Biorefinery combining HTL and FT to convert wet and solid organic, industrial wastes into 2nd generation biofuels with highest efficiency

NEWSLETTER

Heat to Fuel

September, 2019 - Second Issue

INSIDE

STATUS OF HEAT-TO-FUEL

Heat-to-Fuel is now on the meridian of its time. The project passed its first periodic review and is achieving some interesting results.
In this issue of the newsletter you can get an overview of some of the project's activities during this time, as well as getting to know a part of the members of the Consortium.

ACTIVITIES

- 4th International Congress on Catalysis for Biorefineries, 12/11/2017.
- Horizon 2020 Workshop on Bioenergy, Advanced Biofuels and Renewable fuels, 10/04/2018, Brussels.
- ComSyn Workshop, 18/04/2018, Stuttgart.
- 11th International Conference on Sustainable Energy & Environmental Protection, 8/05/2018, Paisley.
- 25th international symposium on chemical reaction engineering, 22/05/2018, Florence.
- 2nd meeting on H2020 Biofuels and Alternative Fuels, 7/06/2018, INEA, Brussels.
- Sustainable Places 2018 Conference, 27/06/2018, Aix-les-Bains.
- 4th Forum on Hydrothermal Processes, 19/09/2018, Leipzig.
- German PhD-Colloquium Bioenergy, 21/09/2018, Leipzig.
- Thermal & Catalytic Sciences Symposium (TCS) 2018, 08/10/2018, Auburn.
- COP24 Climate Change Conference, 4/12/2018, Katowice.
- The Netherlands' Catalysis and Chemistry Conference, 4/03/2019, Noordwijkerhout.
- H2020 Contractor's Workshop Biofuel projects, INEA, 23/05/2019, Brussels.
- 27th European Biomass Conference & Exhibition EUBCE 2019, 29/05/2019 Lisbon.
- Sustainable Places 2019, 5/06/2019 Cagliari.
- The AIZ-CIS-GIC Jointly Meeting 2019, 11/06/2019, Amantea.
- 2019 North American Catalysis Society Meeting, 23/06/2019, Chicago.
- Convegno GRICU 2019, 30/06/2019, Palermo.

PUBLICATIONS

- Loureiro, T. & Sterling, R., "Biorefinery Combining HTL and FT to Convert Wet and Solid Organic, Industrial Wastes to 2nd Generation Biofuels with Highest Efficiency: Heat-to-Fuel", Proceedings (2018), 2, 1128.
- Pipitone, G., et al, "Towards the sustainable hydrogen production by catalytic conversion of C-laden biorefinery aqueous streams", Chemical Engineering Journal (2018).
- Milioti E., et al, "Lignocellulosic Ethanol Biorefinery: Valorization of Lignin-Rich Stream through Hydrothermal Liquefaction", Energies (2019), 12(4), 723.
- Mauerhofer, A., et al, "CO2 gasification in a dual fluidized bed reactor system: Impact on the product gas composition", Fuel (2019), 253, 1605–1616.
- Aranda, I. & Loureiro, T., "Scientific review of the Heat-to-Fuel Project", Proceedings (2019) 20, 6.

To read all our open access publications, please visit HtF repository.

INTERVIEW WITH JM

JOHNSON MATTHEY PLC (JM)

Johnson Matthey is a UK based speciality chemicals company focused on its core skills in catalysis, precious metals, fine chemicals and process technology. The company employs around 14,800 people worldwide in over 30 countries; around 10% of those work in an R&D function.
JM's participation in Heat-to-Fuel has been through the Johnson Matthey Technology Centre (JMTC) based at Sonning Common in the UK. This central facility acts as a focal point for the development of new technologies into emerging market applications. In particular the work has been conducted within the New Applications Group.
As a global leader in sustainable technologies, we apply our cutting-edge science to create solutions with our customers that make a real difference to the world around us.
We've been leaders in our field for more than 200 years, applying unrivalled scientific expertise to enable cleaner air, improved health and the more efficient use of our planet's natural resources.

Premex Autoclave System - Durability measurements

Avalon Autoclave System - Catalyst screening

Ph.D. Andrew STEELE
Principal Scientist

JM Johnson Matthey
Inspiring science, enhancing life

Role of JM in the project:

JM will develop, evaluate and provide catalysts for 2 main systems in the HtF process: 1) In aqueous phase reforming (APR), oxygenated hydrocarbons are reformed at low temperatures (200–250 °C) and medium pressures (15–50 bar), typically with platinum- and nickel-based catalyst. To date low yields of desired products and fast catalyst deactivation have constituted the main barriers. Therefore to maximize the APR effectiveness, JM will look to optimise the operation conditions and provide the required more active and durable catalysts. 2) In Fischer-Tropsch (F-T) JM will provide benchmark catalysts to be incorporated into structured reactors.

Expectations from HtF:

HtF has an ambitious target of decarbonizing the transportation sector, achieved by maximizing the energy efficiency of gasification based biofuel production, while minimizing capital and operating costs.
JM is interested in strengthening their competencies of the APR process and looking at what catalyst limitations apply when adopting such diverse range of biowaste streams.
In the area of Fischer-Tropsch (F-T) the radical innovation in this project is the combining of APR with a FT reactor with associated heat integration. If this is successful a 50% carbon conversion from organic waste to biofuel may be realised.

www.matthey.com

INTERVIEW WITH CRF

Centro Ricerche Fiat (CRF)

Centro Ricerche Fiat (CRF) is an industrial research organization having the mission to promote, develop and transfer innovation for providing competitiveness to its partners within the FCA (Fiat Chrysler Automobiles) group. With a full-time workforce of more than 850 highly trained professionals, CRF fulfils this task by focusing on the development of innovative products, implementation of innovative processes, development of new methodologies and training of human resources. CRF is the lead centre for the FCA group for the innovation on advanced internal combustion engines, hybrid and electric vehicles.
CRF has participated in several projects within Transportation, ICT, NMP, Energy calls. Relevant projects on fuels and biofuels processing were BIOFEAT, Profuel and BIOH2. Moreover CRF was involved in the CLEANENGINE project devoted respectively to clean engine technologies for alternative fuels and lubricants.
Currently, in addition to Heat-to-Fuel, CRF is involved in the Waste2Road European project and in the regional project Saturno, both devoted to the conversion of urban wastes to biofuels.

www.crf.it

Mauro SGROI
Project manager and researcher

Mauro is responsible for all the activities of CRF in HtF and in particular was involved in the definition of the specifications of the biofuels for the automotive application in internal combustion engines.

Role of CRF in the project:

CRF is the end user of the HtF project and is mainly involved in the characterization of the project products for the application as fuels in internal combustion engines. The chemical analysis laboratories at CRF will be deeply involved in the analysis of the finals products of HtF.

Expectations from HtF:

It is well known that the automotive industry is being deeply influenced by the worldwide policies against global warming and greenhouse gases emissions.
The interest of CRF and FCA for the HtF project is motivated by the possibility to power the engine of vehicles with biofuels obtained by waste biomasses not in competition with the food chain and with high efficiency thanks to the very effective integration of all the industrial production processes. This will allow producing biofuels with a reduced cost and with the potential to dramatically reduce the well-to-wheel CO_2 emissions of FCA vehicles.

INTERVIEW WITH KHIMOD

KHIMOD, a subsidiary of ALCEN group, designs and builds units which transform carbon oxydes and electricity (or hydrogen) into hydrocarbons (currently to methane and in a near future to higher hydrocarbons chains such as propane, olefins and diesel). KHIMOD optimized design comes from several years of industrial research and innovation with CEA-LITEN in the framework of "LACRE" joint laboratory. KHIMOD units rely on highly efficient Heat Exchanger-Reactors (HER) made thanks to a cutting edge assembly process (Hot Isostatic Pressed metallic parts) giving the ability to combine high performance, high safety and cost effective manufacturing.
The range of KHIMOD units meets most of CCU (Carbon Capture and Use) needs such as Power-to-Gas, waste management, off-grid production.

KHIMOD is composed of a highly skilled team of PhDs and engineers with key expertise in - Research and development: mechanical design & engineering, chemical processes, testing - Industrial development: automotive process driven by Quality, Cost & Delivery - Business development & marketing, focused on international markets
KHIMOD strategy is to Fight CO_2 by using the KHIMOD superior HER technology, by transforming directly CO_2 into valuable asset or by reducing CO_2 emissions.

Arwa ADEL
Project Manager

KHIMOD
ALCEN

Role of KHIMOD in the project:

KHIMOD is leading Task 4.3: "Manufacturing of Fisher-Tropsch (FT) structured HERs", in which the following technical work is performed:

- Mechanical and thermal design of the module (gas distribution, cooling areas, instrumentation)
- CAD, machining of elements, assembling and instrumenting with catalyst.

Also an intermediate size FT HER is manufactured from the results of a first small FT HER manufactured by CEA.
This intermediate HER (gas flow of 1-2 Nm3/h of syngas) is designed and manufactured thanks to the feedback from the small FT HER to obtain an enhanced efficiency, heat transfers as well as masse transfers taking into account FT reaction thermodynamics.
KHIMOD also participates to Subtask 6.4.1: "Design and manufacturing of the prototype FT/APR HER", in which KHIMOD is in charge of the design and manufacturing of a larger FT HER as well as an APR reactor.

Expectations from HtF:

KHIMOD participation in HtF is a unique opportunity to demonstrate our technology on a Fisher-Tropsch reaction management, and it may pave the way to a full branch of KHIMOD's activity in the future, which is producing Bio-kerosene.
This new branch of activity will make bigger the implementation of KHIMOD's activity around Europe.
Vast number of sites emitting inevitably big volumes of concentrated CO_2 constitute an enormous market potential:

- Energy
- Petrochemistry
- Transportation
- Building materials

www.khimod.com
www.alcen.com

Heat Exchanger Reactor (HER)

CONSORTIUM

Gussing Energy Technologies GMBH

bioenergy 2020+ GMBH

Beta renewables Spa

Commissariat à l'Energie Atomique et aux Energies Alternatives

Centro Ricerche FIAT

Skupina Fabrika

Instytut Chemicznej Przeróbki Węgla

Institut de Recerca en Energia de Catalunya

Johnson Matthey PLC

Politecnico di Torino

R2M Solution Spain

Consorzio per la Ricerca e la Dimostrazione sulle Energie Rinnovabili

Atmostat

TU WIEN

Heat-to-Fuel is a Horizon 2020 EU-funded project carried out by 14 partners from across Europe that aims to deliver the next generation of biofuel production technologies supporting the decarbonisation of the transportation sector.

NOVEL TECHNOLOGIES + COMPLEMENTARY ACTIVITIES DESIGN MODELLING

TESTING | ANALYSIS INTEGRATED HEAT TO FUEL SYSTEM + DEVELOPMENT HARDWARE PROCESSES

REPRESENTATIVE OF NEXT GENERATIONS OF SUSTAINABLE BIOFUELS TECHNOLOGIES

At the end of the project, the technology will be market ready in around 7 years.
The know-how acquired will allow scalability at a demonstration level before commercialisation.

PROJECT FACTS

Title:

Biorefinery combining HTL and FT to convert wet and solid organic, industrial wastes into 2nd generation biofuels with highest efficiency

Acronym:

Heat-to-Fuel

Budget:

€ 5.896.987,50

Type of action:

Research and Innovation Action

Duration:

48 months

This project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement n° 764675