

Green Chemistry Approaches to Renewable Energy

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Abstract - Green chemistry is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. It is not a new branch of science. It is a new philosophical approach that through application and extension of the principles of green chemistry can contribute sustainable development. Green chemistry is essential in developing the alternatives for energy generation (hydrogen cell, fuels cells, biofuels, etc.). As well as continue the path toward energy efficiency with catalysis and product at the forefront. By the help of green chemistry the approaches towards the renewable resources can be made increasingly viable technologically and economically. There is a wide range of renewable feed stocks including trees, grasses, shrubs, marine resources wastes which is used for developing new, sustainable, low environmental impact routes to important chemical products, and biofuels. Renewable resources are used whenever possible at the end of their use, non-biodegradable materials are recycled. Using the environment technology we can conserve the natural environment and curb the negative impacts of human involvement.

Key Words: Renewable energy sources, Feed stocks, Green Chemistry, Bio products.

1. What is Renewable Energy?

Renewable Energy is energy which comes from natural resources such sunlight, wind, rain, tides, and geothermal, heat, which are renewable (natural replenished). [1][2][3][4]



Fig-1: Recycle source

1.1 What is Green Chemistry?

Green Chemistry is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. [5]



**GREEN
CHEMISTRY**



Fig - 2: Green Chemistry

1.2 Green Chemistry approaches to renewable energy?

- * Because of the increasing demand, green chemistry is having an impact on renewable energy. There is a symbiotic relationship between green chemistry and renewable energy.
- * The utilisation of hazardous substances in the design, manufacture and application of chemical products bring new environmental problems and harmful unexpected side effects, which result in the need for practicing green chemistry.
- * However, many chemistry and materials science researchers are still uninformed/unaware about green chemistry principles and application in the developing technologies for the renewable energy sector. [5][6][7]

2. Twelve Principles of Green Chemistry

- i. Prevent waste
- ii. Maximize atom economy
- iii. Less hazardous chemical synthesis
- iv. Safer chemicals and products
- v. Safer solvents and reaction conditions
- vi. Increase energy efficiency
- vii. Use renewable feed stocks
- viii. Avoid chemical derivatives (protecting groups)
- ix. Use catalysts
- x. Design chemicals and products to degrade after use
- xi. Analyze in real time to prevent pollution
- xii. Minimize potential for accidents [8][9][10]

Generally the feedstocks of renewable energy are classified into various components as in mainly three:

- a) Bio-Diesel
- b) Green Algae
- c) Bio-Fertilizer

(Figure – 3)

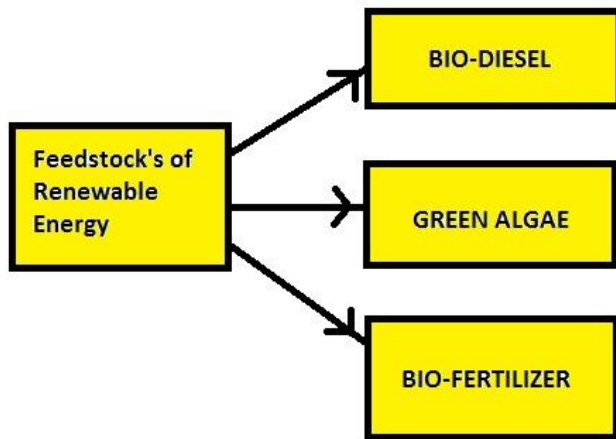


Fig. 3: Feedstock's of Renewable Energy.

2.1 Renewable Vs. Non-Renewable Energy

Renewable Energy	Non-Renewable Energy
-Unlimited stock	-Limited stock
-Less pollution	-More pollution
-Easily available	-Not easily available
-Air, water, solar-energy, wind energy, geothermal energy, etc.	-Petroleum products (petrol, diesel, kerosene, naphtha), coal, fossil fuel.

2.2 Energy from Renewable Source

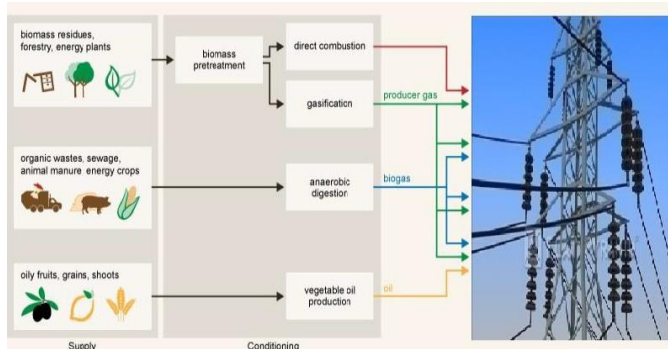


Fig.4: Different types of energy released from Renewable Source.

3. Why to approach Green Chemistry & Renewable Source?

- ❖ Green Chemistry is undeniably a very prominent part of our daily lives.

- ❖ Chemical developments also bring new environmental problems and harmful unexpected side effects, which result in the need for 'greener' chemical products.
- ❖ A famous example is the pesticide DDT.
- ❖ Green chemistry looks at pollution prevention on the molecular scale and is an extremely important area of Chemistry in our world today and the implications it can show on our environment.
- ❖ The Green Chemistry program supports the invention of more environmentally friendly chemical processes which reduce or even eliminate the generation of hazardous substances.
- ❖ This program works very closely with the twelve principles of Green Chemistry.[9][10][11]

3.1 What are the advantages of Bio-Diesel ?

- Reduces carbon monoxide, sulphur dioxide, and other harmful emissions that hurt the environment.
- Naturally oxygenated meaning it carries more molecules of clean burning hydrogen and oxygen and fewer carbon atoms.
- Thinner than regular diesel and serves as a better lubricant thus, increasing engine life.

Fig. 5: Examples of Bio-Diesel.

BIODIESEL

3.2 What are the advantages of Green Algae?

- Extracts can be used as livestock feed and even processed into ethanol.
- High levels of polyunsaturated in algae biodiesel are suitable for cold weather climates.
- Grows practically anywhere. Can reduce carbon emissions based on where it's grown.



Fig. 6: A piece of Green Algae.

4. What are the advantages of Bio- Fertilizer?

- * Bio-fertilizers are cost-effective relative to chemical fertilizers. They have lower manufacturing costs, especially regarding nitrogen and phosphorus use.
- * It is environmentally friendly in that it not only prevents damaging the natural source but also helps to some extent cleanse the plant from precipitated chemical fertilizers.

5. CONCLUSIONS

An understanding of the business value to be gained from efficient use of natural resources is an important first step toward sustainability: toward building a world in which resources are managed to meet the needs of all people now and in the future.

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