

Biofuel production

The limited potential of fossil fuels necessitates consideration of alternative fuels from renewable sources. Biofuels can be used in a short time to replace petrol and diesel in conventional driving concepts. The term biofuels describes biomass based fuels which include bioethanol, biomethanol, biodiesel and hydrogen.

1 Biodiesel

Biodiesel is a vegetable oil methyl ester which can be used as fuel for diesel engines. Biodiesel is produced by chemical reaction of vegetable oil or animal fat with an alcohol. Biodiesel is a promising alternative to conventional diesel fuel because it can be pumped, stored and handled using the existing devices for mineral oil based fuels. Biodiesel is an attractive alternative for classical driving concepts, because it is environmentally friendly and can be synthesized from edible and non-edible oils. The substrates for the production of biodiesel are non-toxic, biodegradable, renewable sources. The disadvantages of the production of biodiesel are however, the relatively high energy demand of the biodiesel generation process and the formation of glycerin as by-product in biorefineries [1][2][3].

Table 1: Technical specifications of biodiesel production

Biogas plant parameters	
Production yield	0.22 – 0.45 l biodiesel per kg substrate
Energy output	Biodiesel as diesel substitute
Substrates	Vegetable oil Animal fat

2 Bioethanol

Bioethanol is produced by the fermentation of sugars from sugar-containing plants (sugar beet, sugar cane) or starch-containing plants (potatoes, corn, grain). The sugar contained in plants is converted during fermentation by yeast and enzymes to ethanol and CO₂. The alcohol fermentation is the most well-known and widely used technical process for the production of bioethanol. Although the energy balance of bioethanol production is positive and the fuel can be used to improve the quality of petrol there are also disadvantages of utilization of bioethanol as fuel for petrol engines. The disadvantage of bioethanol is mainly related to the highly hygroscopic and corrosive properties of the fuel which can lead to damage of engine parts [4].

Table 2: Technical specifications of bioethanol production

Biogas plant parameters	
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Production yield	0.08 – 0.42 l bioethanol per kg substrate
Energy output	Bioethanol as petrol substitute
Substrates	Sugar beet, sugar cane Potatoes, corn, grain

- [1] Yusuf, N. N., Kamarudin, S. K., & Yaakub, Z. (2011). Overview on the current trends in biodiesel production. *Energy Conversion and Management* (52) , pp. 2741-2751.
- [2] Eevera, T., Rajendran, K., & Saradha, S. (2009). Biodiesel production process optimisation and characterisation to assess the suitability of the product for varied environmental conditions. *Renewable Energy* (34) , pp. 762-765.
- [3] Bozbas, K. (2008). Biodiesel as an alternative motor fuel: Production and Policies in the European Union. *Renewable and Sustainable Energy Reviews* (12) , pp. 542-552.
- [4] FNR. (2006). *Biofuels*. Gülzow: FNR.