

Biofuels for Sustainable Development- Evolution of Different Biofuel Generations

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Abstract

Globalization, industrialization and urbanization have led to the global energy crisis. There is a great demand for non-renewable energy sources to meet the energy needs. This in turn has led to the exhaustion of fossil fuels. Therefore there is an urgent need to rely on alternative energy sources that can be replenished and also ecofriendly. Researchers are now trying to find an alternative solution to replace the consumption of fossil fuels with alternate energy sources. This has led to the evolution of the generation of biofuels. The present study aims to give an overview of the development of the different generations of biofuels for sustainable development in the coming future for global growth. It gives an idea to explore next-generation biofuels to meet our energy needs. Although biofuel is not a 'Green energy', it can be used as a substitute energy source. Good energy policies should also be announced by the governments to implement efficiently and effectively.

Keywords: Fossil fuels, Biomass, Next-generation biofuels

Introduction

Urbanization has led to increased energy demand. Future energy needs therefore should be efficiently and securely improved. The present energy needs met by fossil fuels must be replaced with renewable energy sources. Sustainable energy development is most important these days to meet the energy requirements. Biofuels are one such alternative that can be used as a renewable energy source.

Biofuels are made from biomass, obtained by the biological carbon fixation process and are naturally replenished. It is a very good alternative for fossil fuels used across the world to meet energy needs. They can be used as an alternative to fossil fuels, which are non-renewable and takes millions of years to form and also detrimental to the ecosystem. Renewable energy sources that come under Green energy are considered to be the best because they are eco-friendly and doesn't harm the ecosystem by contributing to acid rain and global warming. Even though Biofuels are considered to be renewable energy sources they don't fall under Green energy because they do produce greenhouse gases to some extent.

The different types of biofuels include ethanol, biodiesel, methanol, and biobutanol which can be used as an alternative to

fossil fuels such as ethane/gasoline, diesel, methane and butane respectively. Since biofuels mainly use agricultural crops and products in the process, it is also called agrofuels. Biodiversity thus plays an important role in biofuel production. Diversified farming helps in bringing control over super pests and also threaten to food crops.

Sustainable energy development has led to the evolution of the generation of biofuels from the first generation to the recent fourth-generation biofuels. This evolution in the generation of biofuels is happening just to meet the energy needs in the coming future which would otherwise become a major challenge. Renewable energy contribution at present is not so high to meet the energy supply and needs. Therefore development in further next-generation biofuels is open to the researchers to come up with new ideas and technologies and this has become a current trend in the present research field. The present paper mainly focuses on these issues giving an overall view on the evolution of the generation of biofuels to make the researcher develop next-generation biofuels.

First-Generation Biofuels

Food crops are the main source used in the production of first-generation biofuels. The most common food crops employed in the process include corn, sugarcane, soybeans, vegetable oil, wheat, sugarbeets and peanuts. Ethanol is one of the major biofuel produced from corn. The United States stands first in the production of ethanol using corn. Sugarcane is another important food crops used in the production of ethanol which is grown as a major crop in Brazil. Brazil has a policy of at least 22% ethanol in its gasoline, though 100% ethanol is available for purchase.

The food crops utilized in the production of first-generation biofuels require large land availability and therefore directly affect the cost of food. An increase in population has also created a demand for both energy and food growth.

Second-Generation Biofuels

They are also called advanced biofuels. The biomass used in this is feedstock and hence food crops are protected. Seed crops, waste vegetable oil, grasses and municipal solid waste are used in the process. The threat to the increase in food prices is solved by the introduction of second-generation biofuels. The biomass used here is readily available and the food chain is not under threat. In this case, even though land availability is not a major issue but poorer quality land is used for this purpose. Hence biofuels produced by his method are not stable. The processing of the biomass before its use also involves elaborative steps.

Third-Generation Biofuels

The biofuels derived from algae are categorized under third-generation biofuels. This includes large scale cultivation of algae used for biofuel production. Algae can be cultivated largely in open ponds, closed-loop systems and even in photobioreactors. This involves low cost and high energy. It is one of the best methods used in biofuel generation compared to the first and second generation of biofuels. The biofuel produced by this method is less stable. Biodiesel, ethanol, gasoline and jet fuel are the biofuels derived from the algae.

Fourth-Generation Biofuels

This makes use of genetically modified algae for biofuel production. Biotechnology comes to the rescue when all the doors are closed. The developments in the field of Biotechnology has led to the use of genetically modified (GM) algae in biofuel production. It helps in improving the productivity of algal strains. The algal biomass required for the production can be supplied to a larger extent. Since GM algae are used in the process certain health and environmental risk involved

in the culturing and production should be associated with stringent regulations. The hazardous water residue leftover after the process must be replaced with appropriate mitigation practices with eco-friendly alternatives. If all these practices are taken care then definitely this can be a very good alternative for fossil fuels. The cost barrier is also one of the issues to be solved in this case because it involves sophisticated innovative practices.

Challenges in the Next Generation of Biofuel Production

The challenges mainly include the cost barrier. Biofuels production relies on the availability of land and also use of the innovative technologies, therefore cost barrier is an important issue to be focused on during the development of biofuels. Developing countries need to decrease the use of conventional fossil fuels. Strict legislation needs to be implemented by the government in this regard. Government policies should be undertaken to protect the environment and climate system. The market policy is another major challenge that needs to be focused on. Since the cost of these biofuels is high, their usage is limited. Therefore good government policies need to be implemented in this regard.

Biofuels are not green energy because they do produce greenhouse gases like carbon dioxide and nitrous oxide, which contribute to global warming. But these greenhouse gases produced are less compared to conventional fossil fuels. Moreover, the carbon dioxide produced is also balanced by the use of plants. Therefore biodiversity conservation and environmental protection policies should be implemented. The development of next-generation biofuels is the biggest challenge and must be developed to meet the future energy demand.

Conclusion

Biofuels are definitely an alternative energy source in the coming years. This need has led the researchers to evolve different generations of biofuels. With the advent of technology, different generations of biofuels have evolved and this needs to be further evolved to obtain sustainable energy development. There is a need to explore next-generation biofuels to meet our energy needs in the coming days. Innovative technology, energy policies and market development are much necessary to take a step forward in this field. Dependence on conventional fossil fuels can be decreased with technology innovation in the field of biofuels generation. Energy production, replacement, transportation and distribution should be planned by implementing good government policies, legislations and mitigation strategies.

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