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Solar-Powered Biomass Gasifier (20120099, Dr. Jane Davidson)

Technology No. 20120099

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Solar Energy Powered Biomass Gasifier for Syngas Production

A method of biomass gasification using solar energy produces a higher yield of syngas when compared to traditional combustion methods. The solar-powered biomass gasifier forgoes the traditional method of combusting biomass or fossil fuels and instead uses solar energy to obtain the necessary energy from heat. Using the biomass feedstock as the source of energy to drive the gasification reaction typically consumes 20% to 30% of the original energy content making the gasifier much less efficient. Contrasted against traditional non-solar gasification systems, the solar-powered gasifier produces a 30-50% high yield of fuel per unit feedstock. This new device also outperforms other solar-powered gasifiers by being able to operate at lower temperatures and obtain higher efficiency. The new reactor also has the capability to perform continuously at night. This method of gasification lowers dependency on fossil fuels and produces a more sustainable biofuel.

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Pyrolysis and Gasification of Solid Carbonaceous Fuels

The biomass gasification process involves two different reactions: pyrolysis and carbon gasification. This solar-powered gasifier uses a near-black cavity absorber for receiving necessary energy from concentrated solar energy sources. This method produces sufficient heat energy to perform the conversion reaction of solid carbonaceous fuels including biomass, coal, municipal solid waste, or sewage sludge into syngas. Concentrated solar energy raises the temperature of the internal chamber of the gasifier to proper reaction levels. Molten salts,

which are in contact with the biomass, then act as a heat transfer media and catalyze pyrolysis to speed up the process. The molten salts also increase the efficiency of the reaction along with capturing the ash and tar byproducts for recycling. The syngas that is produced then flows out the outlet ports for collection and storage. Use of solar radiation greatly increases efficiency and yield of the reaction and eliminates the need for partial combustion of feedstock allowing for all biomass to be used to produce syngas.

BENEFITS OF SOLAR ENERGY POWERED BIOMASS GASIFIER:

- 30-50% higher yield of fuel per unit feedstock, compared to traditional gasifiers
- Biomass does not need to be pulverized prior to entering reactor
- Operates at lower temperatures and higher efficiencies than other solar energy powered gasifiers
- Easy removal of ash and tar byproducts
- Low concentration of CO₂ produced
- Able to operate at night
- Continuous process

Phase of Development Proof of concept demonstrated through numerical models and technical drawings.

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