and application of TCR[®] based biofuels.
- TCR[®] experiments reveal that the composition of the bio-oil is superior for utilization in CHP engines



Concept of the TCR[®] technology



TCR[®] bio-oils in comparison to available data from other intermediate pyrolysis bio-oils [1: Hornung, Apfelbacher et al. 2011; 2: Roggero, Tumiatti et al. 2011; 3: Yang, Brammer et al. 2014]



Different fractions of distilled TCR[®] bio-oil and HDO bio-oil