GasBio

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# Newsletter 2-2011

This is the second newsletter in the GasBio project. This issue gives a brief overview of biofuels in aviation and focuses on the project workshop arranged in Gothenburg recently.

## Project workshop in Gothenburg

The second GasBio project workshop was arranged 9 – 10 November in Gothenburg. Metso gave an overview of their gasification activities with emphasis on the Metso gasifier at Södra Cell Värö and the Gobigas project. The latter aims at producing Synthetic Natural Gas from biomass utilizing Metso gasification technology based on indirect gasification. Planned start-up of this plant is 2013. Recent project results within char reactivity, an overview on aviation biofuels and initial work on system analyses were also presented by SINTEF, while NTNU presented the PostDoc work on water gas shift reaction applied to biomass derived synthesis gas that is nearly finalized. This latter work is planned published in the RSC Catalysis Series. Interesting presentations, strong involvement and fruitful discussions made this a successful arrangement.

### Visit to Södra Cell's facilities at Värö

The second day of the Gothenburg meeting was devoted to a visit to Södra Cell's facilities at Värö. The visit included a presentation of Södra and their activities followed by a guided tour at the plant at Värö. Södra Cell is a part of the Södra group owned by more than 51 000 forest owners in southern Sweden. Södra Cell is one of the world's leading producers of market pulp, and most of the raw materials for their pulp come from forests owned by Södra's members. The annual pulp production at the plant at Värö is 425 000 ton, and 90% is exported.

Södra Cell has made extensive energy investments at Södra Cell Värö over the past few years and has recently completed the investments which make Värö mill the world's first fossil-fuel-free pulp mill. An early step in this process was the biomass gasifier that was built to replace the heavy oil with biomass at the lime kiln. This atmospheric Circulating Fluidized Bed gasifier has been in operation since 1987 and has more than 90 000 hours of operating time. The 35 MWth gasifier was designed by Götaverken which was later bought by Metso Power. The total height is 30 m and the diameter is 3.5 m, both outer dimensions. It is fuelled with dried bark, and a new bark dryer was implemented recently.

The pulp process also generates great quantities of energy and, over the last while, electricity and district heating supplies have become an increasingly more important part of Södra's operations. At Värö 65 GWh electricity is delivered to the grid and 120 GWh district heat for the Varberg community is produced annually. This represents 50 % of the heat demand in Varberg.

The gasifier at Söndra Cell Värö

## Biofuels in Aviation

Aviation is a significant contributor of the world's economy, and especially in Norway it is a major transportation method for people and goods. The role of aviation is expected to increase in the future and with it the fuel demand and the environmental impact. The increased $CO_2$ emissions are of major concern. Thus, it is recommended to look into emission-reducing measures. SINTEF has prepared a note, where aviation biofuels are discussed. The note looks into possibilities for alternative jet fuels in the near and mid-term future, giving a background for further studies in this field. The different biofuels suitable for recent and future aviation purposes are investigated based on available open literature; articles, studies, press releases and presentations.

A number of potential alternative fuels and fuel blending may be considered for aviation. These can be derived from coal, natural gas or biomass. Not all of them, however, would significantly reduce GHG emissions. The most likely alternative fuels for aviation are those with similar characteristics to conventional jet fuel. These are by definition "drop-in" fuels, which meet the oil-derived kerosene specifications. There are two biofuel types certified for aviation today, both used in maximum 50 % blends with conventional Jet A/A-1. One of these is hydrotreated vegetable oil (HVO) derived from oil seed plants. This fuel is commercially available and is already in use in small quantities. The other fuel, Fischer-Tropsch (F-T) kerosene derived from lignocellulosic materials is expected to be on the market within the next 5-10 years. Both fuels have certain advantages and disadvantages, discussed extensively throughout the note.

Vegetable oils and fats can be hydrotreated to produce a HVO fuel that consists almost totally of hydrocarbons. Hydrotreating can be carried out at refineries. The chemical processing is similar to the conventional refinery technique. First, the oils are cleaned to remove impurities using standard oil cleaning procedures. The oils are then converted to the shorter chain diesel-range paraffins.

Synthetic fuels are high-quality fuels that can be derived from natural gas, coal or biomass via the Fischer-Tropsch process. The individual fuel production processes share some common features. Synthetic biodiesel, also called F-T biodiesel, is a result of gasification of biomass. In this reaction, biomass is heated with an oxygen deficit and a gas, called syngas, containing mainly CO and $H_2$, is formed. Besides these two components, syngas contains $CO_2$ and contaminations (tars, methane, particles, etc.), which need to be removed. After gas cleaning, the clean gas will be the raw material for the Fischer-Tropsch reaction in which the syngas is converted to hydrocarbons.

## Other news

### Nordic Bioenergy 2011

Nordic Bioenergy 2011 was arranged in Jyväskylä, Finland 5-9 September this year. SINTEF Energi gave 4 presentations in this conference, of which one is related to the GasBio project. The titles of the SINTEF presentations were: 1) Cost-effective small-scale CHP solutions for the Norwegian market, related to the KRAV project, 2) Stable operating conditions in bioenergy plants through utilization of torrefied biomass, related to the STOP project, 3) Achieving low emissions and stable heat release from wood stoves and fireplaces firing at low load, related to the StableWood project and 4) Biofuels in Aviation – an overview, related to the GasBio project.

### The ASME 5th International Conference on Energy Sustainability

was combined with the ASME 9th International Fuel Cell Science, Engineering and Technology Conference in Washington DC, US 7-10 August this year. The conference consisted of plenary talks, invited talks, panel discussions, workshops, tutorials, technical sessions, poster presentations and exhibitions, with a total of 437 high-quality papers from 32 different countries. SINTEF Energi contributed to the ASME 5th International Conference on Energy Sustainability with one conference paper (ESFuelCell2011-54140) entitled "Gasification of biomass to second generation biofuels: A review " which was presented as a technical presentation during the conference by Berta Matas Güell.

### New PhD student in GasBio

Future large scale of syngas production by using lignocellulosic biomass requires a detailed understanding of the thermo-chemical conversion process inside the gasification reactor, which is usually difficult to learn only from experiments. Numerical modeling of biomass conversion in a gasification reactor is the topic for a PhD study in the GasBio project. The objective of this numerical approach is to model, simulate and optimize promising gasifier designs, in order to reduce the risks involved in gasifier scale-up. The work will furthermore be closely related to parallel experimental activity.

A PhD student, Tian Li, has started the numerical studies since 1 Sepember this year. Current work is focused on the open source code MFiX, which is a general-purpose computer code developed at the National Energy Technology Laboratory (NETL) for describing the hydrodynamics, heat transfer and chemical reactions in fluid-solids systems. It is based on a generally accepted set of multiphase flow equations and has been used for describing bubbling and circulating fluidized beds and spouted beds.

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