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Review Article

A Systematic Review On Production Of Bio-Ethanol From Waste Fruits And Peels

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ABSTRACT

Renewable energy is now capturing a headline because of concerns about supplies of fossil fuels, escalating population and industrialization triggering ever-increasing demand of fuels. All over the world, governments have encouraged the use of alternative sources of energy for overcome energy crisis. The high price of crude oil (Fuel) has attracted the greater attention to bio-fuels, especially ethanol. Fruits wastes from food processing plants (such as natural juices, jams, jellies, etc.) are generated in large amounts, these wastes present a tremendous pollution especially in Egypt and developing countries. Worldwide, these wastes are often simply dumped into landfills and ocean or used as animal feed. The recovery of food processing wastes as renewable energy sources represents a sustainable option for the substitution of fossil energy in order to decrease expected environmental damages like global warming and acid rain. Fruits wastes have high levels of sugars, including sucrose, glucose, and fructose, that can be transformed to bio-ethanol through four processes of pre-treatment, enzymatic hydrolysis, fermentation and distillation.

INTRODUCTION

Due to their nature and composition, fruits and vegetables are more likely to decay than grains. This deterioration happens during the harvesting, transportation, storage, marketing, and processing stages, creating waste. Fruit wastes with a high reducing sugar content make for intriguing feed-stocks for the first generation of bio-ethanol production [1]. Ethanol, often known as ethyl alcohol, is an alcoholic molecule that has lately come under consideration as a renewable bio-energy source. It is a clear, colorless liquid that degrades biodegradability, a potential eco-friendly fuel for automotive engines, and a potential replacement for petrol in road transport vehicles[2].The need for fuel is rising daily as a

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result of industrialization and population growth[3].Several inexpensive agricultural raw materials, such as potato and banana wastes, molasses, and food grain wastes, can be used to produce ethanol.[4]This method of producing goods from plant wastes provides a response to the current global issues with the environment, the economy, and energy. Therefore, a thorough examination of the generation of bio-ethanol from plant sources is urgently required. Major traditional agricultural crops used to produce bio-ethanol include maize, sugarcane, and sugar beets. However, because these crops are primarily grown for food and feed, they cannot meet the need for bio-ethanol production worldwide [5]. A sustainable and renewable liquid fuel, bio-ethanol is anticipated to play a significant role in addressing the current global energy problem and the deteriorating state of the environment. Global bio-ethanol output was estimated to reach more than 100 billion liters in 2011 and was projected to grow at a rate of 3–7% per year between 2012 and 2015. This indicates that bio-ethanol is already seen as a desirable alternative energy source to replace fossil fuels. The ASTM D4806 standard specifies the quality standards of bio-ethanol for spark-ignited engines, including what bio-ethanol can replace or combine with petrol. It is possible to convert biomass into ethanol using a variety of microbes, including yeasts [6]. The increased energy demand in households, businesses, transportation, and agriculture demands the quick utilization of bio-energy sources. It is anticipated that the amount of renewable energy derived from biomass will increase consistently from 50 EJ/year in 2012 to over 160 EJ/year by 2050 [7]. The primary cost components in the manufacture of bio-ethanol are the raw material and the energy requirement [8].

HISTORY OF ETHANOL PRODUCTION:

Ethanol was first used to power an engine in 1826, according to the Energy Information Agency. Nicolaus Otto, the creator of the modern four-cycle internal combustion engine, also used ethanol to power an early engine in 1876. In the 1850s, ethanol was also utilized as a fuel for lighting. In the 1920s and 1930s, ethanol was first mixed with petrol to increase octane. Due to fuel shortages during World War II, ethanol was in high demand. When ethanol prices dropped in the early 1980s along with those of crude oil and petrol, state and federal subsidies for the fuel helped to maintain production of the fuel. This also contributed to the development of the "Minnesota Model" for ethanol production, whereby farmers started making ethanol to increase the value of their corn [9].

ADVANTAGES OF ETHANOL PRODUCTION FROM WASTE FRUITS AND PEELS:

1. **Substitution of fossil fuels:**

This could lessen the negative effects of global warming and pollution of the air, land, and water. Our planet urgently needs bio-fuel to replace oil in the future as fossil fuels are about to run out [10].

2. **Productive waste conversion:**

This method would benefit all parties involved, from farmers to business owners. It may be possible to grow appropriate non-feedstock energy crops on barren land [10].

3. **Use bio-ethanol additives to improve the composition of traditional fossil fuels:**

In unleaded petrol, bio-ethanol replaces methyl tertio butyl ether (MTBE) as an octane enhancer. Additionally, it functions as an oxygenated compound to enhance air quality and clean up petrol combustion [10].

4. **Use as an alternative fuel:**

Using bio-ethanol as an alternative fuel lowers CO_2 emissions, lowers the chance of climate change, and replaces some of the oil with renewable energy sources [10].

5. **Reliable and affordable processing techniques:**

Yeast fermentation is a widely used method for producing bio-ethanol, requiring only basic experimental instruments and techniques [2].

6. **Create an integrated bio-ethanol design plant with multiple value-added byproducts:**

A thriving biomass market has the potential to offset these costs associated with producing bio-ethanol fuel. Working lands' economic viability provides a strong motivation to assist in protecting farms and forests from the growing threat of urban and suburban sprawl [2].

SOURCES:

1. **Bio-ethanol derived from feedstock:**

The world's energy resources are gradually running out, mostly due to the use of nonrenewable fuels. Energy consumption is increasing at the same time. Furthermore, the extensive use of fossil fuels has increased the production of harmful gases that are released into the atmosphere, altering the Earth's climate. Utilizing renewable energy sources, such as energy crops and lignocellulosic residues, is essential to solving this issue [11]. The production of food and feed is at odds with the use of edible agricultural crops only for the production of bio-fuel. A common, naturally occurring carrying carbohydrate that is present in a wide variety of plants and plant parts is sucrose. The molecule is a combination of the monosaccharide’s fructose and glucose, which are disaccharides. The primary sucrose-containing feedstocks for the production of bioethanol are sugarcane, sugar beetroot, and sweet sorghum. Their respective feedstock yields range from 62 to 74 tones/ha1, 54 to 111 tones/ha1, and 50 to 62 tones/ha1, and they are primarily harvested in Brazil, India, France, and Germany [12]

2. **Sugarcane production:**

Sugarcane (Saccharum officinarum) is the primary feedstock used to produce ethanol, either as cane juice or molasses. It is indigenous to South Asia's warm temperate to tropical regions. Ethanol is produced from a forage crop that is economically significant. Rum, bagasse, and molasses are some of its key products. In contrast to energy, which can be made up of 43% cellulose, 24% hemicellulose, and 22% lignin, sugarcane molasses is made up of 9.8% fermentable sugars, 42% cellulose, 25% hemicellulose, and 20% lignin. Following the removal of juice from the stalks, a sizable amount of sugarcane bagasse is left behind. One tons of sugarcane can yield anywhere from 25 to 300 kg of bagasse [13]. Because of its comparatively low ash content (4.8%), bagasse also has a lot to offer when using microorganisms in the bio conversion process [14]. The microbe that is most frequently used. Because Saccharomyces cerevisiae can hydrolyze cane sugar into glucose and fructose, which are readily assimilated hexoses, it is a useful enzyme. Zymomonasmobilis is the most promising bacterium; its low energy efficiency yields a higher ethanol yield (up to 97% of theoretical maximum). But its range of fermentable substrates—glucose, fructose, and sucrose—is too limited.

3**. Using wheat straw for production:**

A common agricultural residue with little market value is wheat straw. The production of bioethanol from wheat straw presents an appealing substitute. Nevertheless, commercialization of the process is hindered by the excessively high production costs associated with current technology. More efficient pre-treatment and hydrolysis techniques have been developed in recent years, increasing the yield of sugars [15].

4. **Turning lignocellulose into bioethanol:**

Wood, agricultural waste, and forest residue are examples of lignocellulose materials that can be used to produce ethanol, which has the potential to be a useful replacement or addition to petrol. Three primary components make up lignocellulose: cellulose, hemicellulose, and lignin. The first two are made up of chains of sugar molecules. It is possible to hydrolyze these chains to create monomeric sugars, some of which can be fermented with regular baker's yeast [16]. There are several methods for turning lignocellulose materials into ethanol. All procedures involve the same primary elements: fermentation, product recovery, distillation, hydrolysis of hemicellulose and cellulose to monomer sugar. Regardless of the hydrolysis technique employed, some processes are essentially the same. Enzyme production, for instance, will not be included [16].

PROPERTIES OF ETHANOL:

Density, API gravity, viscosity, cloud point, flash and fire points, heat of combustion, and distillation are some of the fuel's many characteristics. To determine the properties of fuel, a variety of devices are used. Compared to petrol, bio-ethanol has a higher-octane number, wider flammability limits, a faster flame, and higher heats of vaporization. These characteristics enable an IC engine to have a higher compression ratio, a shorter burn time, and a learner burn engine [17]

APPLICATIONS:

Humanity has been aware of ethanol, or alcohol, for over 2,000 years. Alcohol has seen a great deal of use in the last few centuries.

1. The most significant market for premium fermentation alcohol is the spirits industry. It is sold to spirits producers at 96% strength, and after processing, it is bottled at 43% strength.
2. In place of petrol, ethanol is used as a transportation fuel.
3. In a cogeneration system, as fuel for thermal combustion that produces electricity.

EVALUATION:

1. **Qualitative Bio-Ethanol Estimation:**

The production of bioethanol was assessed using the Jones reagent (K2Cr2O7+H2SO4). Following incubation, 1 ml of K2Cr2O7, 5 ml of H2SO4, and 3 ml of sample were added. According to a report, ethanol turned blue-green when it oxidized to acetic acid in the presence of excess potassium dichromate and sulfuric acid. The presence of green color shows that bioethanol could be produced by using a carbon source[18].

2. **Quantitative Assessment of Ethanol Production:**

After four days of fermentation, 10 milliliters of the sample were taken out with a sterile glass pipette in order to measure the specific gravity and, as a result, determine the percentage of alcohol. The percentage of ethanol can be approximated by calculating it using the specific gravity method [18].

CONCLUSION

A popular green fuel alternative is the production of ethanol from fruit waste. Sustainability of the environment depends on this green production. By maximizing the process variables for enzymatic hydrolysis and fermentation—such as time, temperature, and pH—these environmentally friendly methods can be made more profitable. Determining the most effective yeast for increasing the yield from the production of bioethanol based on fermentation techniques is also crucial. Since it is difficult for researchers in developing nations to obtain enzymes, hydrolysis must be carried out using a different method.

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