

UNIZAR, Spain



Figure 1: Biomass pilot scale fluidized bed plant at GPT-UNIZAR laboratories.

The Thermochemical Processes Group (GPT-UNIZAR) is developing its work at the framework of the Aragón Institute for Engineering Research, one of the research institutes at the Universidad de Zaragoza (UNIZAR, Spain). Currently, UNIZAR is a member of the Spanish alliance for R&D in the field of energy (ALINNE), being the only academic institution in that network.

GPT focuses on the valorisation of residues by thermochemical processes, specifically by pyrolysis, gasification and hydrothermal processing, although research lines on other processes such as combustion (pollutants minimisation and development of kinetic models for combustion processes in gas phase), pulp and paper or biodiesel production are also active.

In order to reach the group's objectives, experimental studies at various scales are carried out with process modelling. Thus, the processes are developed through different scales, conducting design, construction, and research from laboratory, through bench and pilot scale, up to

demonstration scale and even to commercial scale (in collaboration with private companies). Efficiency and environmental aspects are also a major consideration.

Different feedstocks and raw materials have been studied, including lignocellulosic and agroforestry residues, sewage sludge, meat and bone meal, plastics, waste tyres, spent liquors from the pulp and paper industry (black liquor), biomass oxygenated compounds and bio-oils, and more recently refuse derived fuels (RDF) from municipal solid wastes.

Following this approach, GPT offers various relevant research infrastructures at different scales, from micro to commercial scale. Furthermore, the associated infrastructure enables a comprehensive characterisation of raw materials and products, gas, liquid and/or solid.

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Figure 2: 700 kg/h biomass commercial-scale downdraft gasification plant at TAIM-WESER.



Figure 3: Micro-scale APR catalytic test rig at GPT-UNIZAR laboratories.

Biomass Commercial-Scale Downdraft Gasification Plant (CDG)

The 700 kg/h air gasification plant is a commercial-scale downdraft plant developed in collaboration with a private company (TAIM-WESER, Spain). The total output capacity for the plant is 750 kW, yielding up to 1 kWe and 2 kWth per kg of biomass fed.

This gasification plant constitutes a significant landmark among biomass gasification technologies worldwide, since it is a fully developed biomass gasification plant at a commercial scale currently under operation and supplying power to the Spanish electrical network system. The only constraints of the installation relate to the feedstock.

Biomass Pilot Scale Fluidized Bed Plant (PFBG)

The pilot-scale fluidized-bed gasification plant has been designed and constructed by GPT, with the aim of providing complete versatility in different biomass feedstocks or any other valuable residues, including RDF or sewage sludge. Thus, special attention and efforts have been devoted to the feeding system, which has resulted in the development and construction of a series of interchangeable feeders that provide full flexibility with respect to the feedstock input to the installation.

The processing capacity of the plant can reach up to 15-20 kg/h, depending on the bulk density and other inherent characteristics of the feedstock taken into consideration. The installation features include a gas cleaning system for both catalytic tar cracking and NOx reduction.

Hydrothermal Processing Plants (APR)

Hydrothermal processing is a relatively low temperature liquid phase process operating at high pressure. This Aqueous Phase Reforming (APR) process constitutes an alternative approach to the conventional technologies for upgrading biomass and other related residues and feedstocks to second generation biofuels.

The main advantage of this process is its versatility regarding the feed, enabling the

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Figure 4: Lab-scale APR test rig at GPT-UNIZAR laboratories.

processing of difficult-to-feed liquid feedstocks, including biofuels (e.g. bio-oil from biomass pyrolysis), or any residual biomass waste stream containing valuable organics, from glycerol (by-product from biodiesel production), through to algae, black liquors or cheese whey, regardless of the water content of the feed. The operating conditions can reach 65 bar and 275°C. The main products are a valuable syngas and liquid byproducts, which may be converted into different high-value added chemicals, fuels and commodities.

30th Anniversary

In 2013, UNIZAR's Thermochemical Processes Group (GPT) celebrated its 30th Anniversary. See [Issue 3](#) of the BRISK newsletter (pages 19 - 21 on the BRISK website) for further details about the achievements and highlights of GPT during the past three decades in the field of biomass thermochemical conversion, residues valorisation and pollutants minimisation.

Did you know?

Grants for travel and subsistence are available for researchers to visit BRISK partners, including UNIZAR.

BRISK will pay for the facility access costs.

GPT
Thermo-Chemical
Processes Group



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**Universidad
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Contact

For further details about how to apply to utilise UNIZAR's GPT facilities as part of the BRISK initiative contact:

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