جامعة المستقبل / الكلية التقنية الهندسية
قسم تقنيات ميكانيك القوى / فرع الطاقة المتجددة
اسم المادة : وقود حيوي / الكورس الاول
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المرحلة : الثالثة
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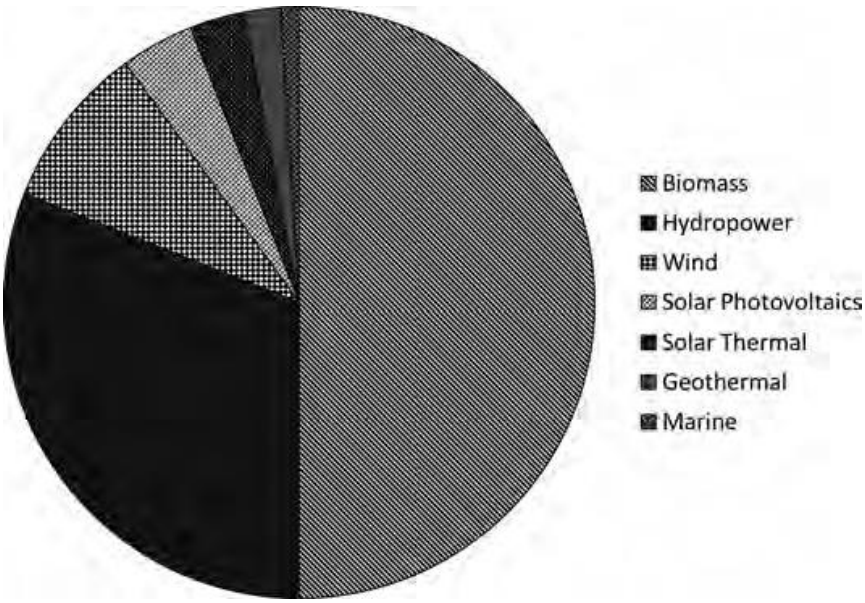
المحاضرة الاولى: مقدمة عن الوقود الحيوي واستخداماته

Introduction

Energy has an inescapable role in the human society because it dictates the technological developments and social progress of a country and, in turn, thus improves the quality of life. With the rapid economic progress and growing world population, the demand for energy is expected to increase exponentially. According to the International Energy Agency (IEA), the world's primary energy demand is expected to grow by 55% between 2005 and 2030, at an average annual rate of 1.8%. At present, the world energy demands are predominantly supplied through fossil fuels such as coal, natural gas, and petrochemical sources. However, these sources are nonrenewable and will be exhausted in less than 100 years as predicted by the World Energy Forum. The increasing energy demands and shortage of fossil fuel production have led to an increase in the costs of the petroleum fuels that jeopardize the economic progress of nations.

Several renewable energy sources have been developed that could replace the conventional fossil fuels. The figure in the following slide is showing the growth of the renewable energy sources till 2017.



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History of biofuels

The emergence of biofuels has endured since the dawn of early civilization. Solid biofuels such as wood, charcoal, cow dung, and so on have been used for cooking and heating purposes for ages. Similarly, liquid biofuels have been used in the automotive industries since its inception. The first internal combustion engine was designed to run on a blend of ethanol and turpentine. The first ever diesel engine, invented by the German scientist Rudolph Diesel, was intended to run using vegetable oil. During the industrial revolution from the mid-1700s through the 1800s, coal began to dominate over biomass as a primary source of energy. Coal-based fuel sources were much cheaper and efficient compared to the biofuels that suffered from serious disadvantages such as tedious conversion technology and high price. Consequently, the increased supply of fossil fuel-based energy sources led to a steep decrease in biofuel production and its usage. Incidentally, during World War I, the shortage in petroleum fuels brought back the demand for bioethanol. In addition, the severe oil crisis in the 1970s prompted renewed interest in biofuels as alternate sources of fuel. Countries like the United States and Brazil started large-scale production of bioethanol and biodiesel for use as transportation fuels. Most of these fuels were produced using food-based crops (first-generation biofuels) such as sugarcane, corn, oil palm, and so on. However, the shift in arable land usage for fuel crops led to a shortage in food resources and increase in food crop prices. Over the past few decades, various efforts have utilized alternate feedstocks to improve the biofuel production technologies to provide a sustainable solution to world energy issues, climate change, and high oil prices.

Biofuel type

Biofuels are developed and utilized in three major forms: solid biofuels such as wood, charcoal, and so on; liquid biofuels such as bioethanol, biodiesel, and so on; and gaseous biofuels such as biogas, biohydrogen, biohythane, and so on. Feedstocks, depending on their nature, can be classified into first-, second-, third-, and fourth-generation biofuels.

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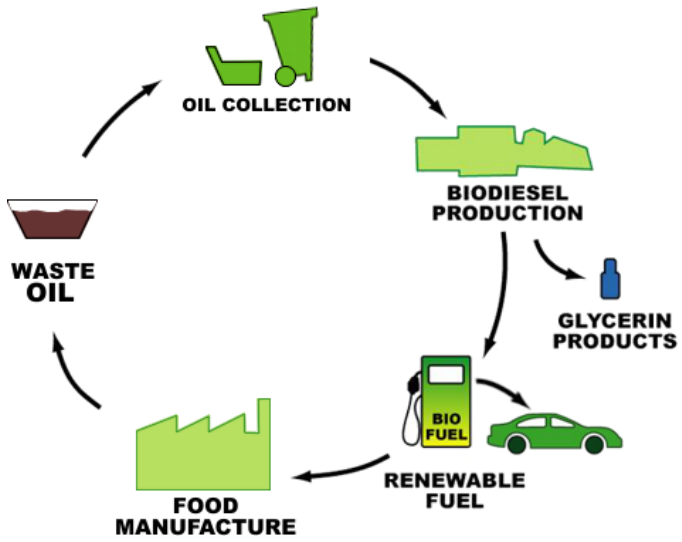

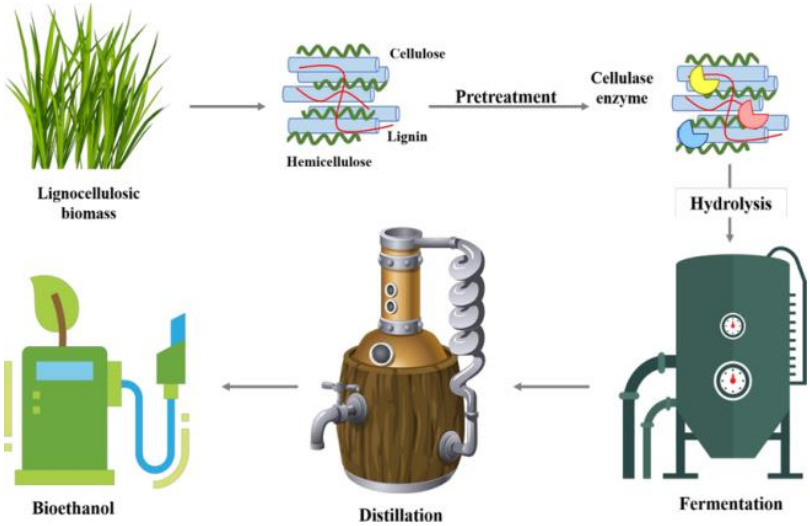

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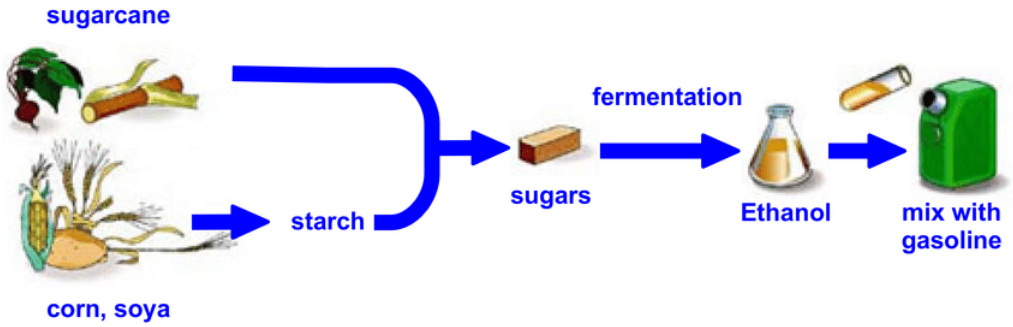
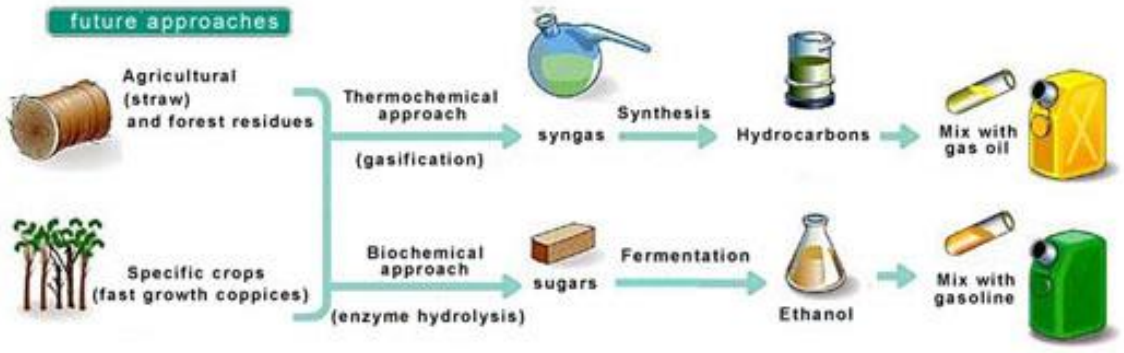
The first-generation biofuels

The first-generation biofuels are produced using sugar, starch, or vegetable oil. They predominately include food crops such as sugarcane, corn, soybean, oil palm, and so on. If used in large quantities, these feedstocks can have a detrimental impact on food supply. At present, the first-generation biofuels are the only fuels that are produced commercially.



The second-generation biofuels

The second-generation biofuels are considered greener as compared to the first-generation biofuels because they are produced using non-food crops such as agricultural and forestry wastes, industrial wastes, municipal wastes, and so on. Currently, these fuels are tested only in the laboratory and their availability and complex conversion technologies limit their practical feasibility.



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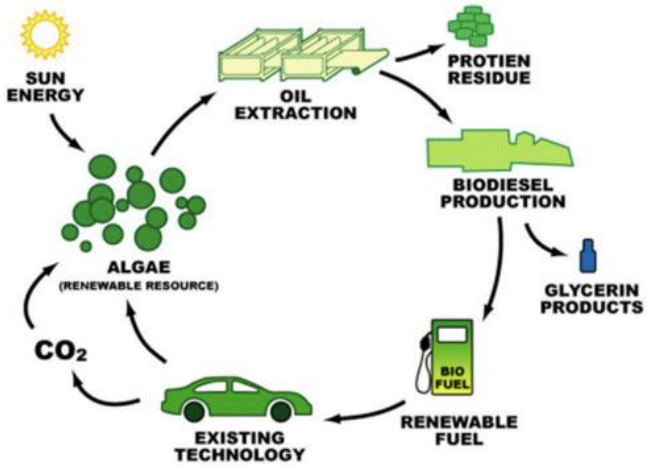
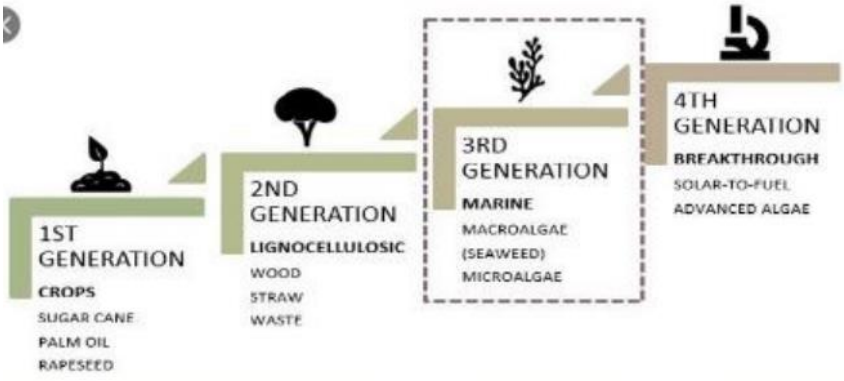
The third-generation biofuel

The third-generation biofuels refers to the biofuels derived from microbial sources. The most commonly used third-generation biofuels are algae, which have shown immense potential for biofuel production with higher yields and lower resource inputs. However, despite numerous advantages, there are several technical barriers for implementation of this technology on a commercial scale.



The fourth-generation biofuel

The fourth-generation biofuels correspond to the genetically modified biofuel and hosts that are currently being developed using metabolic engineering and synthetic biology tools to enhance the overall biofuel yields



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