

GASIFICATION OF END-OF-LIFE PLASTICS

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IEA Bioenergy Task 33 Meeting
Workshop “Waste Gasification”
26th November, Birmingham (UK)



ECN

TNO

innovation
for life

INTRODUCTION

> Current operations

Household waste



MRF



Recycled material



Incineration



Plastics fraction



Germany

INTRODUCTION

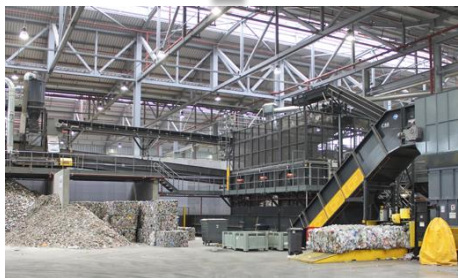
› To be explored



Household waste



MFR



Recycled material



Incineration



Plastics fraction



Gasification



AREA



Other application



BTX

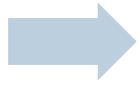


EXPERIMENTAL WORK

Experimental work overview



End-of-life
Plastics



Milena
Lab-scale

~ 3 kg/h



Olga Tar
Removal

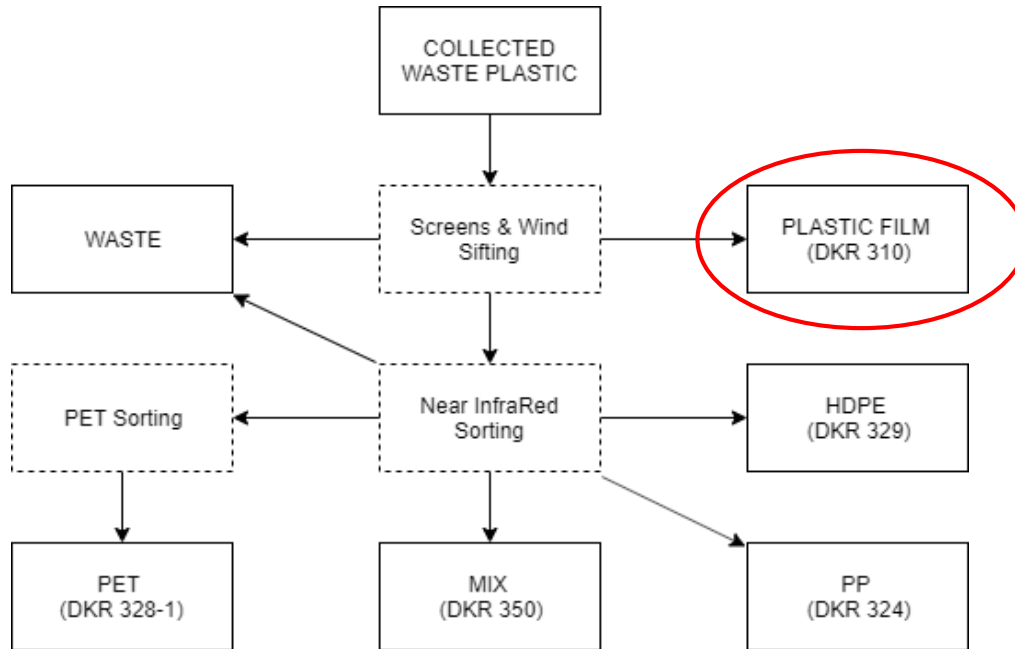


AREA



BTX

› Type of Feedstock: end-of-life plastic stream DKR310



FEEDSTOCK (DKR310)

Product Specification 08/2014 Fraction-No. 310-1

Sorting fraction: **PLASTIC FILMS**

A Specification/Description

Used, residue-drained, system-compatible items made of plastic film, surface > DIN A4, e.g. bags, carrier bags and shrink-wrapping film, incl. secondary components such as labels etc.

The supplement is part of this specification!

B Purity

At least 92 % by mass according to specification/description.

At least 42 % colourless, transparent films > DIN A 3

C Impurities

Max. total amount of impurities 8 % by mass

Metallic and mineral impurities with a unit weight of > 100 g are not permitted!

Other metal items < 0.5 % by mass

Other plastic items < 4 % by mass

Paper, cardboard, carton < 1 % by mass

Other residues < 4 % by mass

Examples of impurities:

- Glass
- Composite paper/cardboard materials (e.g. liquid packaging boards)
- Aluminised plastics
- Other materials (e.g. rubber, stones, wood, textiles, nappies)
- Compostable waste (e.g. food, garden waste)



PRE-PROCESSING

- › Feedstock had to be pre-processed before being fed into the Milena gasifier



Shredded



Pelletized



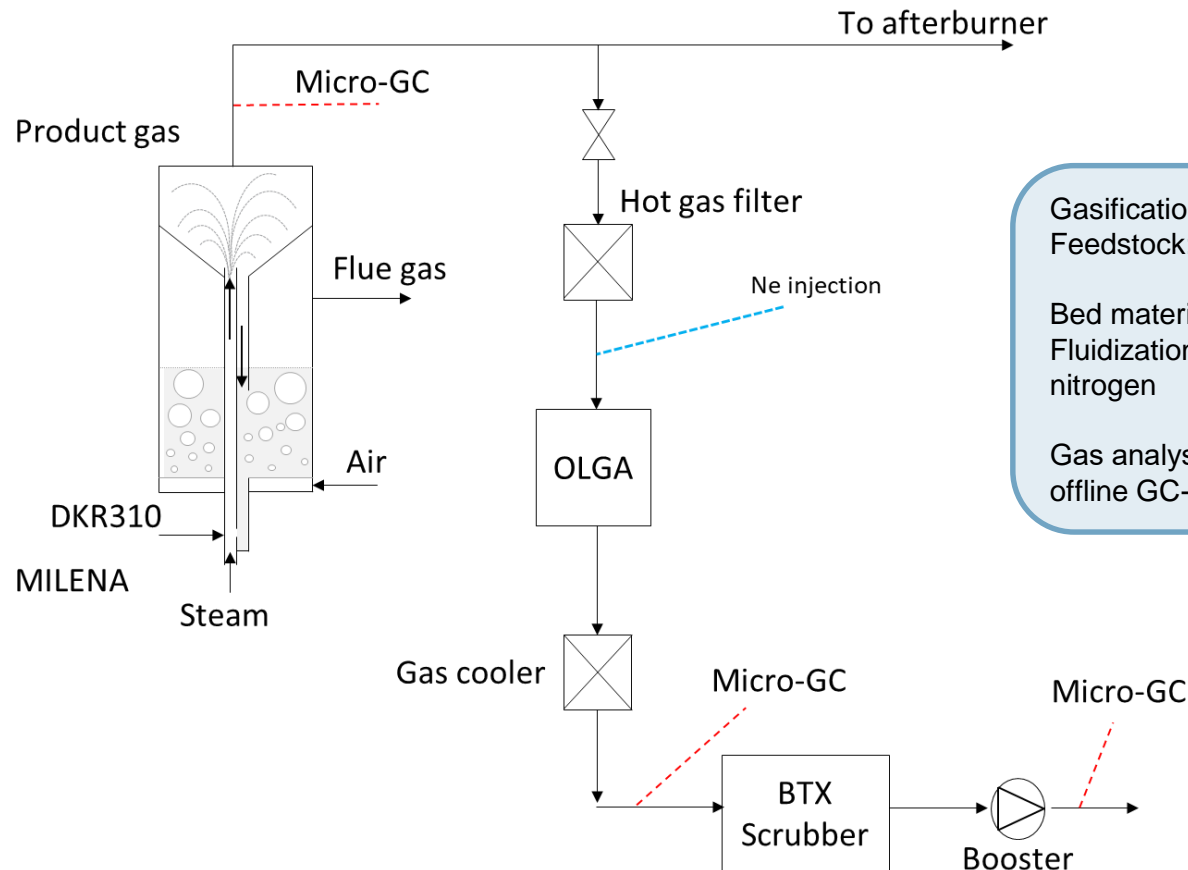
Milled



PRE-PROCESSING



EXPERIMENTAL SET-UP



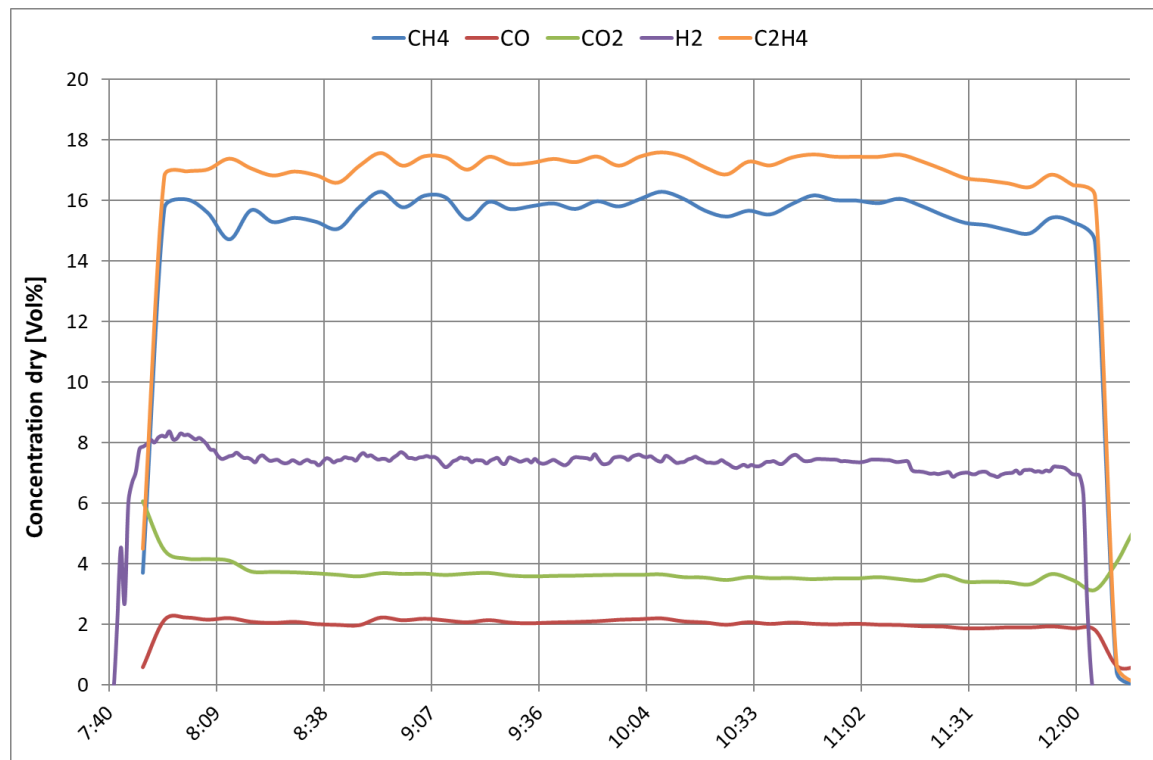
Gasification temperature: **730 °C**
Feedstock: 2.3 kg/h

Bed material: Sand
Fluidization agent: steam (0.8 kg/h) and nitrogen

Gas analysis: online gas analysers and μ -GC, offline GC-FID for HCs and Tar guideline

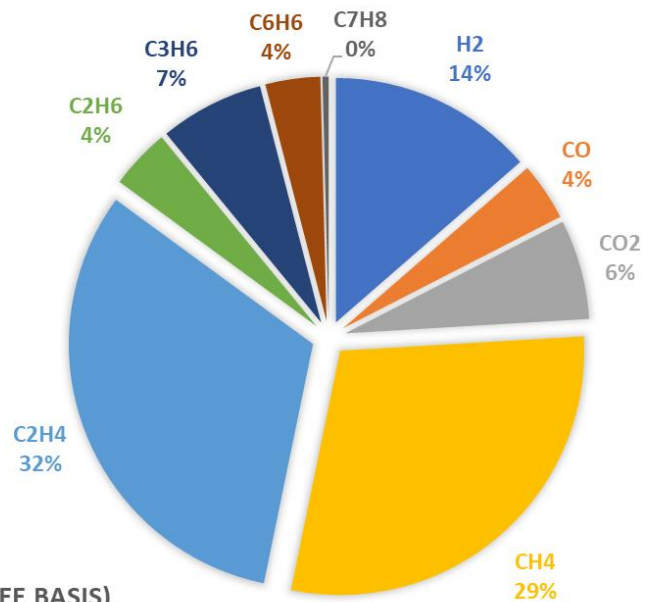
GAS COMPOSITION AFTER MILENA

N₂ also used as fluidizing agent due to hydrodynamics (≈ 45 Vol%)

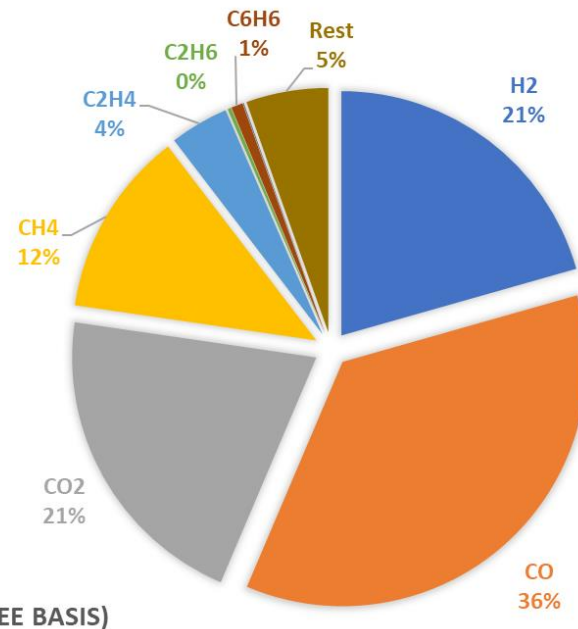


PRODUCT GAS COMPOSITION

DKR310 gasification



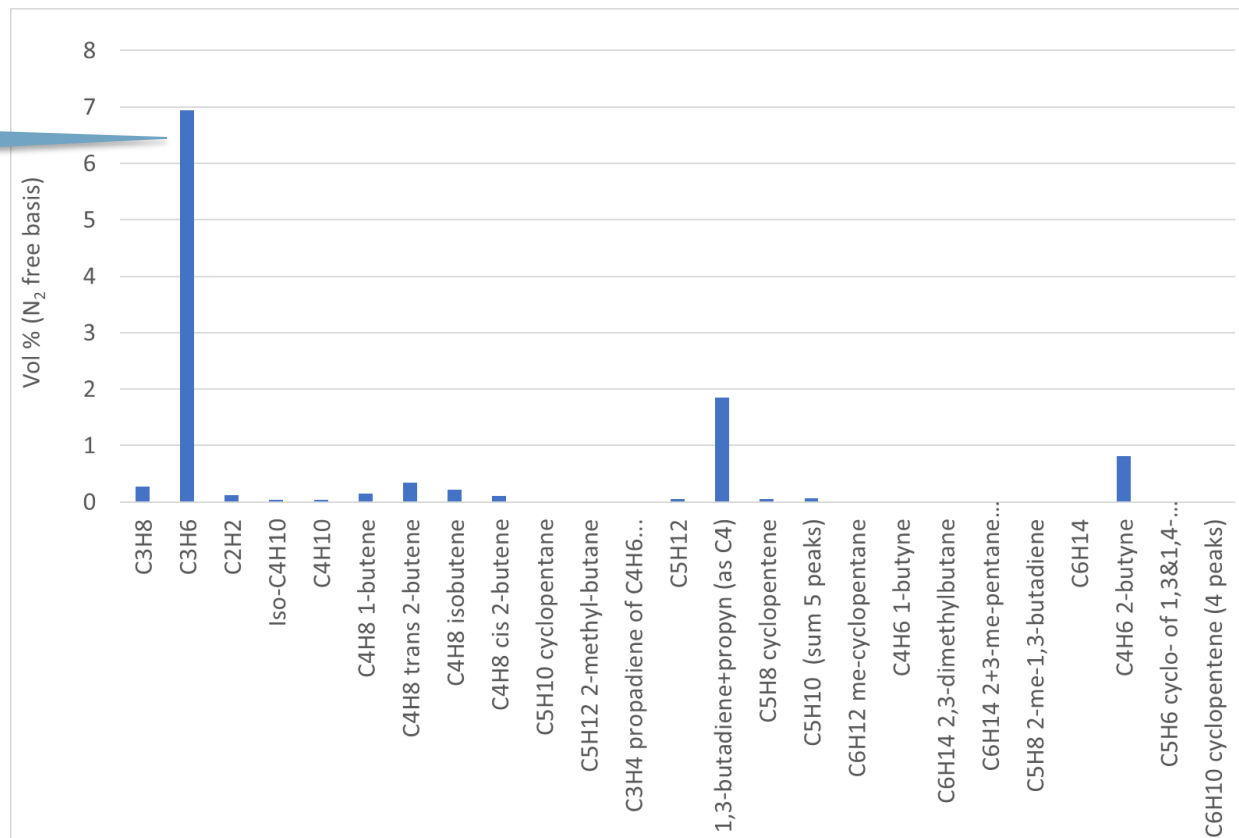
Beechwood gasification



PRODUCT GAS COMPOSITION

Hydrocarbons measured with TGC-FID (C1-C5)

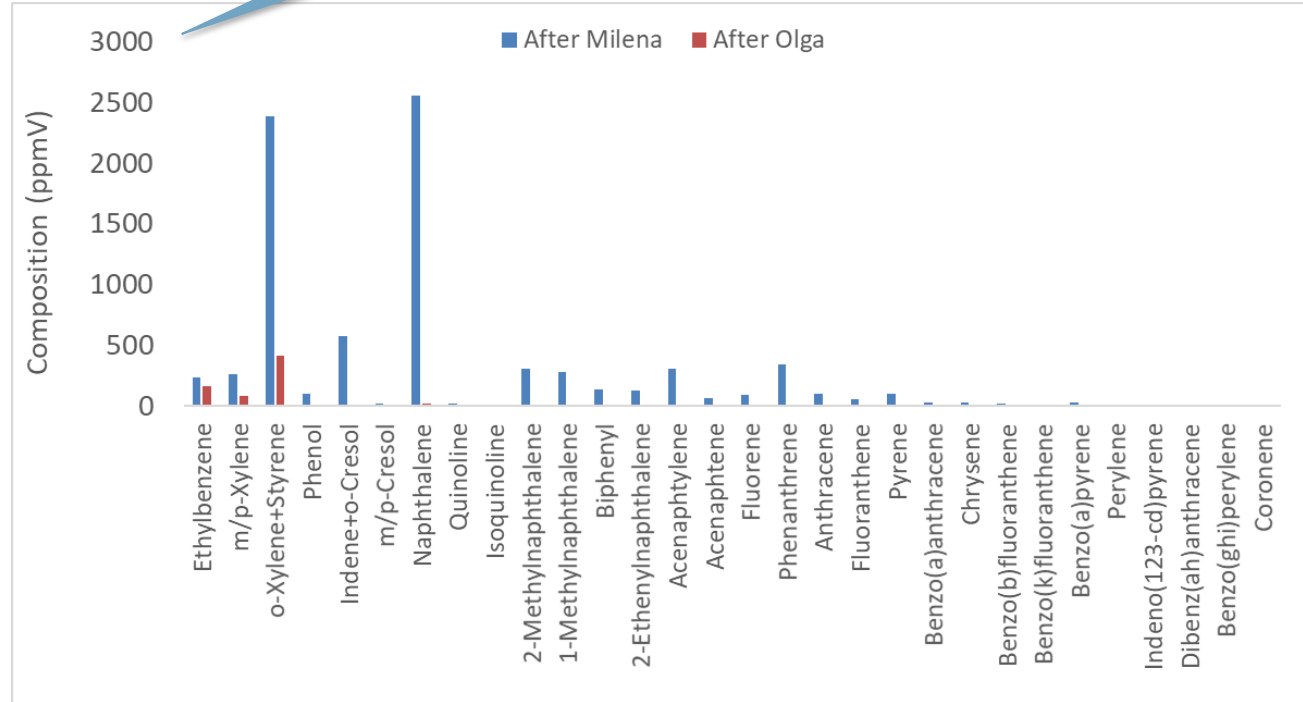
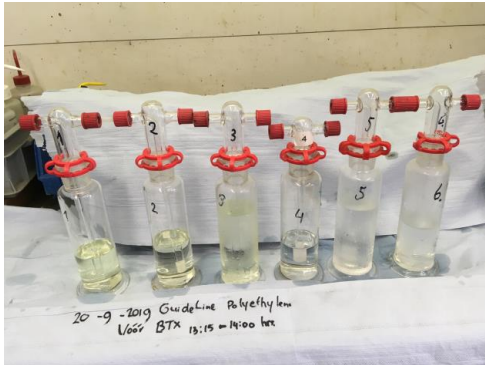
Propylene present in substantial amounts



TAR COMPOSITION

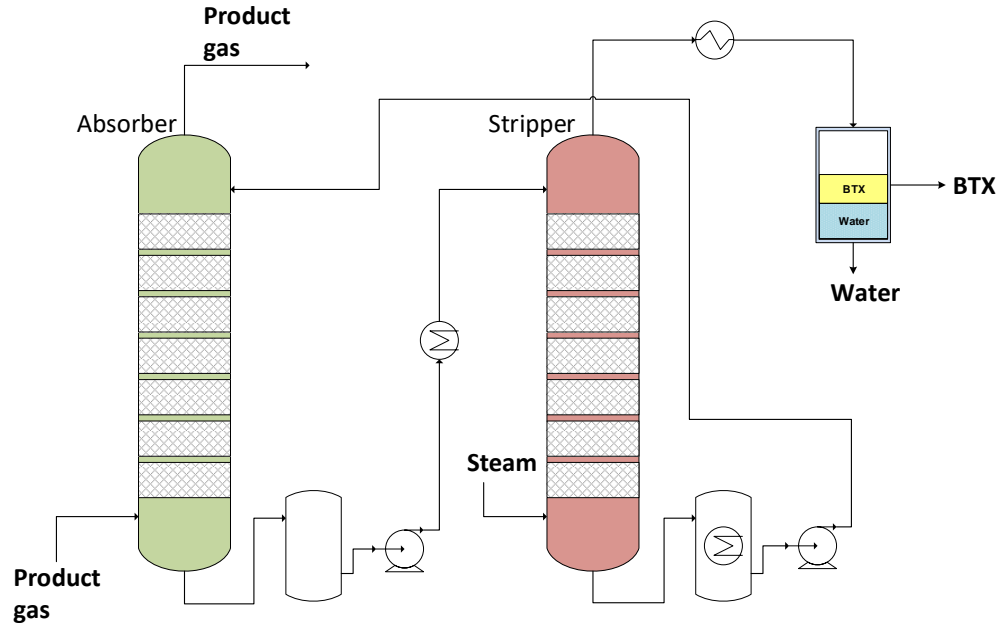
› Polyaromatics composition (Tar guideline method)

Composition diluted with N₂ (≈ 45 Vol%)

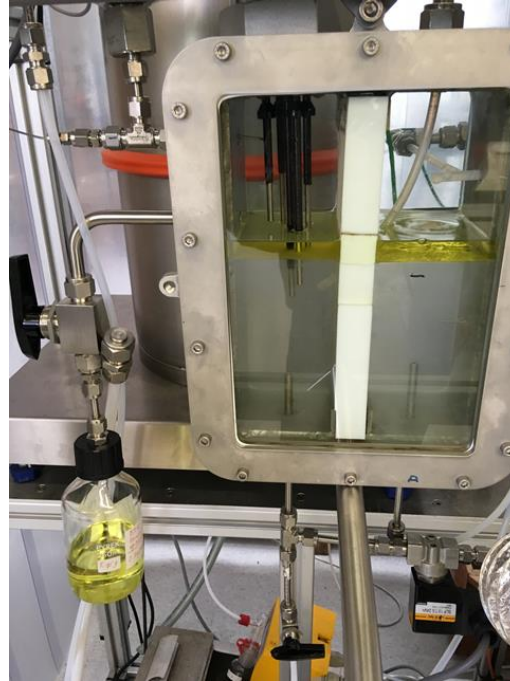


BTX RECOVERY

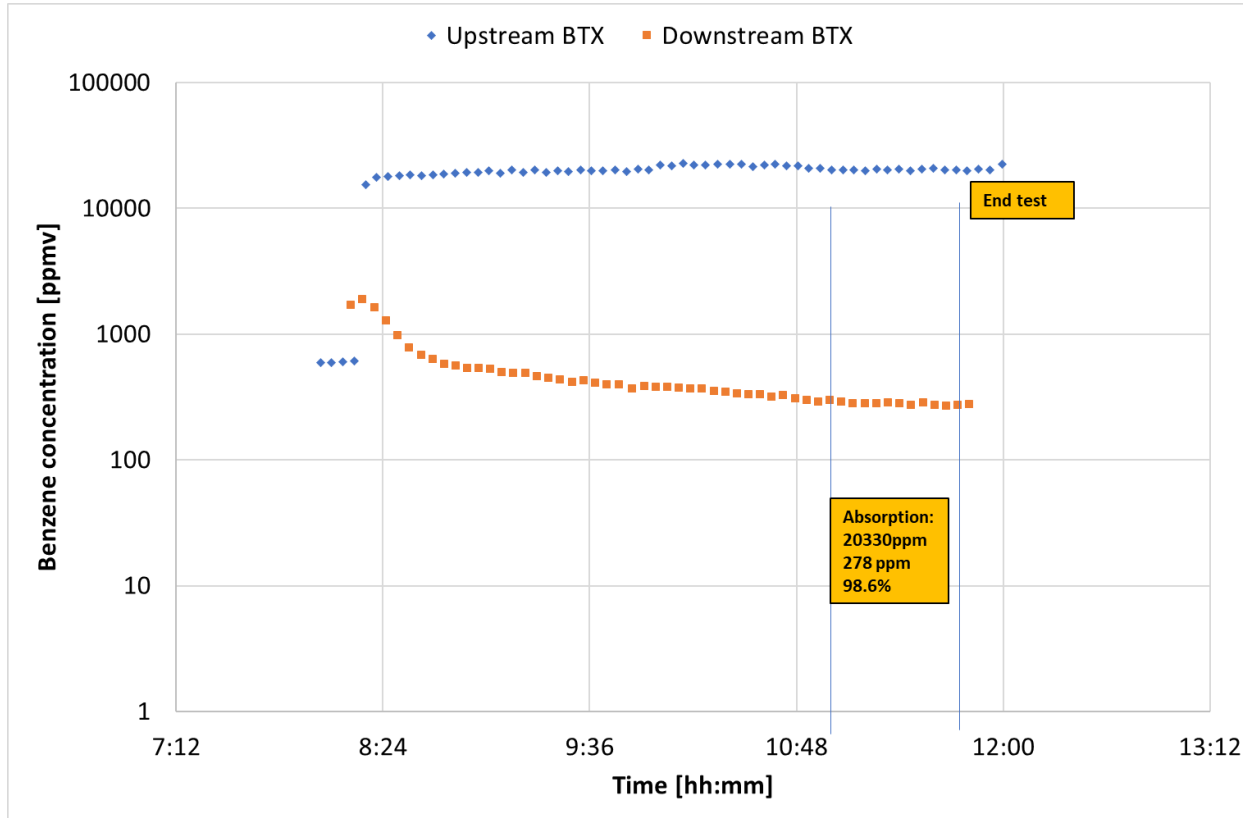
› AREA (Aromatics Recovery Apparatus)



BTX RECOVERY



BTX RECOVERY



Removal Benzene efficiency: 98,6%

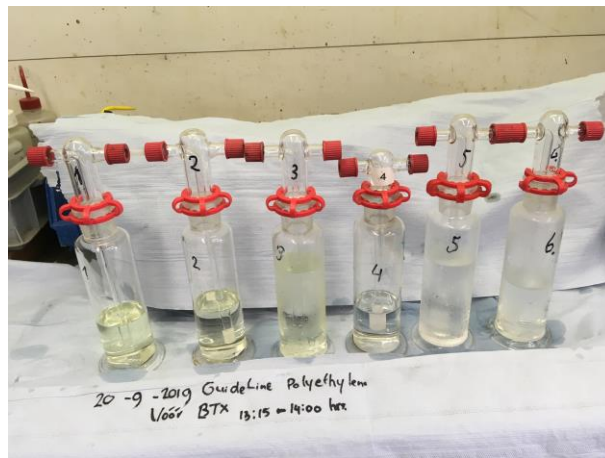
Removal Toluene efficiency: 98.8%



TAR GUIDELINE



After Milena gasifier



After Olga Tar removal



After AREA (BTX removal)

CONCLUSIONS

- › Successful gasification tests with end-of-life plastics (DKR310)
- › Ethylene and methane as the main components in the product gas
- › CO and CO₂ present in low amounts, accounting for about 5 wt% of the initial carbon
- › Almost 10% of the initial carbon finishes as benzene
- › Close to 99% of BTX removal from the product gas achieved

Acknowledgment: Research funded by the Dutch Ministry of Economic Affairs (TKI Recover project, TBBE 218003)



Rijksdienst voor Ondernemend
Nederland

Het project is uitgevoerd met subsidie van het Ministerie van Economische Zaken, Nationale regelingen EZ-subsidies, Topsector Energie uitgevoerd door Rijksdienst voor Ondernemend Nederland