Biomass Densification

The densification of loose biomass has several advantages. The main intention, however, must be the production of a high-quality solid fuel at minimal energy input. Along this principle we conduct cutting edge research in our technical center mainly working with a 30 kW ring-die pellet press. Other densification technologies (e.g. briquetting, prototype technologies) are being investigated as well, in unison with our project partners from industry and other scientific institutions.

Biomass pellets can be continuously produced using a 30 kW ring-die press, at an output of 50kg/h.

Densification

Loose material with:
- low bulk density
- low energy density
- high inhomogeneity

High quality fuel with
- high bulk density
- high energy density
- high homogeneity and standardized characteristics
- ▶ improved handling during transport and storage

Usage

energetic	materially
e.g. combustion	e.g. filling material

Besides our extensive knowledge on pellet production with different biomass types (woody vs. non-woody) and in accordance with DIN EN ISO 17225-6, we are also interested in the production of smaller (<Ø = 6mm) and differently shaped fuels.

Research Focus and Related Services

- Analysis of most relevant solid fuel parameters
- Development of new test methods
- Quality testing of solid biofuels according to ISO standards and other certification schemes
- Predicting the change in thermo-chemical behaviour and emissions from optimized fuels
- Developing models to predict fuel processing and upgrade depending on raw material characteristics
- Investigating the material use of biomass by-products and/or residue biomass in accordance with BioEconomy-principles

Further information:

Free Publications on www.mdpi.com (Open Access)

Foliage and Grass as Fuel Pellets - Small Scale Combustion of Washed and Mechanically Leached Biomass

Torrefied Biomass Pellets - Comparing Grindability in Different Laboratory Mills

More information about the DBFZ and its current and former projects are available at **www.dbfz.de**

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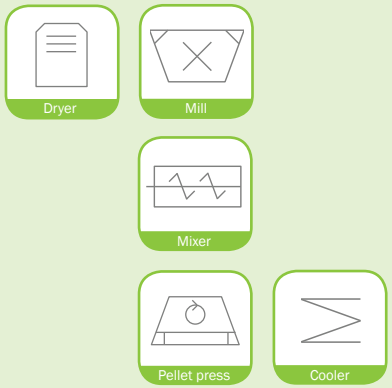
From Biomass to Solid Fuel

Technical Center for Biomass Pre-Treatment and Densification

Pre-Treatment

In order to transform biomass into a reliable solid fuel a variety of process steps can be applied (stand-alone or in combination). The equipment of our technical center allows the analysis of many key process steps. Hence, optimal pre-treatment concepts can be developed to yield high fuel qualities and increased process efficiency, independent of the input material.



Typical process flow for transforming loose biomass material into a solid fuel with defined standardised charcteristics (e.g. durability and bulk density).

Pre-Treatment Technology:
In order to reach optimal fuel quality regarding unfavorable constituents or composition we offer several types of pre-treatment:

- Drying
- Comminution
- Torrefaction
- Leaching and de-watering
- Hydrothermal carbonisation (HTC)

Regarding comminution, the following mills are available at our technical centre allowing exposure of the biomass to different kinds of stress during the break-up: chopper, cutting mill, impact mill, hammer mill.

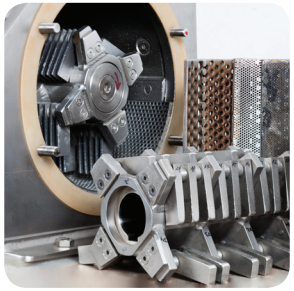
Leaching & Torrefaction

Two pre-treatment technologies have proven to be very promising: (i) mechanical leaching followed by de-watering and (ii) torrefaction, a mild form of pyrolysis. We investigate the underlying principles in our technical center and together with our partners from industry and other scientific institutions work to improve pilot scale applications of these processes.

Examplified process flow for fuel quality upgrade through leaching with the goal of reduced mineral content, ash content and emissions.

Leaching & Torrefaction Technology:
The essential process steps of both technologies can be reproduced with:

- A batch reactor for torrefaction (rotary drum type)
- Several lab-scale appliances for washing and de-watering biomass
- A variety of mills to desintergate solid fuels for e.g. co-combustion purposes



With hammer widths of 3 or 10 mm, the hammer mill achieves particle sizes below 1 mm for corresponding sieve widths.

Conditioning

During conditioning the material is being prepared for densification (pelletizing) and further adjusted depending on the intended conversion path (combustion, gasification). The two main approaches are blending with additives (e.g. for improving thermo-chemical conversion or stability of the pellets) and adjustment of water content. The current focus of our research, for achieving optimal fuel properties, is on: biomass dependent choice of additives, appropriate dosage and optimal form of application.

The addition of pressing aids or additives to the raw material improves the mechanical properties of densified biomass and influences combustion properties positively.

Conditioning Technology:
To achieve a high degree of homogeneity, to adjust the water content as well as for blending with additives different kinds of technology are available:

- Ploughshare mixer (Laboratory scale)
- Compulsory mixer
- Paddle flow mixer
- Inclined blade mixer

The angled-blade mixer has moisture sensors, temperature measurement technology as well as nozzles for applying steam and liquids.