IN MY OPINION

INNOVATIONS IN SUSTAINABLE FUELS AND LEADING INNOVATORS

By SaurabhJoshi, Sector Expert (Chemicals & Energy), Technology Research and Advisory, Aranca

He has expertized installing biogas and wastewater plant's setup and commissioning.

Sustainable fuels have been around for years now and their growth has been mainly influenced by factors such as energy security, fluctuating prices of fossil fuels and government policies to curb global warming. The sustainable fuels currently available commercially are bioethanol, biodiesel and biogas. These can replace conventional energy sources but are associated with certain drawbacks such as higher cost of production, feedstock production leading to depletion of grasslands and rainforests, disruption of food supply chain owing to utilization of food crops,emission of carbon dioxide (CO_2) as a process by product, and higher consumption of water and energy. Researchers have been actively working to develop innovative solutions for enhancing the sustainability of these fuels,besides making their production economically viable.

In case of bioethanol, the focus is on production from non-food crops, agricultural or organic waste. Companies such as GranBio, POET-DSM Advanced BiofuelsLLC, Clariant AG, VersalisSpA, Axens, Praj Industries Ltd, CLEA Technologies B.V. and Biofuel Evolution have developed or are working on processes to efficiently convert these feedstocks into bioethanol. Certain factors have contributed to improving the efficiency of bioethanol production: development of optimized acid hydrolysis process;use of cheaper enzymes with lesser reaction time and higher conversion yields; use of microorganisms capable of utilizingall fermentable sugars and also susceptible to higher bioethanol concentrations; and bioethanol purification process with low energy requirement and high yield. Development of biorefinery is yet another positive in terms of generating additional revenue from byproducts. Lignin, for instance, is an important by productre portedly used in many applications. Companies such as CH Bioforce, Chempolis, MetGen, Vertoro, Kvasir Technologies and Lignopure are engaged

SaurabhJoshi,
Sector Expert (Chemicals & Energy)

in developing technologies for the extraction of lignin from biomass and to convert it into valuable products. Recently, it has also been reported that bioethanol can be produced from waste emissions. LanzaTech has developed a process to convert industrial waste emissions into bioethanol, using aerobic bacteria. Moreover, production of different alcohols like methanol and butanol from sustainable feedstocks has gained traction. Gevo Inc. and Celtic Renewables Ltd have developed a sustainable process to produce different types of alcohols from renewable feedstocks.

The production of biodiesel mainly depends on the efficiency of catalyst and the product purification process. Companies such as Archer Daniels Midland Company, NesteOyj, Renewable Energy Group, Inc., BIOX Corporation and Novozymes A/Shave developed different technologies for biodiesel production. Recent technologies reported for biodiesel are related to the development of feedstocks with higher oil content, use of eco-friendly catalyst with higher conversion yields and reusability,and efficient product separation processes. C16 Biosciences recently developed a technology to biologically produce synthetic oil, which can be further used as feedstock in biodiesel production.

Biogas plants capable of processing different feedstocks are available in the market, but there are very few technologies for increasing the methane content in biogas. However, advancements in purification, use of microorganisms, and conversion of by product CO2 into methane have helped improve the methane content in biogas. BEKON GmbH and Renergon International AG have developed innovative biogas technologies, while Krajete GmbH and Trovant Technology have introduced technologies for the conversion of CO_2.

CO_2 is one of the main contributors to global warming. Some companies have reportedly developed processes for the production of fuel from captured CO_2. Captured carbon emissions are converted into liquid fuels electrochemically,in a process based on electrolysis and use of catalyst. Companies like Carbon Engineering Ltd., Clime works AG, and Drax have either developed or are engaged in developing a commercial process to produce fuel. Redesigning of gasification reactors has also helped companies to develop sustainable thermochemical processes. Companies like Enerkem and Fulcrum BioEnergy have developed advanced gasification processes. Several other companies have either developed or are currently developing processes to produce sustainable fuels.

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Sustainable fuel shave a minor share among fuels consumed globally but help in reducing toxic emissions, mainly from the transportation sector. Advancements in fuel technologies can significantly reduce the cost of sustainable fuels. This will play an important role in achieving the target of complete replacement of fossil fuels, ensuring energy security and reducing global warming.