

Plastic residues co-gasification in fixed bed systems

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AREA 1 / SUBAREA 1.1
 Thermochemical Technologies

Introduction

The efficient use of hard-to-recycle or non-recyclable plastics remains a challenge on the path to a fully CO₂-neutral circular economy. Particularly at decentralized industrial sites, energy-rich waste materials are often disposed of and landfilled without being utilized. Centralized collection and conversion is often neither economically nor ecologically viable.

Activities aiming at the utilization of plastic leftovers from manufacturing sites in thermal co-gasification with biogenic feedstock are shown here.

Research approach

- Feedstock analysis
- Investigation of required feedstock treatment steps
- Laboratory conversion tests (up to 30kW)
- Screening of technologies and/or plant providers
- Pilot scale and/or industrial scale test runs
- Evaluation of process stability and gas quality

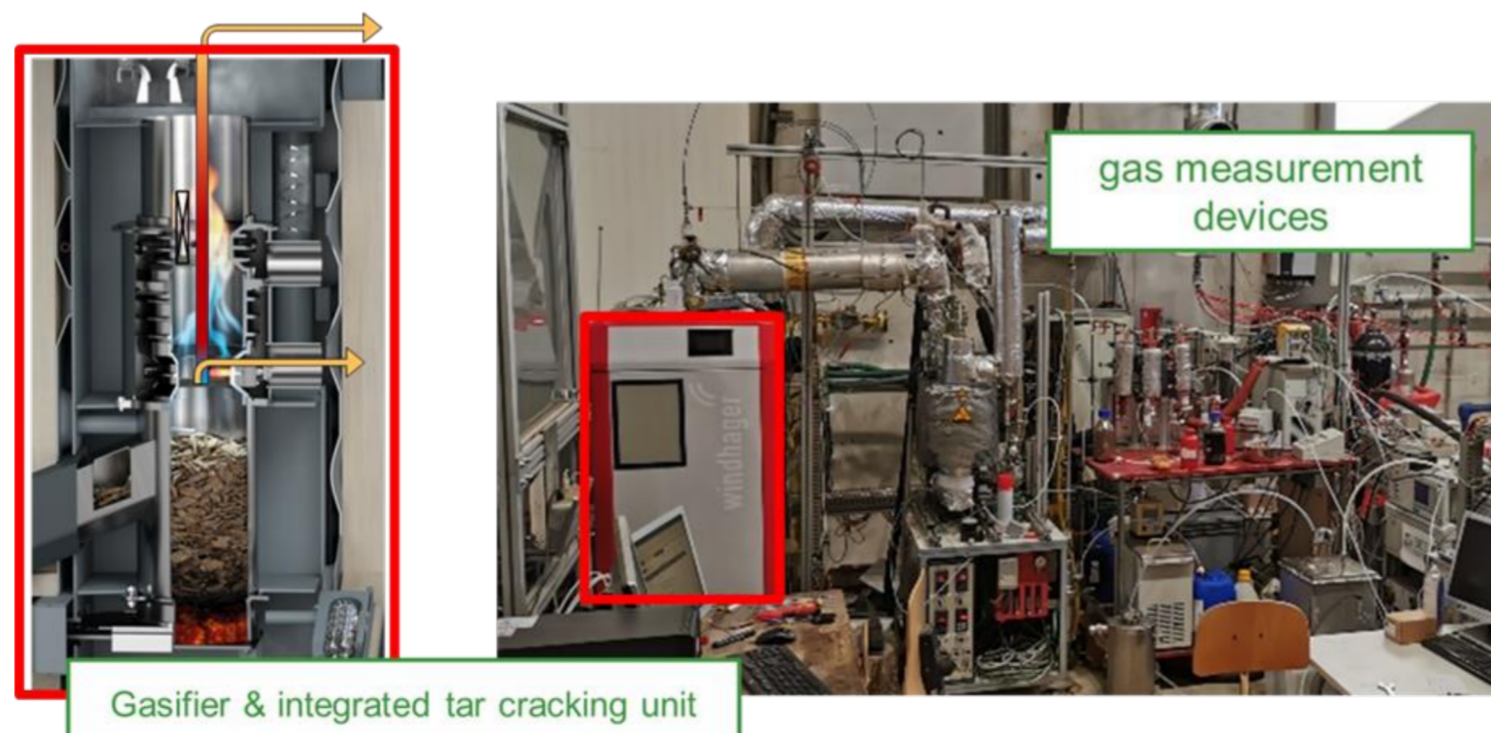
Example of Residue Derived Feedstock (RDF) co-gasification tests in 30kW-scale updraft fixed bed process



The original RDF test material (left) was analyzed, shredded and mixed with woodchips (5/10/20% share of RDF, below) to conduct first conversion test in the lab gas producer test rig in Graz.



Compared to the operation with pure wood chips, only minor changes in the product gas composition towards a higher calorific gas were observed.



30 kW-scale set-up for fixed bed gasification tests, BEST technical center - Graz.

Example – manufacturing of outdoor equipment and sandals

	Fraction of total waste	Ash fraction	Ash melting test	High Alkali	Main ash constituent	Nitrogen	Sulfure	Chlorine	Energy content	Heavy metals
Material no.1 – PE film	20%				Ca/Mg + Si					
Material no.2 – PE +PA film	5%				Ca/Mg + Si					
Material no.3 – EVA Midsole Particles	10%				Ca					
Material no.4 – Rubber mixture Outsole	7%	~			Si					
Material no.5 – Sandal sanding Powder	3%	~			Ca					
Material no.6 – UD fabric white colour	1%				Si					
Material no.7 – UD fabric yellow colour	1%				Na					
Material no.8 – Nylon fabric black colour	1%	~			Ti					
Material no.9 – Polyester/nylon fabric MTP-GRAY-BLUE colour	2%	-			Si + Ti					
Material no.10 – PES-PE Sheet film		+			Si					
Material no.11 – PES-PE Sheet film Printed	48%	+			Ti					
Material no.12 – GA foam with polypropylene High-density cover	2%				Ca					

Composition of different residual streams from a manufacturing site.

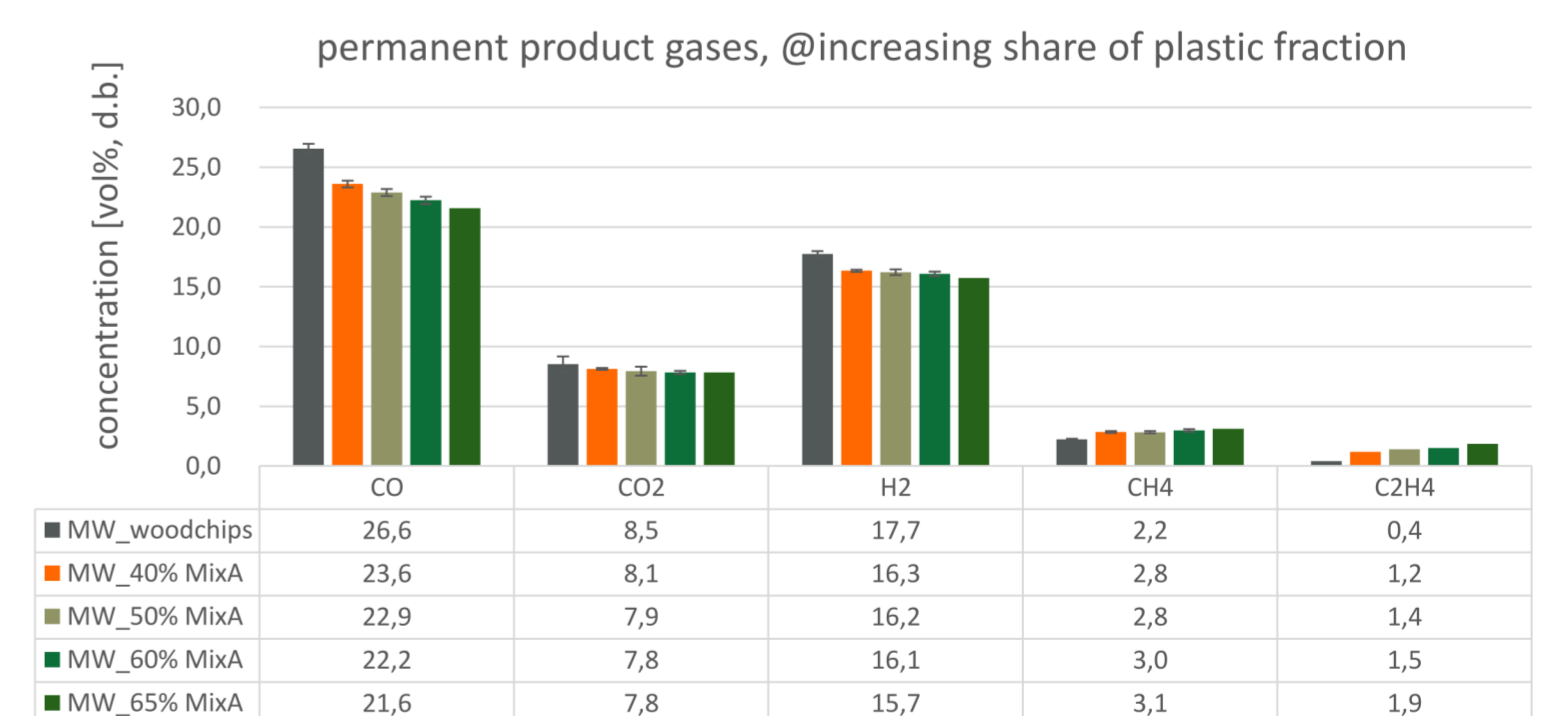
Pilot scale tests

After lab scale investigations and the identification of promising technologies, test runs in pilot/industrial scale are conducted to assess the suitability of the technology in cooperation with plant providers.



Feed conveyor after feedstock mixing, from 20% to 60% share plastics to woodchips.

Selected results



With mixtures up to 70 m. % of plastic residues a stable process could be ensured in two facilities. Online measurements showed only minor changes in gas composition with varying input. For longer system use, elevated concentrations of feedstock contaminants (S, Cl, ash, metals) need to be considered.

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