**Biological sources as an Ingenious Renewables**

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**ABSTRACT**

Due to continuous increase in the emission of green house gases, climate change, the need is to switch to some sustainable alternative sources which not only causes substantial reduction in global warming but also is cost effective and helps in conserving the fossil fuel reserves which are near to depletion. Biological sources contribute in generation of clean and green energy and the various options for generating the same have been discussed like animal bio-waste in the form of fish scales from fish markets act as a potent source of green energy. The use of the renewables should be encouraged for sustainable and secure future.

**Keywords**: Renewable energy, biofuels, biological sources.

1. **INTRODUCTION**

 The growing global population leads to urbanization which further leads to increase in the energy demand. Fossil fuels are considered as a primary energy sources but at the same time the immoderate use of these fossil fuels results in maximum pollution throughout the world which directly-indirectly hampers the climate, biodiversity of earth, human health [1] and this cannot be ignored. The need of the hour is to mitigate this situation and look for some strategies for using renewable sources of energy in best possible ways and finding the sustainable alternative sources also.

 Renewable energy as we all know is that energy from the natural resources which is replenished constantly like sunlight, wind, water, geothermal etc. The renewable energy eases our life by giving us electricity, transportation, heating, cooling etc. The sources of natural renewable energy are very limited so throughout the world the focus is on to find a suitable, easily available, clean and green sources. The more the usage of renewables we encourage, more this helps in combating the green house gases emission and making the environment apt for survival.

1. **VARIOUS ALTERNATIVES FOR GREEN ENERGY**

The main emphasis here is to compile the various options by which the biological sources specifically animals help us to generate renewable energy. The few alternatives are summarized as under:

1. **Draught Animals**: Earlier draught animals were consider only for ploughing and harvesting purposes in the agriculture but due to mechanization in the agriculture the use of these animals was reduced. Even today in rural areas of many countries the power of draught animals has been used for various purposes like transportation, to pump water and so on. Findings from the researchers have proved that the draught animal power (DAP) can be used to generate electricity at a very low running cost[2]. Scientists also studied that electric generation system powered by animals for home lighting etc[3].
2. **Animal Bio-waste**: Waste material from animals in the form of faecal matter, waste from the slaughterhouses, carcasses etc. constitute the animal bio-waste. The continuous search for the alternative source of renewable energy motivate us to delve into every possible option.

 **Livestock waste**:

 Livestock waste is not only used as manure but it is used for the production of Biogas with the help of anaerobic digestion method as well as for the production of electricity[4]. The production of biogas is the best practical way to basically recycle the waste. Research also showed the potential of biogas to produced green electricity[5].

 Along with that another benefit of animal bio waste is the production of Bio-fuels which further helps in reducing the burden on fossil fuels. This can be achieved either by the use of some biological agents like anaerobic and photosynthetic microorganisms, algae etc or by the use of thermochemical treatment like gasification and pyrolysis for the production of liquid or gaseous fuels on the animals waste[6]. The use of biofuels helps in reducing the green house gases and hence reducing the burden on the environment[7].

**Farm animal bio waste**:

 Different animal bio-wastes like the chicken and feathers of birds from poultry slaughterhouse can also be used for the production of biofuels[8]. Even the microorganisms present in intestines of animals can lead to the production of biofuel as in the case of *Clostridium* bacteria which is present in faecal matter of Zebra helps in production of butanol fuel[8].

**Fish Scales**:

 Another animal source which is abundantly available in fish markets as waste, showing promising results in generating green energy is Fish scales. The waste fish scales and wool contains high amount of proteins which help in forming electrochemical cell that can be used to charge the batteries[9]. Recent research showed the electricity generation potential of Rohu fish scales by Triboelectric nanogenerators. And the electricity produced with the help of fish in the above experiment lights upto 90 green LEDs[10] which again is a remarkable achievement in the field of finding a great alternative energy source. Moreover, the incredible use fish scales for making implantable medical devices to replace pacemakers (bio piazoelctric nanogenerators) has also been investigated. The formation of bioplastics from the fish scales for packaging has also reduces the environment pollution. Its main advantage is that it can decomposed very easily and has reduce burden on fossil fuels[11] .

1. **Energy from Insects**: Honeybees not only give us honey and act as pollinator but various bee hive products are also the gift to humans by the generous bees. These valuable bee products have many nutritional as well as medicinal values. The latest research has unraveled that the swarm of honeybees can results in the production of electric charge of 100 to 1000 volts per meter which is higher than the thunderstorm[12]. Study also explored the possibilities of using kinetic energy of bees in the bee hive to generate electricity[13]. Recent research proved that fat stored in the body of insects (which feeds on waste) can be utilized in the production of bio fuels like bio diesel, biofertilizers[14,15].
2. **CONCLUSION**

 All the above discussed alternative sources are easily available in large quantities and are cost effective with causing minimum environmental damage. If we are able to harness the power of these alternative sources, we can reduce the pollution burden and can make the earth a sustainable planet.

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