biosweet

Biomass for Swiss Energy Future
Swiss Competence Center for Energy Research

In cooperation with the CTI

Energy funding programme
Swiss Competence Centers for Energy Research

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Commission for Technology and Innovation CTI

Biomass upgrading by torrefaction: pilot scale operation and testing

J-B. Michel[1], M. McCormick[1], J. Ropp[1], C. Tansley[2] , B. Correa[2], M. Schmid[3], M. Vögeli[3]

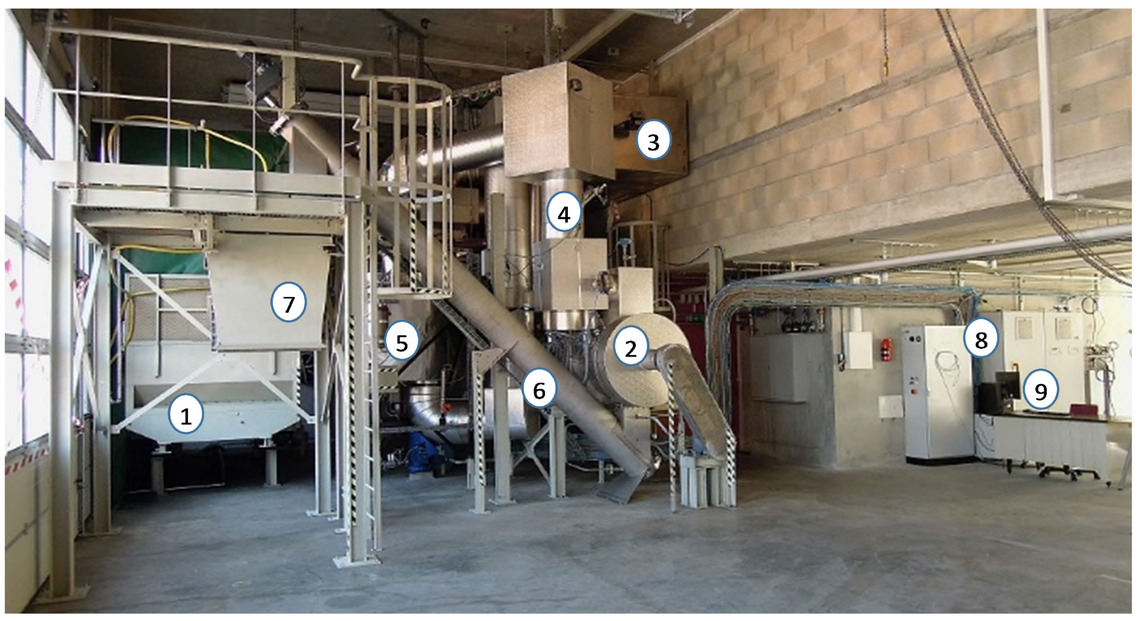
[1]University of Applied Sciences and Arts Western Switzerland, HEIG-VD, Thermal Engineering Institute CH-1401 Yverdon-les-Bains,

[2]Granit Technologies and Engineering SA, CH-1350 Orbe, [3] Ökozentrum, CH-4438 Langenbruck

Summary

- Demonstrated technical and economic feasibility of torrefying low quality biomass residues at the pilot scale (100kg/h)
- Improved combustion properties on two domestic boilers
- Future use in various forms (powder, chips, and pellets)

- High efficiency fuel and with a constant calorific value
- Hydrophobic fuel, enabling external storage
- Reduced transport costs of pellets compared to normal pellets
- Reduced grinding costs
- Reduced carbon footprint
- Seasonal storage and tradability



Plant components

1.Raw biomass storage and feeding system
2.Torrefactor (biomass dryer in the upper-back)
3.Thermal oil heater
4.Torgas line to the burner
5.Flox® burner system with turbo-compressor
6.Screw cooler of torrefied chips
7.Output hopper
8.Power supply and control cabinets
9.PC Control & supervision

Innovation

- Compact and automated plant, remote supervision
- Use of poor quality hog fuel, locally sourced
- High value product fuel, meets ISO/TS 17225-8
- Recovery of the torrefaction gas in a Flox® burner to provide heat to the process

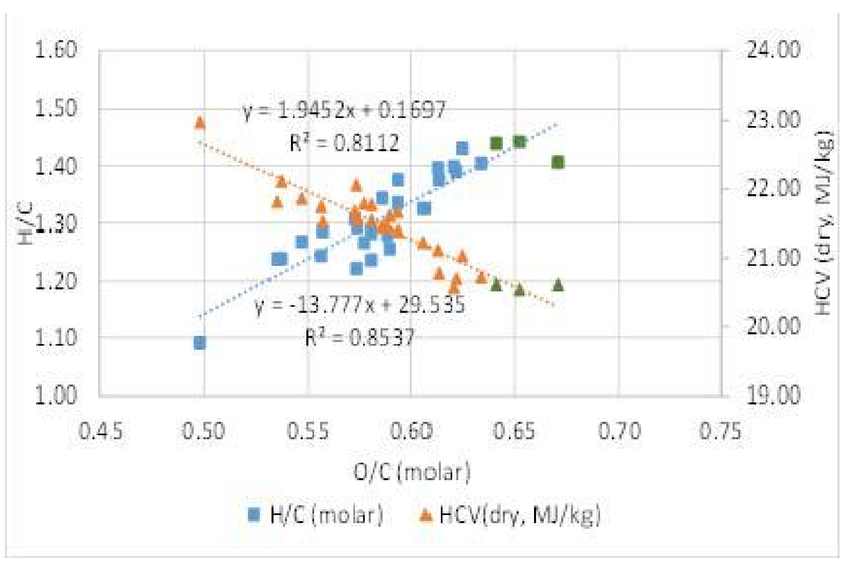
Example of products

Raw biomass (hog wood)

Torrefied chips

Results

- Seven runs: 17 to 42 hours, continuous operation
- Mass loss: 21% to 32% (about 8-10% energy loss)
- High heating value of products: 20.6-21.7 MJ/kg increase of 5-8 %
- Better combustion properties on domestic boilers, lower emissions of particulates (10%), CO (40-94%) and HC (39-85%) compared to raw fuel
- Potential scale-up to 500 kg/h commercial plant with good profitability and a pay-back of about 5 years using low-cost residues at the current cost.



Van Krevelen and HCV correlations with hog wood

With the financial support of the State of Vaud (Switzerland) within the framework of the program "100 million for renewable energy and energy efficiency".