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RECENT STUDIES ON BIO-FUELS: INSIGHTS FOR FUTURE RESEARCH

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Short Profile

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ABSTRACT:
Research on bio-fuels gain momentum as it replaces the use of fossil fuels and in turn claims environmental and economic benefits. Energy crisis made remarkable change in exploration of novel energy and have started taken diverse measures worldwide. Recent studies on bio-fuels mainly focus on discovery of cellulose rich plant sources from non-food crops for generation of carbon neutral bio-fuels. In the recent past, research on bio-fuels mainly address on cost effective production of bio-fuels from various sources with simplified methodologies. This paper discusses latest studies on bio-fuels to comprehend the research directions at present and give insights for future research.

KEYWORDS
Bio-fuels , Future Research , Recent Studies ,claims environmental .

INTRODUCTION:

Finding new energy resources has been the hot topic worldwide. Bio-diesel has received much attention in recent years. Bio-fuels are important because they replace petroleum fuels. On the other hand, use of bio-fuels claimed a number of environmental and economic benefits. They reduce the carbon footprint and the dependence on foreign fuel sources in key economies. Due to energy crisis many countries have started taken diverse measures in order to address the problem. On one hand the demand for energy has been on the increase due to rapid development of industry and on the other hand the sources of energy are depleting. This triggered exploration of various alternative energy sources. In the recent past, many research studies are conducted on bio fuel production. The present article aims to present a snap shot of the recent studies on bio-fuels to comprehend the research directions at present and give insights for future research.

RESEARCH STUDIES ON BIODIESEL:

Dupree (2015) found that the xylan polymer, which comprises about one third of wood, has an unexpected shape inside the plant cell walls. The structure of the xylan was ascertained by creating 2D maps of the molecular structure of the woody stalks of thale cress. Plant cell walls provide the mechanical strength to plants. This major step forward in understanding the molecular architecture of plant cell walls will impact the use of plants for renewable materials, energy and for building construction. In another research study conducted by Hong et al., (2013) suggested that the genetic mutations did create differences in cellulose production and formation. The study also reported that the cellulose produced by the mutated plant could be more efficiently processed into the sugars necessary for bio-fuel production. It is possible to modify cellulose structure by genetic methods, so that potentially one can more easily extract cellulose from plants as energy sources.

Mason et.al., (2014) discovered variant straw plants whose cell walls are more easily broken down to make bio-fuels, but which are not significantly smaller or weaker than regular plants. The discovery could help ease pressure on global food security as bio-fuels from non-food crops become easier and cheaper to make. The impact of carbon emissions on global warming is driving the need for carbon neutral bio-fuels. Many existing bio-fuels are produced from crops which can be used for food, and therefore have a negative impact on global food security. One answer is to make fuels from woody, non-food parts of plants such as straw. These are rich in polysaccharides (sugar chains) which can be broken down into simple sugars and then fermented into ethanol for fuel. According to Scheller et al., (2012), it is possible to obtain plants with reduced amounts of xylan in their walls by preserving the structural integrity of the xylem vessels using xylan engineering system. The xylan engineering system is a great step towards tailored bioenergy crops that can be easily converted into bio-fuels.

Poplars are dense, easy to store and flourish on marginal lands not suitable for food crops, making them a non-competing and sustainable source of bio-fuel. Wilkerson et al., (2014) believed that by designing poplars for deconstruction, the degradability of a very useful biomass product can be improved. The idea to engineer biomass for easier degradation first took shape in the mid-1990s. Attempts were made to reduce energy usage in the paper pulping process by more efficiently removing lignin, the polymer that gives plant cell walls their sturdiness, from trees. If weak bonds could be introduced into lignin, this hardy material could be "unzipped," making it much easier for chemical processes to break it down.

Finding inexpensive ways to remove lignin is one of the largest barriers for production of cost-effective bio-fuels, says Achinivu, et al., (2014). The researchers began by making a number of liquid salts called "protic ionic liquids" or PILs. These PILs are fairly inexpensive to prepare, because they are made by mixing together with an acetic acid and a base. As part of the pretreatment process, one of the PILs is mixed with biomass and then heated and stirred. The lignin dissolves into the PIL, leaving the cellulose behind as a solid. The leftover solid cellulose can be easily processed and filtered from the mixture for use in the next bio-fuel production steps.

Hydrogen is considered one of the most promising fuels for the future. If hydrogen can be produced directly from sunlight we will have a renewable and environmentally friendly energy source. One biological way of producing hydrogen from solar energy is using photosynthetic microorganisms. During photosynthesis, water splits into hydrogen ions (H+) and electrons (e-). An enzyme hydrogenase facilitates the conversion of hydrogen ions into hydrogen gas. Photosynthetic cyanobacteria and green algae usually possess hydrogenase enzyme and capable to use energy from the sun and produce hydrogen through their own metabolism.

Mamedov and Styring (2013), made a discovery that changes the view on hydrogen production from green algae. The researchers studied in detail about operation of Photosystem II in two different strains of the green algae Chlamydomonas reinhardtii. They found that, the activity of Photosystem II varies under different conditions, and thereby affects hydrogen production. Further they confirmed that substantial amount of the solar energy absorbed by Photosystem II goes directly into hydrogen production.

As much as 80 per cent of the electrons that the hydrogen-producing hydrogenases need come from Photosystem II, which is much more than previously believed. This means that most of the hydrogen production is driven directly by solar energy. The discovery gives us hope that it in the future will be possible to control the green algae so that the efficiency becomes significantly higher than it is today (Stenbjörn Styring., et al. 2013).

The components of biomass in higher plants include cellulose, hemicelluloses, lignin, extractives, ash, and other compounds. Cellulose, hemicelluloses and lignin are three major components of a plant biomass material. Cellulose, which is an abundant component in plants and wood, comes in various forms and a large fraction comes from domestic and industrial wastes (Nanbu, et al., 2007).

Production of bio-ethanol from biomass is one way to reduce both consumption of crude oil and environmental pollution. Using bio-ethanol blended gasoline fuel for automobiles can significantly reduce petroleum use and exhaust greenhouse gas emission. Bio-ethanol can be produced from different kinds of raw materials. These raw materials are classified into three categories: simple sugars, starch and lignocelluloses. Bio-ethanol from sugar cane, produced under the appropriate conditions, is essentially a clean fuel and has several clear advantages over petroleum-derived gasoline in reducing greenhouse gas emissions and improving air quality. Conversion technologies for producing bio-ethanol from cellulosic biomass resources such as forest materials, agricultural residues and urban wastes are under development and have not yet been demonstrated commercially (Balat and Balat, 2009).

To ensure that good ethanol is produced, with reference to greenhouse gas (GHG) benefits, the following demands must be met the following: (1) Ethanol plants should only use biomass.(2) Cultivation of annual feedstock crops should be avoided on land rich in carbon.(3) By-products should be utilized efficiently in order to maximize their energy and GHG benefits, and (4) Nitrous oxide emissions should be kept to a minimum by means of efficient fertilization strategies, and the commercial nitrogen fertilizer utilized should be produced in plants which have nitrous oxide gas cleaning (Borjesson, 2009).

Microalgae have high potentials in biodiesel production compared to other oil crops. Many algal species are rich in oils and especially microalgae grow rapidly (Chisti, 2007). Further, the microalgae cultivation does not need much land as compared to that of terrestrial plants. On the other hand, biodiesel produced from microalgae will not compromise the production of food and other products derived from crops.

CONCLUSION:

Increasing the use of bio-fuels for energy generation purposes is of particular interest now-a-days because they allow mitigation of greenhouse gases, provide means of energy independence and may even offer new employment possibilities. Research in genetic engineering coupled with advanced cultivation and downstream technologies will benefit the future development of bio-diesel production. Whereas, developing techniques to modify the structure of plant cellulose in crops for better and easier conversion to fermentable sugars could be transformative in a bio-based economy.

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