

## SUSTAINABLE TRANSPORTATION FUELS BY CO-PROCESSING OF TCR®-BIO-CRUDE-OIL IN CONVENTIONAL PETROLEUM REFINERIES

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### INTRODUCTION

The generation of biofuels is a major field of interest today. Particularly with methods that convert residual and waste bio materials, which possess comparable quality to conventional fuels from crude oil. Fraunhofer UMSICHT has developed an intermediate pyrolysis process combined with an integrated reforming step. The bio-crude-oils produced by thermo-catalytic reforming (TCR®) have unique properties such as high heating value, low total acid number, low water content and they are miscible with fossil and biofuels. Due to the thermal stability and the low oxygen content, the TCR® bio-crude-oil can be further improved by thermal processing methods such as distillation and hydrotreatment as used for petroleum refining.

### RESULTS

In contrast to fast pyrolysis oil, TCR® bio-crude-oil is highly comparable to crude oil regarding its composition. Therefore, blending and co-processing of bio-crude-oil with crude oil in a petroleum refinery is a promising approach. The results of the distillation are shown in Figure 3. The crude oil contains less atmospheric distillable compounds than the used bio-crude-oil. Due to the high correspondence between the calculated and the measured results of the blend (50 % bio-crude-oil and 50 % crude oil), it can be assumed that there is no significant polymerization of bio-crude-oil and crude oil during thermal processing. As a result, transportation fuels like gasoline and diesel reached the limit of less than 10 ppm sulfur, which is a critical limit for ultra-low-sulfur fuels in Canada, USA, and Europe. Polymerization or coking was observed during the upgrade.

### CONCLUSION

- The applicability of pure bio-crude-oil derived transportation fuels has already been successfully tested.
- Renewable TCR®-based gasoline shows comparable specifications to fossil EN 228 gasoline and EN 590 diesel.
- Polymerisation or coking was observed during the refining process of the blend.

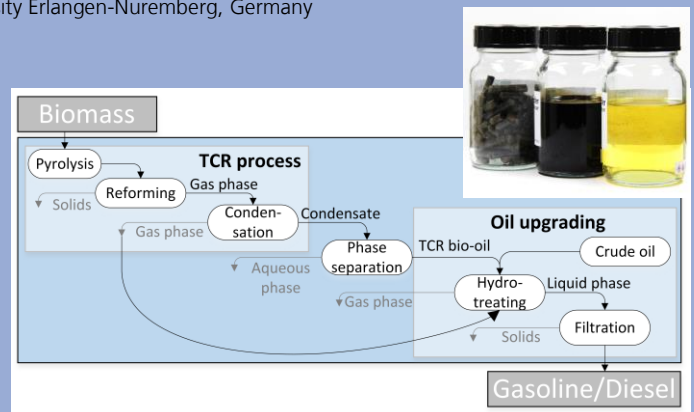


Figure 1: Concept overview: Production and co-processing of TCR®-bio-crude-oil in conventional refineries

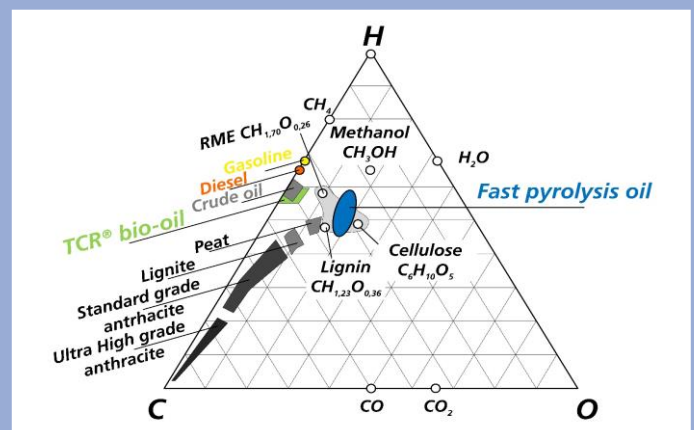


Figure 2: CHO-diagram for the composition of fossil and biogenic fuels in comparison to TCR® bio-crude-oil from sewage sludge

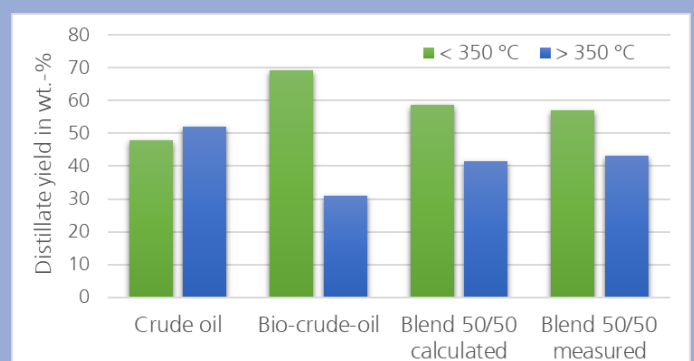


Figure 3: Distillation summary for crude oil and bio-crude-oil