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Biological Aspects Of Renewable Energy

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ABSTRACT

Biomass energy plays vast and growing role in the global energy system. Energy from biomass makes significant contribution to reducing carbon emission especially from difficult to decarbonize sector like heavy transport and manufacturing but land incentive bioenergy often entails substantial carbon emission from land use change as well as production, harvesting and transportation green hydrogen is a clean versatile fuel that can be produced directly photo biologically or bio inspired devices and indirectly such as fermentation and electrical hydrolysis

The biomass is a major energy source before the discovery of fossil fuels and biomass is naturally and widely available and most significantly it is carbon neutral energy. Government of India identified an emerging challenges from climate change and growing demand of renewable energy promoting the generation of renewable energy to mitigate the challenges and reduction of carbon emission

Key words biomass biofuels climate change land photosynthesis hydrogen

Introduction

Population explosion and growing industrialization put pressure on energy demand and supply similarly an increasing price and shortage of oils and volatility of oil prices disturbed the socio economic operations of dependent developed and developing countries created strong interest in renewable energy security, Carbon emission, climate change concern drive has increased the need of renewable energy and its wide use and consumptions all forms of renewable energy arise from three main sources the light of the Sun, the heat of the Earth crust and gravitational attraction of the Moon and the Sun.

The solar energy trapped by green plants vegetation algae and bacteria to the photosynthetic process and creates biomass as a stored energy like Protein fats and cellulose which can be converted in to ethanol, methane and hydrogen

Coal Natural gas and petroleum consumption emits huge amount of carbon in to atmosphere near about 1.6billion tons of carbon per year worldwide which is big climate concern so alternative renewable energy sources are nuclear electric power and hydroelectric power and biomass energy. The potential of biomass energy is much larger although production of biomass energy some amount of CO₂ emitted to the atmosphere. The biomass can be converted in to ethanol methanol and hydrogen by using effective biological systems to produce large amount of bio fuels and might be full fill the needs of economic energy fuels to people

Source of biomass - It refers to material made from cell tissues of organisms plants and algae it is a sustainable option of usually comes from the waste material such as mill saw dust ,paper mill sludge, yard waste ,sugar mill husk and rice mill husk livestock manure and forest residue crop waste etc.

Biomass is a carbon neutral energy source because it does not adds new carbon in the atmosphere each type of biomass must be evaluated for its environmental and social impacts if it is really advancing sustainability and environmental impacts moreover considerable care is needed in determining what is waste biomass-1

Municipal Waste:- It is commonly known as garbage by decaying and processing methane gas can be produced and waste processing can solve two problems first disposal of waste and second production of renewable energy however environmental impacts are similar to coal plants air pollution and ash generation etc. while fuel source is less standardize than coal fuels and the MSW contains many toxic and hazardous materials that should be removed properly before using in processing plant.

Landfill gas or Biogas:- It is manmade biogenic gas the methane is produced from biological processing of sewage treatment plant and anaerobic composting and livestock manure management system. Consumption of methane is safe and economic in use and it emits lesser amount of CO₂.

Dedicated biomass for energy –The sustainability and prospects for ecosystems managed for energy production are quite different for herbaceous crops forest plantations and naturally regenerating forests across all these systems can be challenging to operate in mode that truly climate beneficial and how much land intensive bioenergy would be sustainably produced (creutzig et. al 2015).

Complete account of greenhouse gas - GHG emission from bioenergy can come from four factors they are (a) emission from production harvest transport and processing (b) the carbon debt from converting any ecosystem in to bioenergy production (c) the payback period for managed bioenergy to return to pre harvest carbon stocks (d) loss of counterfactual sink that occurred in absence of harvest-10.

Bio hydrogen:-Since fossil fuels readily produce inexpensive hydrogen and emits CO₂ in atmosphere while bio hydrogen is low carbon technology and low cost renewable energy. Photo biosynthetic hydrogen or algal bio hydrogen approach is a relatively good option may include artificial photosynthesis and biomass based gasification.

German biologist have adapted an efficient approach to produce bio hydrogen by a device work in three steps are the first step - Green algae produce carbohydrates by photosynthesis Second step – Carbohydrates piped in a reactor of lactic acid bacteria that converts the sugar to Lactic acid Third step- Lactic acid routed to a fermentation containing Purple bacteria where it is used as substrate for hydrogen production in the system all of the hydrogen atoms of lactic acid can be converted in to hydrogen gas-7.

Photo catalytic production of hydrogen – bio hydrogen is a embodied energy exist in the green algae and cyanobacteria and clostridium etc. The photosynthetic machinery is located in a thylakoid membrane of the chloroplast the machinery consist of populations of two type of light absorbing complexes photosystem- I and photosystem-II with their light harvesting complexes LHC-I and LHC-II respectively as well as population of

cytochrome b6f ATP synthases and electron transport system it may be feasible to genetically engineered photosynthetic organisms to produce hydrogen directly-5.

We have known that green algae that can produce hydrogen from water Hydrogenase catalyze the reaction hydrogen ion plus Ferredoxin-1 yields gaseous hydrogen plus ferredoxin0. The hydrogen ions and electrons are intermediates for photosynthesis process however under anaerobic conditions hydrogenase which is oxygen sensitive enzyme become induced and catalyzes convert the protons and electrons in to hydrogen-8.

Biological reactions that yield potential fuels

Representative organisms	Net reaction	Bio fuels
1 Sugar	ethanol + CO ₂	= ethanol
2 Methanococcusjannaschii	-- hydrogen + CO ₂	= methane
3 Clostridium burtyricum	-- sugar + water	= hydrogen + acetic acid
4 Methanosarcina	-- acetic acid	= methane
5 Purpule bacteria	-- lactic acid +water	= methane
6 Cyanobacteria and green algae	-- hydrogen +hydrogen ferredoxin1	= Hydrogen

Long-term prospects for land incentive bioenergy- Bioenergy is a significant part of the energy economy accounting 9.5% of total energy supply and some 70% of renewable energy more than half bioenergy involves traditional use of biomass while there is considerable scope for improving sustainability and efficiency the use of biomass-3.The use of renewable energy can address the issues of climate change with huge potentials of carbon captured and storage (CCS) the bioenergy plays a significant role because of three reasons first bioenergy can meet needs for base load electrical power it is important as existing fossil fuel based thermal capacity is retired-2 second the shipping and aviation requires fuels with high energy density and bio fuels can meet this criteria with low cost .Third bioenergy captured carbon can provide carbon negative energy source and use of negative emission technologies can reduce the carbon emission -9.

Bioenergy in current contest - The traditional and modern bioenergy share is 9.5% of primary energy supply both the amount and percentage of bioenergy are poised to grow significantly over coming decades.(international energy agency 2019).

Analytical structure to study the relationship between biological energy and security

1. Energy system as object exposed to security threats – security of supply Critical infrastructure protection and resource availability and demand matching.

Security of demand – protection of market share and stable cash inflow.

2. Energy system as subject enhancing insecurity –Economic and political risk factors are struggle for scar resources and resource cruse similarly technological risk factors are dam safety fuel tankers and gas transport and environmental risk factors are climate change pollution and threat to biodiversity.

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