Success Story
COMET

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bioenergy2020+

LowQualityFuel
Utilization of low quality biomass in industrial scale DFB plants
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Further use of ash after energetic utilization of biomass

Further use of biomass ash after energetic utilization of biomass contains a significant potential to increase the added value of renewable processes. Through collaboration with the industrial scale power plant in Senden, near Ulm, Germany, which is based on the dual fluidized bed gasification technology, first ground-breaking results have already been gained.
Based on this research an international consortium was formed to further investigate the utilization of biomass ash fractions.

Biomass gasification

Utilization of biomass as renewable feedstock can significantly contribute zu the generation of different products. Biomass gasification in a dual fluidized bed is a promising and innovative technology to reach this goal. A bed material is used in this process, which acts both as heat carrier and catalyst to improve the gasification. The generated gas can be used for the production of a broad spectrum of different products, such as electricity, district heat, Fischer-Tropsch-diesel or chemicals. Therefore, all these products can be generated based on renewable energies.

Not only can the product gas be further used, but also ash, which is present as residue from gasification. Especially cheaper feedstocks, which are interesting as future fuel, contain a significant amount of nutrients, which are found in the ash. The recovery and further use of those nutrients contains an immense potential of this technology.

However, nowadays, the ash fractions cannot be further used, since olivine, a mineral also used as gemstone, is used as bed material. Heavy metals present in olivine are found in the ash and render further usage impossible.

If inorganic residues – ash fractions – could be further used, biomass gasification in a dual fluidized bed would be improved significantly.

Ongoing research at the industrial scale power plant in Senden, near Ulm, Germany (Figure 1), has already proven to be valuable, since numerous ground-breaking results could be gained on-site.

Influence of biomass ash

Investigations of BIOENERGY 2020+ have shown, that biomass ash interacts with the bed material, which results in the formation of layers on the particle surface (Figure 2).

It could be observed, that this layer increases the catalytic activity of the bed material. Layered particles showed a higher catalytic activity than the original catalyst – fresh olivine.

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Furthermore, it could be proven that other potential bed materials also develop similar layers and thus, could be used as catalyst in the process. However, the formation of particle layers is also risky regarding undesirable agglomeration and melting processes.

Therefore, an alternative bed material has to be able to develop a stable catalytic ash layer through interaction with biomass ash and at the same time inhibit undesirable agglomeration processes.

Based on these results an international collaboration between BIOENERGY 2020+, the Technical University of Vienna, the University of Technology Luleå and the University Umeå, Sweden, could be established.

Within this cooperation the mechanism of layer formation for different materials could be explained. Alternative materials are currently tested in experimental work.

Fig. 1: The power plant in Senden, near Ulm, Germany – a dual fluidized bed biomass gasification plant (copyright: BIOENERGY 2020+)

By combining the expertise of the Swedish research groups with that of the Technical University of Vienna and BIOENERGY 2020+ a highly efficient consortium to further investigate this topic was formed.

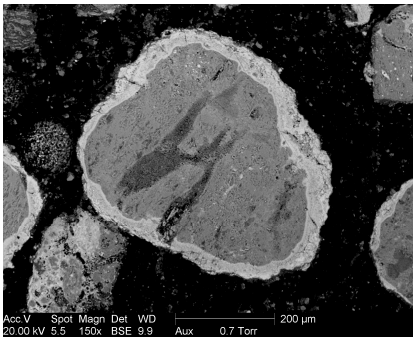

Fig. 2: Ash layer through interaction between biomass ash and bed material (copyright: BIOENERGY 2020+)

Impacts and effects

Replacing olivine with an alternative, heavy metal free bed material would make the further use of ash possible. Recovery of nutrients, which are present in the ash fractions, would increase the added value of this technology immensely.

The ongoing research is an important step regarding the ecologic development of the dual fluidized bed biomass gasification technology.

Thus, the technology itself would be more competitive as new products can be gained from the process. In addition to electricity, district heat, Fischer-Tropsch-diesel or chemicals also ash fraction could be used as high-grade fertilizer

Furthermore, the international collaboration increases the efficiency by the utilization of synergies.

Contact and information
K1-Centre LowQualityFuel

BIOENERGY 2020+ GmbH
Inffeldgasse 21b, 8010 Graz, Österreich
T 01 58801 166323
E matthias.kuba@bioenergy2020.eu, www.bioenergy2020.eu

Project coordinator
Friedrich Kirnbauer

Projektpartner

Organisation	Country
Stadtwerke Ulm	Germany
Technical University of Vienna	Austria
BIOENERGY 2020+ GmbH	Austria