Tar Separation and Conversion using Microwaves (TSC-MW) to improve conversion efficiency into electric energy from pyro-gasification

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ABSTRACT

Lignocellulosic biomass can be converted into energy through thermochemical processes such as combustion, pyrolysis and gasification. Nowadays pyrolysis and gasification, and their combination, are of great interest given their high overall conversion rate into energy compared to direct combustion. In this field, tar removal from output gas is still an open issue when energy conversion of such gas through engines or turbines is considered (tar is a general expression for a complex mixture mainly made of heavy hydrocarbons or poly-aromatic hydrocarbons).
DEVELTAR project was aimed to investigate a device for the removal of tars (cracking) from pyrolysis and gasification gaseous effluents in order to improve their quality as fuel. Tars are condensed and collected by cooling the gaseous effluents than transferred by a wet film of oil to an electricity based technologies with high power and low energy such as microwaves that was extensively examined for this specific purpose.
The device developed during the research project was able to use the electrical energy efficiently concentrated towards the disruption of tar molecules, minimizing energy losses through a proper geometrical configuration and setup of process parameters. The main advantage of these technologies is the possibility to concentrate most of the energy on the target molecules avoiding a general increase of the overall energetic level (temperature). The electrical device is not intended for a specific pyrolysis or gasification technology, but as wide-ranging add-on module to be coupled within the gas purification line.
The validation at industrial level of the abovementioned technologies, currently known at fundamental research level only, was done at the end of the project. The main foreseen advantage of this technological approach is a relevant improvement in terms of yield of combustible gas, i.e. electrical energy produced downstream, through a low additional energy expenditure, hence an improvement of the net energy balance.
The DEVELTAR project has been implemented by Sea Marconi Technologies Sas, a leading company in the field of energy and environment, as project leader. Sea Marconi has been supported by Spike Renewables Srl a partners with relevant competences in the field of interest and a leading engineering and consultancy company in the renewable energy field.

Keywords: *pyro-gasification, gasification, tar removal, electric conversion efficiency, biomass, microwaves.*

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