Success Story

COMET

BE2020

BIOENERGY 2020+ GmbH

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New fuels for gasification

Most commonly waste is incinerated. In contrast to combustion, the dual fluidized bed gasification process produces not only electricity and heat, but also gaseous and liquid fuels. This gasification process is operated successfully with biomass. This research work demonstrates that waste materials can also be gasified in the dual fluidized bed gasifier. Thus they are recycled efficiently, which is very important, because modern societies generate more and more waste.

Recycling and production of secondary raw materials

As the global energy and raw material consumption is continuously rising, the efficient use of resources is crucial. Recycling and the production of secondary raw materials is very important to achieve resource efficiency. The EU targets at a recycling rate of 50% for glass, paper, plastics and metals and a recycling rate of 70% for construction and demolition waste by 2020. Therefore, viable and efficient recycling technologies are necessary. Gasification processes, that convert solid fuels into a combustible gas with high heating value, are interesting options. The dual fluidized bed gasification process (DFB) was developed at

bmwfw Federal Ministry of Science, Research and Economy

bmvit Austrian Ministry for Transport, Innovation and Technology

the Vienna University of Technology and allows efficient conversion of biomass into electricity, heat and fuels. Commercially available, the DFB gasifier is a proven technology for the gasification of woody biomass. The existing industrial DFB gasifiers in Austria, Germany and Sweden run on wood chips mainly from forestry.

Within this research work, it is investigated whether the DFB gasification process is also suitable for residues and waste. However, these materials are mostly inhomogeneous, are of varying quality and are most commonly challenging fuels for gasification plants. For further investigation, several residues and waste materials have been selected: different kinds of waste wood, sawdust and various plastic residues. In order to assess their suitability for the DFB process, these materials are analyzed in detail and gasified in a 100 kW pilot plant. The process conditions of the pilot plant are in good agreement to the industrial gasifiers, therefore the experimental results can be transferred to larger scale applications.

Waste woods and plastic residues

For the test runs in the pilot plant, different kinds of waste woods from several origins were selected (wood processing industry, shredded furniture, etc.). Waste wood is generated when products made from wood are discarded, but also includes residues from forestry and wood processing industry. In Austria, waste wood amounts to 8% of the waste. Depending on the degree of pollution, waste wood can be processed to pulp and paper or to chip boards or has to be disposed of in waste incineration plants. In addition, plastic residues were studied, as they represent a growing share of waste and often occur in mixed biogenous waste streams. Most commonly, plastic residues originate from packaging and are incinerated with municipal solid waste.

Operation of the pilot plant showed that the selected residues and waste can be gasified without problems and thus, DFB gasification of these materials is technological feasible. The quality of the product gas was found to be clearly influenced by specific fuel properties. The influence of specific waste fuel properties on the gasification process was analyzed in detail based on the experimental work and the mass and energy balances. A special focus was placed on the consequences of impurities that are released from the fuel. Product gas cleaning is a crucial part of the DFB gasification process to remove impurities such as nitrogen, sulfur and chlorine. Based on this research work, product gas cleaning devices can be designed. During gasification, undesired compounds, tars, are formed by incomplete reactions. Tar formation is also influenced by fuel properties. Gasification behavior of plastics is different from wood and leads to significantly more tar. The influence of fuels with high contents of fine particles was studied systematically for the first time. It was found that tar formation increases with increasing amount of fine particles in the fuel. The influence of the fuel properties on gasification contributes to explaining the gasification process itself in more detail, which serves as a knowledge base for further optimization.

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Fig. 1: The pictures show some of the studied materials

Impact and effects

DFB gasification is suitable for residues and waste and it is a conceivable process for chemical recycling of these materials. In contrast to other processes, DFB gasification has a broad range of products: electricity, heat and synthesis products such as gaseous and liquid fuels. Based on this work, the advantages of gasification can be applied to waste materials.

Contact and information

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