Thermochemical conversion processes: application and advancements in biomass gasification.

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Abstract

The current situation of international instability, with its economic and social consequences, provides yet another reason to emphasize the significance of dependence on fossil fuels and non-domestic energy sources, in addition to environmental ones. On the other hand, the same subject provides a new starting point for reviving the relevance and interest in locally available renewable energy sources, among which bioenergy certainly can play a key role.

Biomass is one of the oldest sources of energy. Primarily used to generate heat, it has gained significant momentum due to its renewable nature and its ability to effectively meet energy needs without contributing to increase greenhouse gas emissions into the atmosphere. Thus, it can contribute to combating climate change and diversifying energy supply sources.

In this context, R&D activities on unconventional thermochemical processes, such as gasification and pyrolysis, appear promising to play a role in reducing dependence on fossil fuels and achieving the targets for reducing greenhouse gas emissions by 2030, compared to 1990 levels, and climate neutrality by 2050.

This contribution will present an overview of technological developments in gasification, their current state of maturity, and their most advanced applications, which, in addition to power generation, aim to produce advanced energy carriers—such as liquid and gaseous biofuels—intended to replace fossil-based fuels, such as natural gas and oil.

The most highly developed applications will be presented, including potential integrations with intermittent power sources (i.e. solar and wind RES). A discussion of the results achieved will reveal their potential and the challenges regarding full industrial development and widespread diffusion.