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BIOFUEL:EVALUTION AND INCREASING EFFICIENCY TO THE APPLICATION OF BIO FUEL VEHICLES

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Abstract : Biofuel is considered to be a promising solution to the energy and environmental challenges in the transport sector. However, there are few studies focusing on the current status, future potential, policy framework, barriers and opportunities of biofuel development. This paper covers the generation of biofuels accordingly it contains the types of biofuels. This paper discuss about the efficiency of biofuels and also the method to increase the efficiency in biofuels (method used steam explosion method) which is used in algae and the application of biofuels in vehicles by techniques of adoption of alcohols and adoption of esterified biodiesel and synthetic fuel. This paper discuss about the potential of biofuels in transportation field as it can reduce the dependence in the fossil fuels

1.Introduction

The global energy solutions in general are unsustainable, and the situation is the worst in the transport sector, which is almost totally dependent on crude oil. The demand for energy in transportation is growing. A gap between supply and demand of transportation fuels can be foreseen. For sure, in a medium- and long-term perspective our world of transportation will be going through major changes concerning energy sources, energy carriers, and end-use applications. Some automotive technologies set strict requirements for fuel quality, and some fuels require a dedicated infrastructure. On the other hand, limitations on energy sources (feedstock), production processes, and infrastructure determine the availability of energy carriers (fuels), and all this must be taken into account by automotive engineers,the conditions vary from country to country, and policy actions can have strong impact on the development. In the coming years, we may see a variety of solutions ñ vehicles running on CNG or LPG, on ethanol or conventional bio-diesel, or on synthetic liquid fuels (based on natural gas, coal and biomass), and, of course, even on oil-based fuels The complicated fuel mix will be challenging. Transport is a major sector concerning energy consumption and CO2 emissions. As estimated by International Energy Agency (IEA), the oil consumption by transport sector accounted for over half of total oil consumption globally . Transport sector was responsible for 23% of global energy-related CO2 emissions in 2013 . China, as the respresentative of emerging economies, has experienced rapid growth in its vehicle market over recent years Biofuel is considered to be part of the solution to the transport issues. Biofuel is derived from biomass, which helps to decouple transport fuels from petroleum resources. The life cycle CO2 emissions of biofuels are generally lower than petroleum-derived fuels, contributing to reducing CO2 emissions from the transport sector [8]. Moreover, biofuels improve fuel quality when blended with conventional fuels, which helps to reduce vehicle tailpipe emissions and improve air quality

1.1Energy security: Biofuels can readily replace petroleum fuels and, in many countries, can provide a domestic rather than an imported source of transport fuel. Even if imported, ethanol or biodiesel will likely come from regions other than OPEC (Organization of Petroleum Export Countries), creating a broader global diversification of supply sources of transport fuels.

1.2 Environment: With lower GHG emissions over the whole fuel chain, biofuels are generally more climate-friendly than petroleum fuels. Either in their neat form or as blends with conventional petroleum fuels, vehicles running on biofuels emit less of some pollutants that exacerbate air quality problems, particularly in urban areas. Reductions in some air pollutants are also achieved by blending biofuels, though some other types of emissions (e.g., NOx) might be increased this way.

1.3Fuel quality: Refiners and automakers have become interested in the benefits of ethanol to boost fuel octane, especially where other potential octane enhancers, such as MTBE, are discourage

2.CLASSIFICATION OF BIO FUEL

- **First generation**: conventional biofuels made from food and feed energy crops (e.g., corn, palm oil, etc.). First generation production technologies are well established. The competition with the food supply-chain is however a matter of concern. The “food vs. fuel” debate has raised because it has been suggested that the increased use of food and feed crops for energy production might increase food prices also causing food shortage. Also, it must be born in mind that, in the future, the effects of climate change could decrease the yields of food crops

- **Second generation**: biofuels produced from non-food and -feed energy crops (e.g., straw, wastes, etc.). Second generation production technologies are relatively mature, but the complexity of processes and the scarce availability of raw materials is limiting their potential. Their production is more complex and expensive.
- **Third generation**: biofuels produced from algae. Among algae, microbial algae (or microalgae) are the most promising for biofuel production. Sometimes, other innovative biofuels which are still not commercialised are linked to the third generation. Two examples are biofuels produced from cyanobacteria and higher alcohols. Sometimes, in the literature, a
- **fourth generation** of biofuels is mentioned biofuels produced by genetically engineered micro-organisms and photosynthetic micro-organisms, from thermochemical processes, from waste co2

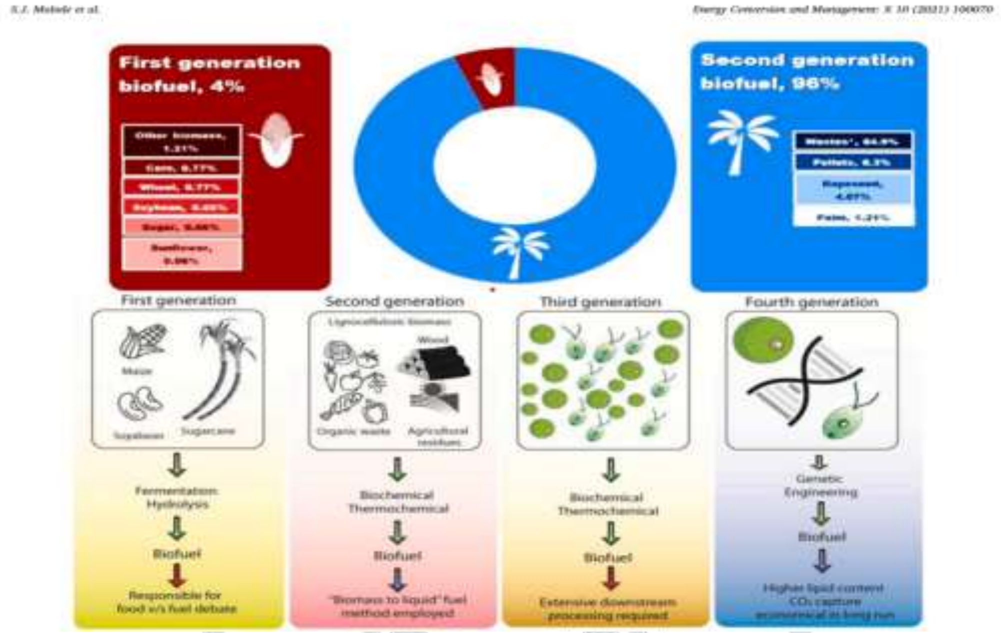

Fig:1generation of biofuel

Fig Reference: Recent advances and viability in biofuel production Shweta J. Malode a,* , K. Keerthi Prabhu a , Ronald J. Mascarenhas b , Nagaraj P. Shetti a,* , Tejraj M. Aminabhavi c a Center for Electrochemical Science & Materials, Department of Engineering Chemistry, K.L.E. Institute of Technology, Hubballi 580027, Karnataka, India b Electrochemical Research Group, Department of Chemistry, St.
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2.1. Biodiesel

Biodiesel is a fuel produced from lipid feedstocks like vegetable oils or animal fats. To bring the oil properties closer to those of diesel, the process of transesterification is used to give a fatty acid methyl ester (FAME) typically known as biodiesel. Biodiesel can be blended and used without modifications in compression-ignition engines (CIEs) . Since stability and decomposition issues may arise, biodiesel is typically blended with conventional diesel up to 7–10%v/v (B7–B10 blends) . To increase the blend percentages, engines must be modified in order to optimise the operating parameters (injection timing, compression ratio, injection pressure) . In Europe there are already examples of captive fleets using B20, B30 and B100 blending grades .

2.2. HVO Hydrotreated Vegetable Oil

HVO, also named 'green diesel' by producers, is a paraffinic diesel derived from biomass. HVO is part of the "renewable diesels" group, which also includes the Fischer-Tropsch diesel (FT-diesel). Renewable diesel is a general term used for refering to new-generation diesels derived from biomass . Two groups of technologies allow producing renewable diesel: hydroprocessing (HVO) and thermochemical processes like pyrolysis and gasification . These fuels can be used in conventional vehicles also directly without blending . HVO does not contain oxygen, aromatics and sulphur and it has better properties than FAME and diesel e.g. higher cetane number1 and heating value, better oxidative stability properties. HVO does not have FAME's advantage of being highly lubricant

2.3. Bioethanol

Bioethanol is a liquid alcohol produced in two steps. In the first step, the fermentation of carbohydrates using yeasts produces the hydrous ethanol (water and maximum 95.6% of ethanol). In the second step, the residual water is removed using solid adsorbent, extractive distillation or membrane separation to obtain anhydrous ethanol. Bioethanol is classified in three generations based on the feedstock used and is blended with petrol in spark-ignition engines. In Europe, for conventional vehicles, the percentage of ethanol blended with petrol is limited to 10%v/v (E10). Flexible fuel vehicles (FFVs), which account for 0.1% of the EU passenger car fleet , can run with a percentage of blended ethanol up to 85%v/v (E85).

2.4. Synthetic liquid biofuels

Several thermochemical routes can convert biomass into synthetic fuels for transport . The process of biomass gasification, which produces syngas, and subsequent thermochemical route is often referred to as 'biomass to liquids' (BtL) Synthetic diesel, also named syndiesel and Fischer-Tropsch diesel, for example, is made from syngas by the Fischer-Tropsch process. The co-products of this process can be biogasoline, biokerosene or both, depending on the catalysts used and the process conditions . Synthetic biofuels have similar or even superior properties to those of their fossil-equivalents. They practically contain no sulphur and aromatics , and can be used in existing engines without any modifications .

2.5. Biomethane

Biomethane produced from biomass is a sustainable alternative for feeding compressed natural gas vehicles, which in 2017 amounted to 0.4% of the passenger car fleet Biomethane can be produced by anaerobic digestion or methanation of biosyngas. The first process, a fully mature technology , produces biogas from organic matter. After that, biogas can be purified to biomethane (also named UBG: upgraded biogas) . Bio-synthetic natural gas (bio-SNG) is the biomethane produced from biosyngas.

2.6 Bio-hydrogen

Hydrogen herein is produced by reforming bioethanol . As the products of biomass conversion are mainly hydrogen rich gases, they have been used in conventional internal combustion engines or gas turbine to provide power or heat. However, it would be more effective to use fuel cells to convert hydrogen energy into electricity efficiently, cleanly, and silently. It is anticipated that distributed reforming of biomass-derived liquid fuels could be commercial during the transition to hydrogen and used in the mid- and long-term time frames . Biomass resources can be converted to ethanol, biodiesel, or other liquid fuels, which can be transported at relatively low cost to a refueling station or other point of use and reformed to produce hydrogen. Biomass-derived liquids, such as ethanol and biodiesel, can be produced at large, central facilities located near the biomass source to take advantage of economies of scale and reduce the cost of transporting the solid biomass feedstock. The liquids have a high energy density and can be transported with minimal new delivery infrastructure and at relatively low cost to distributed refueling stations or stationary power sites for reforming to hydrogen. The reaction pathways and thermodynamics of steam-ethanol reforming (SER) have been extensively studied recently . Most processes converting ethanol into hydrogen involve a reaction with water in the steam-reforming reaction , which is very similar to reforming natural gas. The ethanol is reacted with steam at high temperatures in the presence of a catalyst to produce a reformate gas composed of mostly of hydrogen and carbon monoxide

$$C_2H_5OH + H_2O \rightarrow 2CO + 4H_2 \qquad HR = 260\ kJ{-}mol^{-1}$$

This reaction is strongly endothermic, requiring a flame to heat the reactor to the 800 °C necessary to achieve high conversion at residence times of one second. Then, the carbon monoxide created in the SER is further reacted with high-temperature steam to produce additional hydrogen via the water-gas shift (WGS) reaction.

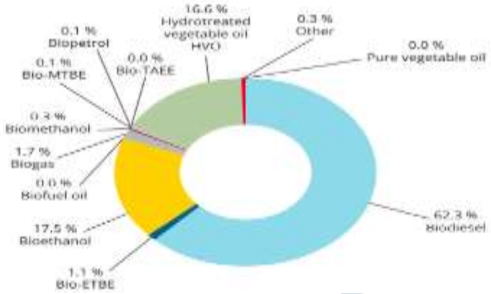


fig3: EU biofuel energy supply shares in 2017

Fig reference: A review on biofuels for light-duty vehicles in Europe

3.Biofuel efficiency and methods to increase their efficiency

3.1Biomass-to-Fuel Efficiency (EF)

In the first generation of biofuel we use , corn stover is used as a representative biomass feedstock. The total carbohydrates (cellulose and hemicellulose) in corn stover contribute approximately 60–65% of the biomass's combustion energy. The remaining chemical energy, primarily from lignin, is utilized for pretreatment, sugar isolation, and product separation in the biochemical (sugar) pathway . Typically, 35–40% of the biomass's chemical energy is sufficient to operate biorefineries without requiring external energy input.The EF values for converting sugars to biofuels depend largely on the efficiency of sugar isolation and the conversion yields during microbial fermentation or enzymatic biotransformation. In this study, the EF is 57%, corresponding to 88–95% sugar release from the biomass, consistent with data from other sources. With sugar yields of 88–99% for cellulose and hemicellulose, and sugar-to-ethanol conversion yields of 92–95%, the EF for cellulosic ethanol is estimated at 50%, with a range of 48–56% . For butanol fermentation, the sugar-to-butanol conversion yields range from 82% (current) to 93% (future) , resulting in an EF of approximately 48%, with a range of 47–53%.Methane is produced through anaerobic fermentation, where microorganisms convert all organic components (except non-hydrolytic lignin) into methane. This process achieves EF values ranging from 62% to 81% [54, 55], with a practical EF of around 65%. This is higher than the EF values for ethanol (50%) and butanol (48%). In contrast, long-chain fatty acid esters (microdiesel) are produced through semi-aerobic fermentation due to NAD(P)H imbalances [6, 22, 23]. Semi-aerobic fermentation consumes more sugar for cell mass synthesis, leaving less carbohydrate available for microdiesel production [6, 56]. As a result, the EF for microdiesel fermentation is approximately 35%, with a range of 7–37%, depending on fuel yields, which vary from 13% [22] to 64% (future) .Syngas is generated from biomass through gasification, a process involving partial combustion at temperatures above 1000 K in the presence of oxygen and/or water. Although gasification is a mature technology, a significant portion of the biomass is consumed during partial combustion, leading to relatively low energy efficiencies despite the utilization of all organic components . The EF for hydrogen production from biomass ranges from 55% to 71% , with an average value of around 60%. For other syngas-derived fuels, the EF values are as follows:

- Methanol: 51–55% (preferred EF: 54%) .
- Dimethyl ether (DME): 39–57% (preferred EF: 52%) .
- Fischer-Tropsch diesel (FT-diesel): 41–52% (preferred EF: 51%).

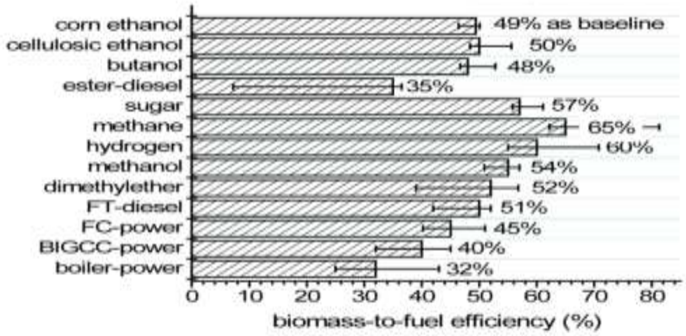


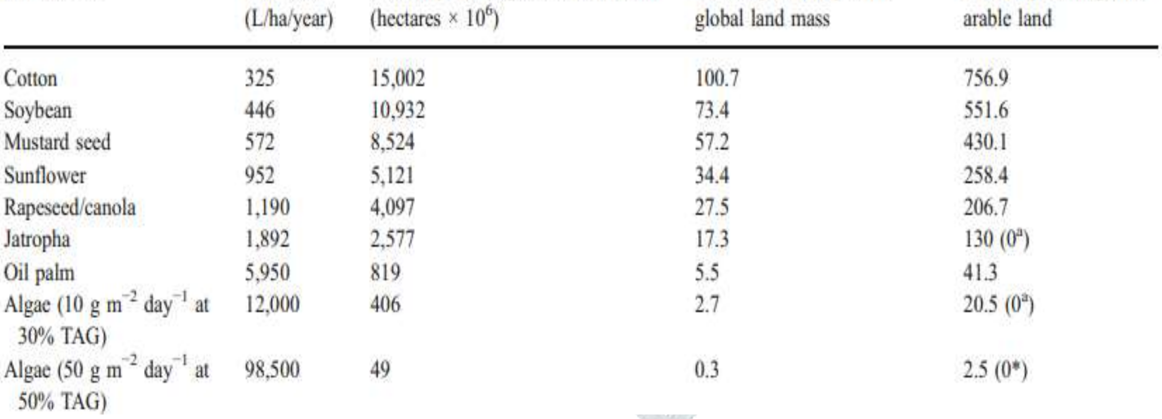
Fig3 : Comparison of biomass-to-fuel (BTF) efficiency in the biorefineries or power stations.
FIG REFERNCE: Energy Efficiency Analysis: Biomass-to-Wheel Efficiency Related with Biofuels Production, Fuel Distribution, and Powertrain Systems Wei-Dong Huang1,2, Y-H Percival Zhang

3.2METHOD TO INCRESE BIOFUEL EFFICIENCY WITH MICROALGAE

The potential of biofuel production is highlighted by the fact that even using current technology, Brazilian sugarcane-based and US corn-based bioethanol production are reported to be cost competitive at oil prices of US $40 and US $60 per barrel, while the equivalent for biodiesel is US $80 . Thus, since the oil price has recently reached US $100 per barrel, these fuels can in theory already be produced economically Therefore, even modest increases in photosynthetic and process efficiency are expected to yield significant increases in economic competitiveness. Further more oil production (which has driven up the oil price) is increasingly thought to be close to its maximal capacity, indicating that additional bio-fuel production streams will increasingly find a market.

Biodiesel is developing into one of the most important near-market biofuels as virtually all industrial vehicles used for farming, transport and trade are diesel based. In the past decade, the biodiesel industry has seen massive growth globally, more than doubling in production every 2 years . The increased demand for vegetable oils for the production of biodiesel has led to significant pressure on the vegetable oil market. Indeed the world's biodiesel industry is currently operating far below capacity due to a lack of feedstock. Second generation microalgal systems are increasingly predicted by international experts and policy makers to play a crucial role in a clean environmentally sustainable future as they have important advantages. Most significantly, these achieve a higher yield per hectare (potentially over 15-fold higher than oil palm, the biggest current oil producer; Table 1) and their ability to be cultivated on non-arable land, thereby reducing the competition with food crops for land (see "Addressing the Concerns of Biofuel Production" section). Algal production systems are recognized as among the most efficient means of producing biomass for fuel (Table 1) and further improvements are likely to occur in the near future. For example, algae are already being engineered for increased photosynthetic efficiency of the overall culture due to improved light penetration and reduced fluorescence and heat losse

Table1: Comparison of crop-dependent biodiesel production efficiencies from plant oils



Plant source	Biodiesel (L/ha/year)	Area to produce global oil demand (hectares × 10^6)	Area required as percent global land mass	Area as percent global arable land
Cotton	325	15,002	100.7	756.9
Soybean	446	10,932	73.4	551.6
Mustard seed	572	8,524	57.2	430.1
Sunflower	952	5,121	34.4	258.4
Rapeseed/canola	1,190	4,097	27.5	206.7
Jatropha	1,892	2,577	17.3	130 (0^a)
Oil palm	5,950	819	5.5	41.3
Algae (10 g m^{-2} day^{-1} at 30% TAG)	12,000	406	2.7	20.5 (0^a)
Algae (50 g m^{-2} day^{-1} at 50% TAG)	98,500	49	0.3	2.5 (0*)

Table Reference: Second Generation Biofuels: High-Efficiency Microalgae for Biodiesel Production Peer M. Schenk & Skye R. Thomas-Hall & Evan Stephens & Ute C. Marx & Jan H. Mussgnug & Clemens Posten & Olaf Kruse & Ben Hankamer

3.3STEAM EXPLOSION METHOD

3.3.1.Microalgae biomass

Three different microalgae strains were used for this study: two marine species, N. gaditana and P. tricornutum, and a freshwater species, C. sorokiniana. These species are potentially good candidates for biofuel production since they have high photoautotrophic biomass and lipid production rates and can grow to high densities (N10 g L−1) while tolerating a wide range of conditions with regard to pH and temperature . The microalga N. gaditana was obtained as a paste, containing 78% (w/w, wet basis) moisture, whereas the microalgae C. sorokiniana and P. tricornutum were in lyophilized state. For the microalgae powders, distilled water was added before its use, to reproduce the harvested and concentrated microalgae with water content of 80–90.

3.3.2 Pretreatment methods for cell disruption

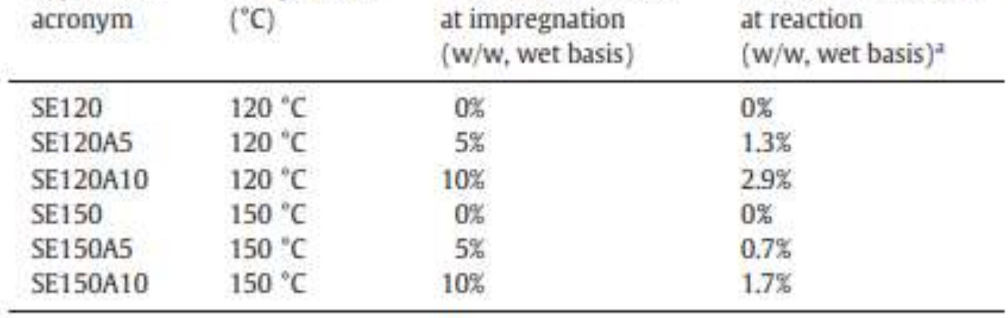
The microalgal samples were disrupted using four different methods:

- steam explosion at 120 °C/150 °C for 5 min
- ultrasound using an ultrasonic bath at a resonance of 37 kHz and at ambient temperature for 5 min;
- microwave using a microwave oven at 2450 MHz and at a temperature of 150 °C for 5 min
- autoclaving at 120 °C for 5 min.

3.3.3. Steam explosion pretreatment

Steam explosion of microalgae was carried out in a batch unit, equipped with a 4 L steam generator, 2 L reactor and a collection vessel. A flash valve at the bottom of the reactor allows a sudden decompression to the atmospheric pressure of the collecting tank. A schematic diagram of the steam explosion setup is shown in Fig. 4. In each experiment, 100 g of microalgal sample was introduced into the reactor, which had been preheated. Some samples were previously impregnated with sulphuric acid at a concentration of 5% or 10% (w/w, wet sample basis) by mixing for 10 min at 30 °C. The steam explosion pretreatments were conducted at two different temperatures, 120 °C and 150 °C (corresponding to saturated steam pressures of 2 bar and 4.7 bar, respectively) with a fixed retention time of 5 min. Only one reaction time was checked. Due to the small size of microalgae, the selected reaction time (5 min) is enough to reach homogeneity in temperature. This homogeneity is assumed to provide a proper and smooth explosion. After reaction, the exploded samples were collected for further analysis. Table 2 shows the specific experimental conditions, i.e. temperature, time and acid concentration at impregnation and at reaction, used for each steam explosion experiment. It must be noted that the concentration of sulphuric acid as reaction differs from the initial concentration at impregnation due to the dilution effect of the added steam

TABLE 2: Experimental conditions of the steam explosion experiments



Experiment acronym	Temperature (°C)	H_2SO_4 concentration at impregnation (w/w, wet basis)	H_2SO_4 concentration at reaction (w/w, wet basis)[a]
SE120	120 °C	0%	0%
SE120A5	120 °C	5%	1.3%
SE120A10	120 °C	10%	2.9%
SE150	150 °C	0%	0%
SE150A5	150 °C	5%	0.7%
SE150A10	150 °C	10%	1.7%

Table reference: Steam explosion as a fractionation step in biofuel production from microalgae E. Lorente a, ∗, X. Farriol a , J. Salvadó a,b

Since the amount of added steam varied for each experimental condition, the values of acid concentration were experimentally determined considering the amount of acid at impregnation and the total amount of sample collected after the steam explosion treatment. The mass balance before and after the steam explosion treatment was checked by measuring the dry matter content and ash content of the original and exploded samples by means of a thermogravimetric analysis (TGA). For all the experiments, good balance closures (N98%) were obtained.

3.3.4. Lipid extraction

Lipids were extracted from microalgal biomass using two methods: the Bligh and Dyer method which uses a ternary system of chloroform/methanol/water and is the most commonly used method for the quantitative extraction of lipids from microalgae at analytical level ; secondly, n-hexane extraction was performed to evaluate the extraction performance compared to the Bligh and Dyer method. For the Bligh and Dyer method, 20 mL of the microalgal sample was mixed with a 75 mL mixture of chloroform–methanol (1:2 v/v) using a magnetic stirrer at 300 rpm for 10 min. Then 25 mL of chloroform and 25 mL of distilled water were added to form a two phase system. The phases were separated by 5 min centrifugation at 3500 rpm. The chloroform phase was then separated (after carefully transferring the mixture to a separatory funnel) and the solvent was evaporated using a rotary evaporator. Finally, the amount of lipid obtained from each sample was measured after further drying overnight in an oven at 70 °C. The extraction of lipids with n-hexane was performed by mixing 20 mL of sample and 20 mL of n-hexane. The mixture was kept at 40 °C/60 °C and 200 rpm for 4 h, and then centrifuged at 4000 rpm for 10 min. Two different extraction temperatures were tested in order to analyse the influence of this variable. After centrifugation, the mixture partitioned into three fractions: organic phase, aqueous phase and residual solid. The top hexane phase was collected and then it was heated to dryness in the oven (at 70 °C) to enable gravimetric quantification of the lipid extract. Both the Bligh and Dyer and n-hexane extraction methods were performed in duplicate and no significant differences were found between the two measurements.

3.3.5. Carbohydrate analysis

The fresh microalgal samples were subjected to analytical acid hydrolysis in order to determine the total extractable sugars, following a standard procedure (ASTM D1106-84). This method is commonly used with lignocellulosic materials, but has been also previously applied for the analysis of microalgae biomass . In brief, 300 mg of dried algal biomass was subjected to a two-stage sulphuric acid hydrolysis: 1 h at 30 °C in 72% (w/w, wet basis) sulphuric acid in a water bath, followed by 45 min at 120 °C in 4% (w/w, wet basis) sulphuric acid in an autoclave. After hydrolysis, the acid insoluble residues were separated from the hydrolysate using glass fibre filters (pore size b0.2 μm) and an aliquot of the hydrolysate was assayed quantitatively for component sugars by HPLC. Regarding the steam exploded samples, the identification and quantification of the monosaccharides present in solution were achieved by HPLC analysis of the remaining aqueous phase after n-hexane lipid extraction. HPLC analyses were performed with a Biorad Aminex HPX-87H column (300 mm × 7.8 mm) and a refraction index detector. The temperature of the column was maintained at 50 °C and a solution of sulphuric acid 5 mM was used as a mobile phase at a flow rate of 0.5 mL min−1 . Monomeric sugars were identified by comparing their retention times with those of standards and quantification was based on integration of individual peaks in the chromatograms together with the use of a calibration curve prepared with the standards. The determination of total sugar amount was achieved by integration of the sum of all identified peaks present in the HPLC chromatograms.identified peaks present in the HPLC chromatograms.

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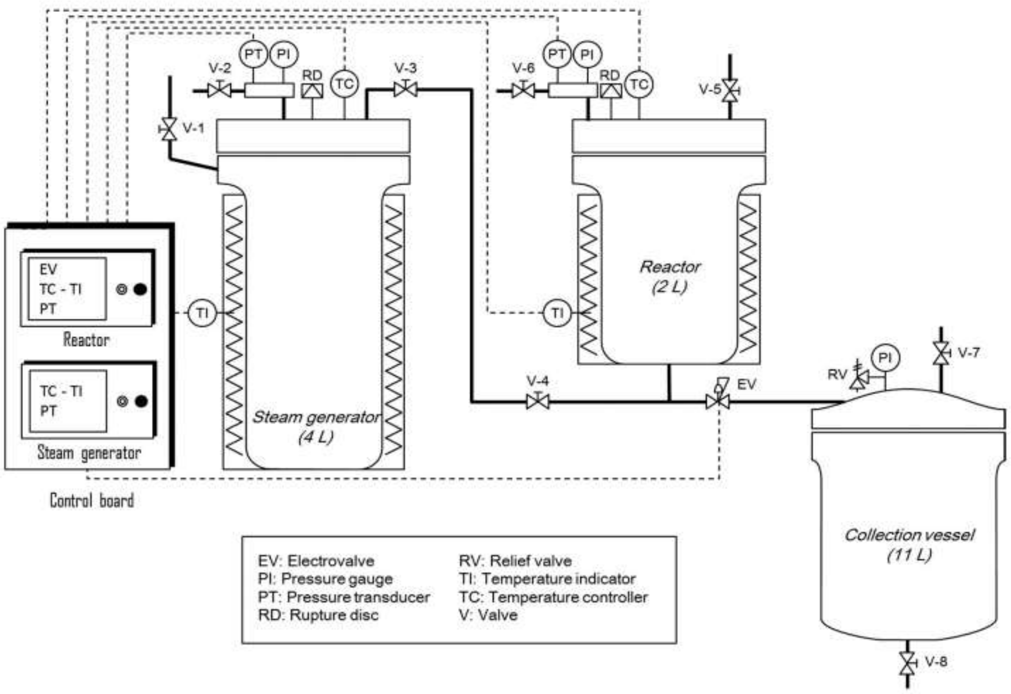

Fig 5:experimental setup of steam explosion method
Fig reference: Steam explosion as a fractionation step in biofuel production from microalgae E. Lorente a, ⁎, X. Farriol a , J. Salvadó a,

4.Bio fuel application in vehicles

The present work employs the GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) code developed by Argonne National Laboratory to examine the lifecycle energy and GHG emissions of various biofuel/vehicle technologies. The details of the model have not elaborated on in this work. In the present model probability-based distribution functions are developed to describe energy use and emissions for individual operations in fuel production and transportation processes, as well as vehicle operations. The CO_2-equivalent GHG emissions are calculated by considering the global warming potentials (GWPs) of three types of GHG emissions, i.e., 1 for CO_2, 23 for CH_4, and 296 for N_2O, which are recommended by the Intergovernmental Panel on Climate Change (IPCC) for the 100-year time span . Fig. 6 shows the scope of a well-to-wheels analysis for biofuel/ vehicle systems. The boundary of the present fuel-cycle model could be divided into two stages, i.e., the biomass-to-tank (BTT) stage and the tank-to-wheels (TTW) stage. The BTT stage starts with the feedstock production (farming, harvesting and transportation) and ends with biofuels available in the fuel tank of vehicles. The TTW stage covers all vehicle-operation activities.

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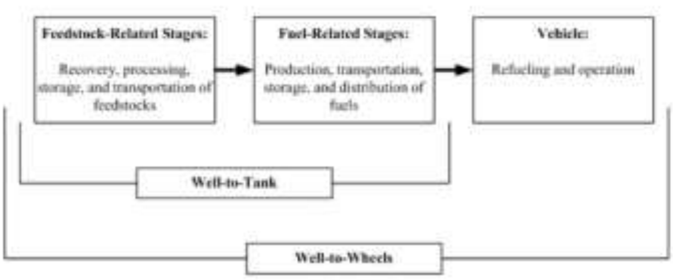


Fig 6: the scope of a well-to-wheels analysis for biofuel/ vehicle systems

Note that the present study considers the operation-related energy and emissions only. That is, the energy and emissions related to operational activities for the fuel process and vehicle are included. Those of infrastructure-related energy consumption and GHG emissions, such as energy and emissions associated with building roads, plants, and plant equipment, are not included for any of the pathways evaluated. There has been a vigorous debate about the extent to which biofuels lead to GHG reductions and about the emissions associated with land-use changes (LUC) caused by biofuel production [68–70]. When biofuel production involves LUC then there may be additional emission impacts, either positive or negative, that must be taken into account in calculating the GHG balance. The land-use change could be: Direct, as when biofuel feedstocks are grown on land that was previously forest; Indirect, when biofuel production displaces the production of other commodities, which are then produced on land converted elsewhere (domestic or foreign land). For biofuels to provide the envisaged emission reductions in the transportation sector, it is essential to avoid large releases of GHG caused by LUCs. However, emissions related to current biofuel production generate only approximately 1% of the total emissions caused by land-use change globally, most of which are produced by changes in land use for food and fodder production, or other reasons.

4.1 Vehicle adaptation to alcohols

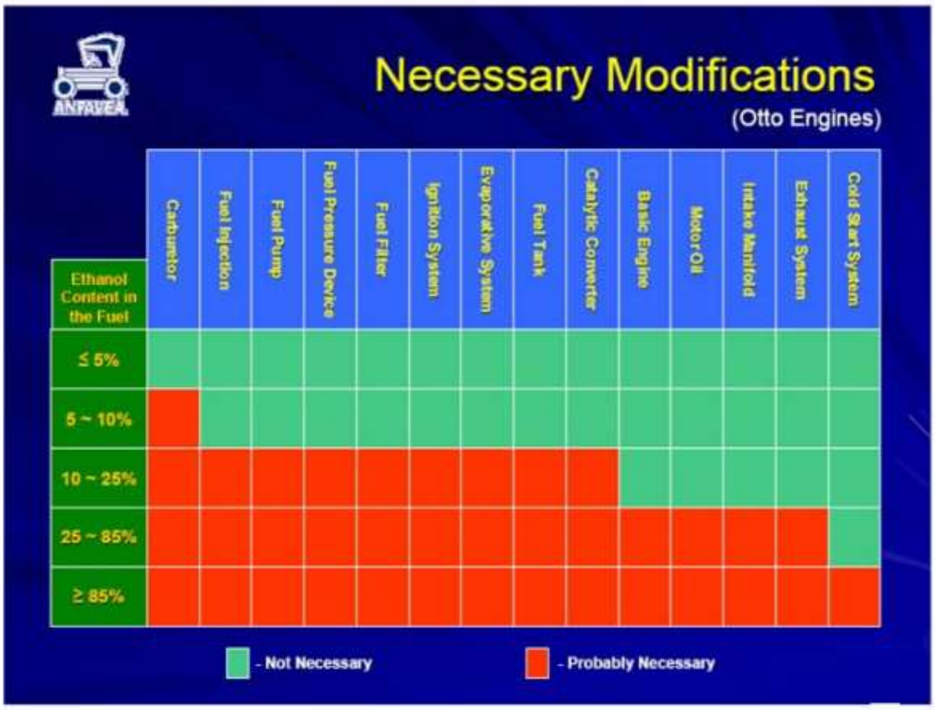
Alcohols (methanol, ethanol) can be used either for blending into gasoline and, with some preconditions, as a fuel itself.

Alcohol is characterized by:

- high octane rating
- oxygen contained in the alcohol enhances combustion to some extent

- heat value 45ñ60% of that of gasoline
- high latent heat of evaporation
- poor lubricity
- increases gasoline vapor pressure when used for low-level blending
- polar compound, may cause corrosion
- modified engines can run on neat or almost neat alcohol.

Ethanol is widely used for blending into gasoline. With ethanol concentrations up to some 10% normally no vehicle modifications are needed. Ethanol is preferred over methanol for better stability and water tolerance, smaller risk of corrosion, and lower toxicity. It is possible that methanol is phased out as a gasoline component. From an engine and an end-use point of view ethers are preferred over alcohols. Ethers have less affinity to water, are less corrosive and have less effect on vapor pressure than alcohols. Diesel-ethanol emulsion fuels have been studied in Brazil, Sweden, and the U.S. In Brazil and the U.S. emulsion fuels have been approved for some special services. Adding ethanol to diesel lowers cetane number, lubricity and fuel stability. These issues can at least partly be addressed by using proper fuel additives. Additives cannot, however, alleviate the issue of flash point; even the addition of a small amount of ethanol lowers the flash point of the fuel so that for safety reasons it has to be treated in the same way as gasoline. This creates major problems in a working environment accustomed to handling diesel fuel (Nylund et al. 2005). therefore, predict that diesel-ethanol emulsions will remain niche fuels. Spark-ignition engines for neat alcohol Alcohols have a long tradition as racing fuels. The cooling effect (high latent heat of evaporation) and high octane rating make it possible to increase engine output compared with gasoline. Gasoline engines can run on neat alcohol under the condition that fuel flow is increased significantly and that cold starting is facilitated. Startability on neat alcohol is poor due to low vapor pressure and high boiling temperature. For general use fuel alcohol is typically blended with 15% gasoline (E85, M85). 81 Electronically controlled fuel systems provide some fuel flexibility, meaning also that the engine can, based on closed-loop feedback, adjust to some variation in fuel composition. True Flexible Fuel Vehicles (FFVs) can operate on any fuel from gasoline up to 85% alcohol. The FFV system is requires a fuel detection system based on either a physical or virtual fuel sensor to determine fuel alcohol concentration. The alcohol fuel also has to be taken into consideration in choosing materials for the fuel system. The added cost for a vehicle manufacturer to produce FFV vehicles is rather limited, especially since fuel detection today can be handled computationally without added hardware. Currently FFV vehicles are common in Brazil, Sweden and the U.S



Necessary Modifications

(Otto Engines)

Ethanol Content in the Fuel	Carburetor	Fuel Injection	Fuel Pump	Fuel Pressure Device	Fuel Filter	Ignition System	Evaporative System	Fuel Tank	Catalytic Converter	Basic Engine	Motor Oil	Intake Manifold	Exhaust System	Cold Start System
≤ 5%	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
5 ~ 10%	🟥	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
10 ~ 25%	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟩	🟩	🟩	🟩	🟩
25 ~ 85%	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟩
≥ 85%	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥	🟥

🟩 - Not Necessary 🟥 - Probably Necessary

Fig 7: Modifications necessary with alcohol fuels

Figure reference: Nils-Olof Nylund, Päivi Aakko-Saksa & Kai Sipilä Status and outlook for biofuels, other alternative fuels and new vehicles

FFV technology provides fuel flexibility at moderate cost, and therefore it can be expected that FFV vehicles will grow in numbers globally. Drawbacks of FFV technology include poor performance at low temperature and incompatibility with fuel direct injection. Using direct fuel injection spray and mixture formation very much depends on fuel properties such as evaporation characteristics, density, and viscosity.

4.2. Alcohols in diesel engines

Alcohols as such are not suitable for diesel combustion, due to low ignition quality. If high-concentration alcohol is going to be used in compression ignition engines either the engine or the fuel has to be modified. In the past, Detroit Diesel manufactured glowplug equipped heavy-duty engines to use methanol or ethanol, but due to many problems the production was discontinued. Ethanol treated with ignition improver and lubricity additive can be used as fuel in conventional diesel engines, although some engine modifications are still needed. Since 1989 the Swedish company Scania has delivered altogether 600 buses for additivetreated ethanol. The engine modifications include increased compression ratio (28:1), a special high-capacity fuel injection system, and a catalyst to control aldehyde emissions . An ignition improver additive significantly increases the cost for running heavy-duty vehicles on ethanol fuels. Thus, it would be desirable to eliminate the need for this additive.

4.3.Vehicle adaptation to esterified biodiesel (FAME)

Conventional biodiesel can be used in diesel engines in the same way as ethanol can be used in spark-ignited engines, i.e., either as a blending component or as a fuel itself. As in the case of ethanol, using neat biodiesel may cause some problems, especially in cold conditions. Using neat FAME might require some modifications to the engine, mainly changes in gaskets, hoses, and elastomers. FAME is a strong solvent, and can dissolve deposits in the fuel systems of old vehicles, causing clogging of fuel filters. One issue regarding FAME that has arisen recently is the incompatibility with vehicles equipped with particle filters. In light-duty applications, the manufacturers periodically use late injection to increase exhaust temperature and facilitate particle filter regeneration. With high boiling FAME, there is a risk for fuel dilution of the engine oil. This again can lead to engine seizures. Some contaminants in FAME, such as phosphorus, can contribute to filter clogging. (VDA 2006) Straight vegetable oil is not suited for conventional high speed diesel engines.

4.4.Vehicle adaptation to synthetic fuels

Synthetic fuels derived from natural gas, biomass, and even coal are high quality fuels, attractive for use in a diesel engine. The FT diesel fuel has no sulfur, almost no aromatics, and a high cetane number. FT diesel provides excellent emission performance with reduced NOx and PM emissions. The FT diesels, GTL, CTL, and BTL may take a leading position on market, depending on e.g., price and technology development. From an end-use point of view synthetic fuels are a convenient option as no engine modifications are needed. FT fuels can be used as a blending component or even as is. In the latter case lubricity additives may be needed. Running on pure FT diesel an engineís power output can be reduced somewhat (5%) due to low fuel density. An engine can be run on 100% synthetic diesel with standard settings, and this will reduce NOx and PM emissions. Alternatively, at least in theory, the engine manufacturer could recalibrate the engine to give improved fuel efficiency at a given emission level. Vegetable oils and animal fats can be converted into a product resembling FT diesel using hydrogenation. Tailored synthetic fuels might be the only option to meet the fuel requirements of future advanced combustion systems .Fischer-Tropsch can also render gasoline components. Little information is available on the performance of FT gasoline.

5.Conclusion

This paper concludes that biofuel has great potential to enhance in many fields mainly in transportation field. Biofuel has the ability to break the dependency in fossil fuel and crude oil. Anyhow bio fuel is easy to obtain and can be reproduceable unlike petrol and diesel. The generation of biofuels is developed and also the use of biofuel also growing.as the primary source started from corn to now micro algae and genital biofuel has developed. Biofuel has more potential to improve in future research as steam explosion is just one of the method there are lots of methods to be found in the field of biofuel.

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