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Renewable fuels

When it comes to renewable fuel, Mannvit Engineering's expertise is mainly in the production of four types of fuels; biodiesel, bioethanol, biomethane, and methanol. Currently, Mannvit is designing a biodiesel production plant, which utilises waste vegetable oil and animal fat. Further, Mannvit participates in the design of a methanol production plant, which is based on capturing CO_2 from a geothermal power plant.

Biodiesel

The "traditional" biodiesel i.e. fatty acid methyl ester (FAME), is produced from fatty acid triglycerides obtained from various plants, such as rape, palm and soy, or various waste like waste vegetable oil (WVO) or animal fat. The process is based on a catalysed reaction of fatty acid glycerides with methanol and is relatively economic. The methanol used today in the production is mainly derived from fossil fuel production. As a result biodiesel is 85-90% renewable fuel. Ethanol can be used instead of methanol (giving fatty acid ethyl ester, FAEE), but it is more expensive and complicated to use than methanol.

Biodiesel is widely used in Europe, but to a lesser extent in other parts of the world. Most common are 5% and 10% v/v blends (B5 and B10) in fossil derived diesel. Generally, most diesel engines can use a biodiesel blend up to at least 20% v/v without problems, but many car producers only warrant the use of B5-B10 blends.

Mannvit Engineering is now designing a 450 tpa biodiesel production plant, which will utilise waste vegetable oil and animal fat cuttings. Mannvit has been leading the project from early beginning. In the R&D stage of the project Mannvit designed and operated a small pilot scale production unit to obtain necessary information for the process development. The biodiesel produced by the pilot unit has been tested on both small and large vehicles.

Mannvit Engineering is at the forefront of the biodiesel production in Iceland and has comprehensive experience in R&D of biodiesel production, and within the company is an extensive knowledge of biodiesel production and use.

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Bioethanol

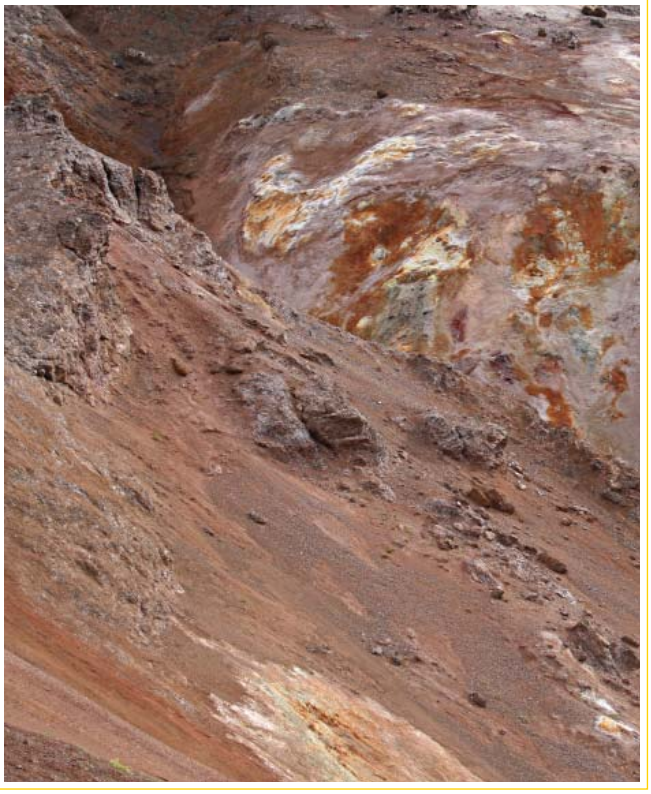
Production of bioethanol from starchy or sugar-rich material by microbial fermentation (mainly yeasts) is a well known process, which is widely used. The largest producers are U.S.A. and Brazil, reaching back to the oil crisis in the 1970's. Ethanol produced this way is commonly referred to as 1st generation bioethanol.

Ethanol produced form cellulosic rich biomass is a 2nd generation bioethanol. The production is based on the use of raw material such as lumber, grass/straw, waste paper and various agricultural residues, which are not used as animal feed or for human consumption.

Today, bioethanol production accounts for approximately 94% of all biofuel production in the world, with about 60% of the production coming from sugar and 40% from other crops. It has been estimated that all available lignocellulosic biomass could yield approximately 1670 billion litres replacing approximately 32% of the global petrol consumption if used as E85.

Mannvit Engineering is now cooperating with the University of Akureyri in two bioethanol R&D projects. These projects are the process design and feasibility study for 2nd generation bioethanol production, and R&D on conversion of crude glycerol from biodiesel production into ethanol, respectively.

Mannvit Engineering plans to design and operate a pilot plant in cooperation with the University of Akureyri. What is special about this project is the use of thermophilic bacteria from hot springs, which are capable of degrading, to some extent, cellulosic material to ethanol and hydrogen.



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Biomethane

Methane commercially available and in use today is mostly as the main component of natural gas. Biogas is formed by controlled anaerobic digestion of biomass, such as manure, sewage and municipal solid waste. By upgrading the biogas, which involves removal of CO_2, H_2S and moisture, biomethane is obtained. Biomethane can be used for same purposes as natural gas, i.e. for heating and as a vehicle fuel. Also, biogas can be used directly for heat generation and in CHP processes.

Mannvit Engineering has many years of experience in the field of methane production and utilisation. Currently, Mannvit is working on many biomethane projects.

Mannvit, in cooperation with the University of Akureyri, is now working on R&D projects which aim to increase the efficiency and yield of anaerobic digestion systems by using various strains of mesophilic and thermophilic bacteria.

In association with Reykjavik municipality, Mannvit has prepared the design of a new anaerobic digestion plant which will be capable of production methane from organic waste. That methane can be used to produce electricity and heat, or be upgraded to fuel for cars.

Mannvit is also participating in a project in cooperation with the Agricultural University of Iceland (AUI) and other companies in developing an agricultural waste solution for farmers. The idea is to assist farmers by analysing the waste from individual farms and present feasible utilisation or disposal pathways. One of possible utilisation of agricultural waste, such as manure and crop residues, is biogas generation by anaerobic digestion. In this case Mannvit's expertise and experience in this field is an important part of the project.

Methanol

Methanol can be used as a fuel for internal combustion engines, mainly in combination with petrol. As a fuel, methanol has received a less attention than bioethanol as an alternative to petroleum based fuels. Presently, methanol is usually produced using natural gas as a raw material.

Mannvit Engineering is currently working on a basic design and project management for Carbon Recycling International, an Icelandic/American venture company, in utilising geothermal environments to convert CO_2 into methanol. Carbon Recycling International plans to capture CO_2 emitted from a geothermal power plant and use the electricity from the same plant to electrolyse water into hydrogen and then combine H_2 and CO_2 to produce methanol.

The recycling of CO_2 results in a net reduction of greenhouse gas emissions and this cost effective conversion of CO_2 into fuel enables a sustainable production of renewable fuel.

Carbon Recycling International has developed clean technology which enables direct conversion of renewable energy to fuel at smaller or large scale plants and which can take advantage of distributed energy systems. Energy sources can be from any renewable source such as geothermal, hydro, wind or solar, resulting in clean liquid renewable fuel. The synthesis process consists of an integrated system of electrolytic and catalytic reactions, facilitating an efficient production plant with a streamlined design.