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Biomass Gasification Technologies for Biochar Production and Energy Generation

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Starting from 2012, the innovative SME Tecnoforest Ltd. (formerly an academic spin-off of the University of Genoa) has addressed its activity towards the testing of existing, and the development of new, small-scale biomass gasification technologies aimed at assuring electric and thermal self sufficiency to rural enterprises of the agricultural and wood-based sectors (www.tecnoforest.wordpress.com). Tecnoforest researchers took great advantage from the parallel activities being carried out at DIME/SCL, the Combustion Laboratory of the DIME Department, University of Genoa (www.en2.unige.it/savona-combustion-lab/). On the other hand the intrinsic limitation of these power plants' typologies, common to both downdraft and updraft gasifiers, has become apparent as the main obstacle preventing, in absence of costly abatement provisions, their continuity of operation: namely, the unavoidable need of progressively heavier maintenance provisions, especially related to the removal of sticky carbon-rich deposits and soot on the internal surfaces of the various plant components. In order to tackle this issue, a novel approach has been recently pursued at Tecnoforest, based on the evidence that no tar is produced not only when woodchips are directly burned, but also when they undergo a delayed combustion (i.e. a gasification) provided the embers are not 'stifled' from an overwhelming amount of feedstock weighing upon them from above. This concept, which implies a 'floating' front of the embers (without any physical hearth), has been implemented in three similar types of 'gasifiers', all of sturdy, 'rural' technology, two fully operational and already on the market, a third still undergoing development. They are the following: 'SynChar', a thermal converter featuring a cyclic (batch) operative modality, producing biochar of pharmaceutical quality while a clean syngas flame issues from its top nozzle; 'SynBurner', a clean syngas generator, with continuous operation, suitable to fuel gas burners for air heaters, boilers and furnace applications; 'SynGen' a syngas generator suitable to feed dual-fuel diesel gensets, after proper mixing, for ignition purposes, with small quantities of vegetable oils, even exhausted.

Recent Publications

1. Ballesteros-Plata D, Infantes-Molina A, Rodríguez-Cuadrado M, Rodríguez-Aguado E, Braos-García P, Rodríguez-Castellón 1. D.Accornero, E.Manzino, F.Pittaluga (2011). Rapid-Growth Forestation Techniques and Wood Thermal Pre-Treatments for Enhanced Energy Generation. Proceed. CEBC, Central European Biomass Conference 2011, Graz, Austria, Jan. 2011
2. Accornero D, Caruggi M, A. Nilberto, Pittaluga F (2011). Nuovo impianto di produzione elettrica da 800 kW mediante gassificazione di biomasse. Atti del Convegno ATI, Associazione Termotecnica Italiana, Arcavacata di Rende (CS), 05/09/2011, p. 1-7, ISBN: 9788895267111

3. D.Accornero, E.Manzino, F.Pittaluga (2012). A novel separation technology for nano- particles at discharge of combustion and incineration equipment. EQA Environmental Quality, 8 (2012), p. 13-24, ISSN: 2281-4485
4. D.Accornero, A.Nilberto, F.Pittaluga (2013). Design features and performance data of a new 400 kW biomass gasification plant of downdraft type. J. Energy and Power Engineering, Vol.7, N.2, Febr. 2013, p. 229-236, ISSN: 1934-8975
5. E.Manzino, D.Olampi, F.Pittaluga (2015). Performance Analysis of a Woodchip Downdraft Gasifier: Numerical Prediction and Experimental Validation. J. Energy and Power Engineering. Vol.9, N.4, Apr. 2015, p. 336-347, ISSN: 1934-8975

Biography

Ferruccio Pittaluga, recently retired, has been full professor of Thermal Machines at the University of Genoa. Now continues his teaching activity as contract professor. His fields of interests have been Thermo-Fluid Dynamics, Combustion & Gasification, Atmospheric Emissions. In 1998 he established DIME/SCL, the Combustion Laboratory of the University of Genoa, of which has been in charge up to his retirement in 2015. The participation to numerous National and EC-funded R&D programmes, mostly dealing with environmental sustainability of combustion processes, has granted, in the years, rich support for research activities and technological developments. In 2011, with a few of his former doctoral students, he was co-founder (and since then, president) of Tecnoforest, an academic spin-off (now an innovative SME) addressed at rapid growth forestation, wood gasification and biomass-based renewable energy cogeneration. Tecnoforest has been for some years Italian representative of APL gasifiers (USA).

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