Valorisation of organic sidestreams by thermochemical conversion: production of biochars by pyrolysis

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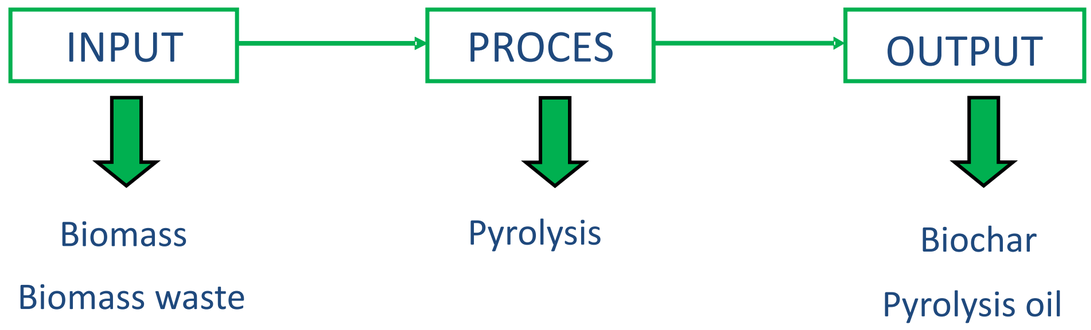
There is a need to valorize various organic (heterogenous) sidestreams available in (chemical) industries. Several refinery schemes have been successful to extract single or multiple compounds with added-value but often a (post-extracted) residue is left behind with no direct economic value. The conversion of these heterogenous (post-extracted) organic sidestreams by thermochemical conversion into biochars and/or activated carbons can solve part of this problem, which is critical to the development of a sustainable global circular economy.

European Comission. (2015). Circular economy: Closing the loop. Retrieved October 22, 2018, from https://ec.europa.eu/commission/sites/beta-political/files/circular-economy-factsheet-general_en.pdf

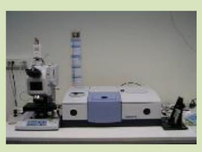


Analytical expertise

Elemental Analysis
AAS
ICP-OES
ICP-MS
XRF

Chromatography
IC
GC GC-MS
HPLC
GPC
LC-MS

Spectroscopy
NMR
FTIR
UV-VIS-NIR
MS
Raman

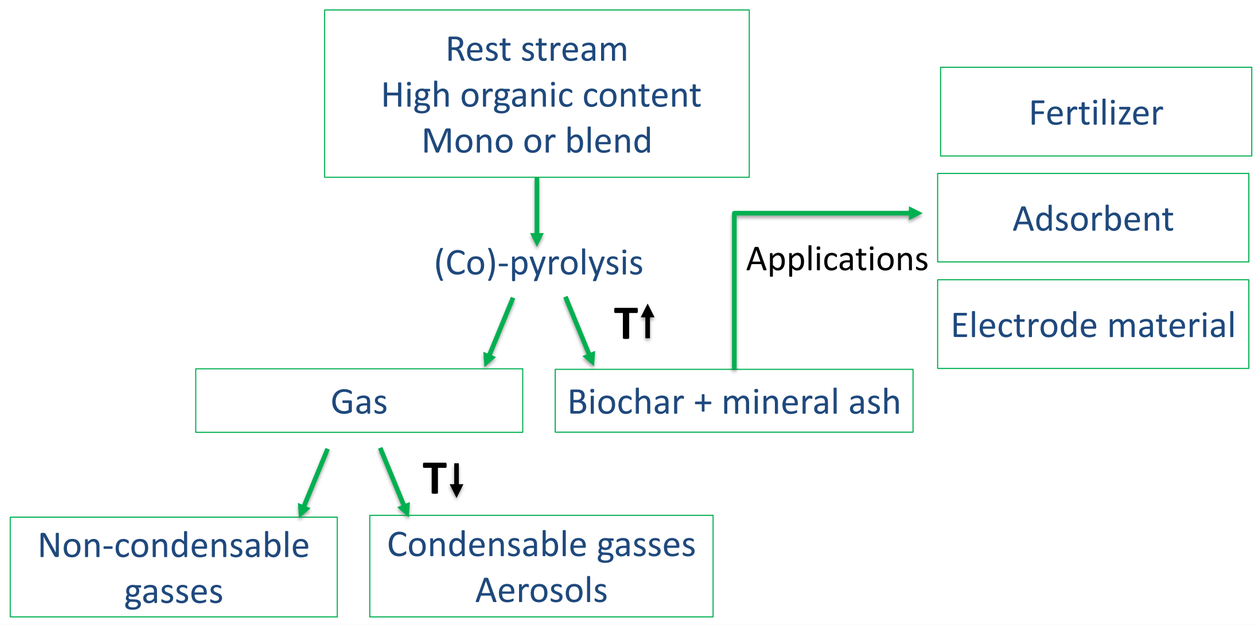


Rheology
Plate
Cone

Thermal Analysis
DSC TGA
DMA TMA

Coupled Techniques
Headspace-, thermal desorption-, pyrolysis – GC-MS, IC-ICP-MS
FT-IR microscopy
TG coupled techniques TG-FT-IR,TG-MS, TG-TD-GC-MS

Pyrolysis process

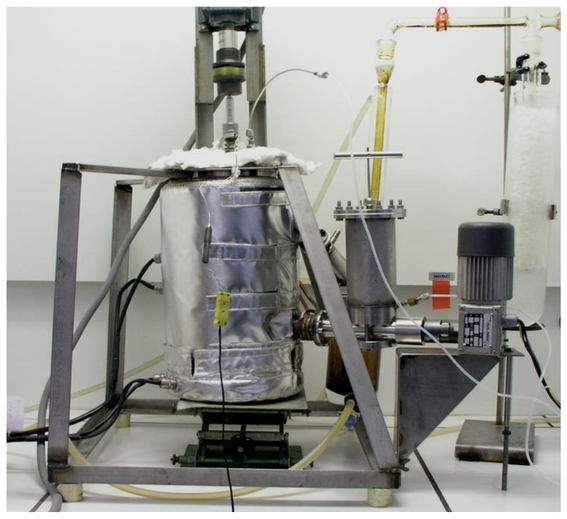


Input materials

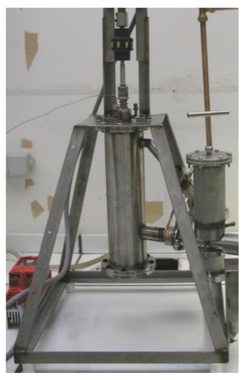
Selected waste streams

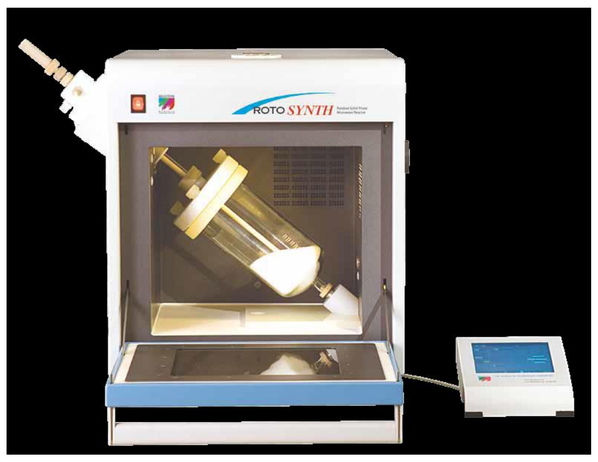
e.g. (Metal contaminated) willow
(Metal contaminated) poplar
Rapeseed cake
Raspberry cake
Manure (Pig)
Sewage sludge
Brewer's spent grain (BSG)
Urea/Melamine Formaldehyde
Municipal solid waste
Agricultural waste
Particle board (PB)

Pyrolysis equipment: laboratory and pilot scale



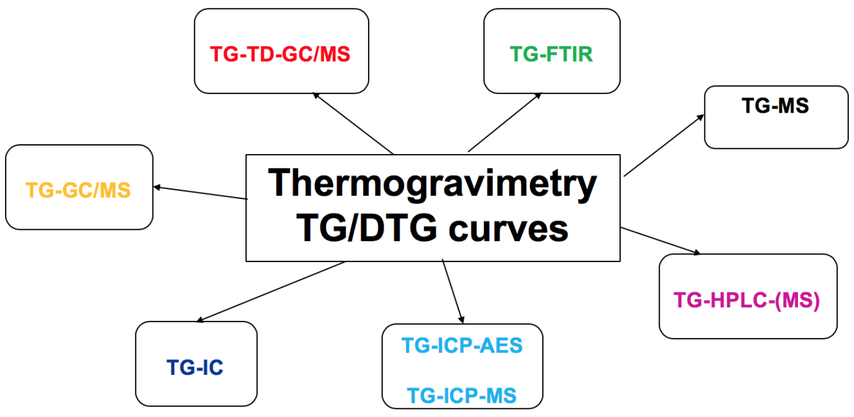
Laboratory pyrolysis reactor

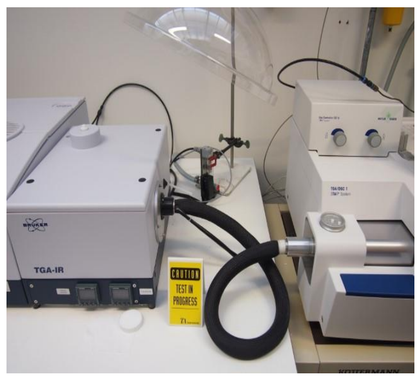




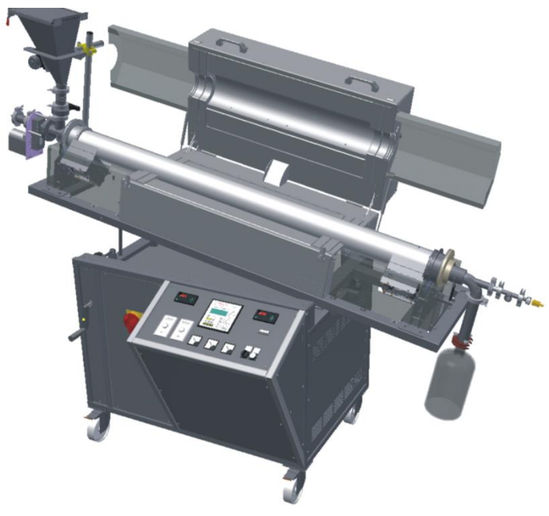
Commercial microwave apparatus (Milestone)

Chemical-analytical approach





TG-FTIR apparatus



Commercial rotary tube furnace (Nabertherm)

TG-MS apparatus

Thermochemical conversion processes include direct combustion, gasification, liquefaction and pyrolysis. Pyrolysis is thermal degradation and conversion in an oxygen deficient atmosphere to produce a char and a variety of gaseous and condensable (bio-oil) products. In recent years, microwave assisted pyrolysis was proven to be a promising alternative to conventional pyrolysis because of its accelerated reaction rates and higher energy efficiency. Biochar is the solid and carbon rich product obtained from the conversion of lignocellulosic materials by pyrolysis at moderate temperatures. This product has the potential to improve soil fertility and its physical properties as slow nutrient releaser, by increasing the soil water retention, increase soil pH and by an improved microbial activity.

We are interested to collaborate with (industrial) stakeholders that provide an organic sidestream that is suitable as feedstock for biochar production and is willing to study its potential at pilot-scale.