ISSN No:-2456-2165

Implications of Green Technology for Climate Change Mitigation Minimizing Waste and Pollution

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Abstract:- Climate change is the long-term alteration of temperature and weather patterns. Natural factors like variations in the solar cycle as well as human activity, particularly the burning of fossil fuels like coal, oil, and gas, may be to blame for these shifts. The main greenhouse gases that cause climate change are carbon dioxide, CFCs, and methane. Energy, industry, transportation, buildings, agriculture, and land use are the main emitters. The globe has warmed by about 1.1°C since the late 1800s, according to the discovery. The warmest decade on record occurred between 2011 and 2020. Currently, some of the repercussions of climate change include severe droughts, water shortages, deadly fires, increasing sea levels, flooding, melting polar ice, catastrophic storms, and a reduction in biodiversity. More than half of the world's population lives in shelters, which account for three quarters of the world's energy consumption and greenhouse gas emissions. This is the foundation of global climate change mitigation and strategic low-carbon development (GHG). Solar energy, organic compost, nanotechnology, vertical farming, and other modern examples of green technical methods are utilised. The efficient application of green technology is crucial for managing trash and pollutants in an eco-friendly and sustainable way, which will reduce GHG emissions and the effects of climate change. This review article argues that it is imperative to investigate novel and alternative approaches for making use of these potentially valuable resources and to modify people's behaviour in this direction.

Keywords**:** *Green Technology, Climate Change Mitigation, Greenhouse Gas, Emission, Fossil Fuel.*

I. INTRODUCTION

A detailed analysis of the vulnerabilities of human populations to future climate change, including associated sea-level rise and changes in the frequency and intensity of climate extremes, is made by the most thorough and current scientific assessment of climate change impact. This includes evidence of recently observed changes in climate that have already affected a variety of physical and biological systems such as considering the potential effects on water supplies, agriculture and food security, human health, coastal and other forms of communities, and economic activity. floods, droughts, heat waves, and windstorms. identifies areas that are particularly vulnerable to future climate change and evaluates the probable reactions of natural settings and the creatures that live there to that change. examines how climate change adaptation might reduce negative effects or increase positive effects [1]. The concentration of greenhouse gases is rising as a result of anthropogenic activity (GHGs). As a result, major surface warming of the globe and other related climate changes are anticipated during the next few decades. GHGs like carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) are the main contributors to global warming [2]. Recent instances of catastrophic weather have shown the urgent need for major modifications supported by technical innovation to assist people in adjusting to these new climatic conditions. In addition to helping communities adapt to droughts, floods, and the growing threat of pest infestation, technological innovation such as climate-smart agriculture, new types of hazard defence, and weather prediction tools can also help protect infrastructure and human lives from storms, floods, and heatwaves. Technologies for water catchment and conservation help address the issue of water scarcity, and vaccines, new medications, and public health innovations that promote prevention boost people's resistance to infectious diseases and heat-related risks that are becoming more common as a result of climate change [3]. Stabilizing atmospheric greenhouse gas (GHG) emissions will require accelerating the development of innovative low-carbon technologies and pushing their widespread use [4]. The technology moving towards a green energy strategy makes solar powered water pumping systems for irrigation a possible alternative to traditional electricity and diesel-based pumping systems. The water supply needed for irrigation is impacted by the lack of energy and rising fuel prices. Photovoltaic (PV) technology converts solar energy into electrical energy and is utilised for solar water pumping. This electrical energy is utilised to power the sprinkler irrigation system's water pump, which is connected. This technology's major goal is to show the best way to conserve water and electricity. The sprinkler with solar water pump is used in a water irrigation system to minimise water usage and lower electricity consumption. In order to reduce water usage, the sprinkler is utilised to spray water onto the irrigation field. The solar pump's motor is run by photovoltaic (PV) technology, which also generates power. Water and electricity use are reduced because to sprinklers and photovoltaic technology, both of which are affordable and environmentally friendly [5]. In recent years, the output of solid waste has been significantly influenced by population growth, urbanisation, industrialization, intensification of agriculture, and increased food production. Destructive processes, such as landfilling and incineration, are utilised to dispose of this expanding solid waste. These techniques remove different nutrients from solid waste that would otherwise be recycled using other techniques. Because solid waste is heterogeneous in nature, managing it with a single technique is insufficient. But in order to recover or manufacture value-added products from solid wastes, several biological processes can be used the non-toxic fraction of the solid wastes as feedstock. These biological processes include vermicomposting, composting, and bio methanation. Vermicomposting has been cited as one of them for its suitability, affordability, and speed in the management of solid wastes. Earthworms employ this process to turn the portion of solid waste that can be composted into vermicompost, a stabilised, finely divided peat-like material that may be applied as manure to agricultural areas to enhance the health of the soil [6]. Green engineering and green chemistry are two subfields of green technology that make use of plant-based materials. Green nanotechnology is one of these subfields. It reduces the usage of energy and fuel by using less material and renewable inputs when possible. Additionally, nanotechnological Earthworms use this method to convert the amount of solid waste that can be composted into vermicompost, a stabilised, finely divided material similar to peat that can be used as manure in agricultural areas to improve the soil's health products, procedures, and applications are anticipated to provide major contributions to environmental and climatic protection through the reduction of greenhouse emissions and hazardous waste as well as the saving of raw materials, energy, and water. The key benefits of green nanotechnology include increased energy efficiency, lower waste and greenhouse gas emissions, and decreased consumption of non-renewable raw materials. Green nanotechnology presents a fantastic opportunity to prevent negative impacts from happening in the first place [7]. The difficulties were thought to impede climate negotiators' progress on reduction, and they supported ethical worries regarding research on climate engineering and adaptation [8]. Given that adaptation is a requirement for both the present and the future, the adaptation-mitigation debate has a lot of practical importance today [9]. According to research, short-term mitigating measures could make future adaptations more difficult. For instance, rapid deforestation to sequester carbon or the development of carbon-neutral biofuels may come at the expense of biodiversity losses, which may be necessary to help natural systems adapt to changing climatic circumstances [10]. Other instances of maladaptation include adaptation strategies that increase emissions, such as air conditioning in response to heatwaves or energy-intensive desalination methods to enhance water supplies [11].

➢ *The Calibration of Green Technology is Extremely Difficult for Three Main Reasons:*

- The technologies examine the trade-off between current mitigation costs and projected adaption costs. The optimal selection of the discount rate, which is experimentally debatable, has a significant impact on this value [12]. Decision-making about adaptation and mitigation may differ since the benefits of adaptation are frequently local and private, but the benefits of mitigating climate change are a worldwide (uncertain) public good [13].
- The effects of climate change on the economy are uncertain: The climate system may become unpredictable and an existential threat to human existence once the thresholds are crossed, which may be beyond the capabilities of any current and anticipated technical solutions [14].
- Technologies currently in use opine that money invested in mitigation cannot be used for adaptation, and vice versa. However, according to empirical evidence, adaptation and mitigation are not always mutually exclusive, and there are instances where adaptation efforts support mitigation and vice versa [15,16].

➢ *Use of Various Green Technologies for Climate Change Mitigation:*

- *Agriculture Waste Management:*

✓ *Bioplastic Production From Agriculture Wastes:*

Population growth has led to increasing the growth in agricultural activities, thus increasing the generation of agricultural wastes indirectly. The petroleum-based traditional seedling and plantation plant pots or polybags are considered the most widely wastes generated. These pots and polybags are non-biodegradable and usually are disposed after usage in landfills which will lead to pollution. To solve this issue, the concerned industries are investigating to find an alternative for these non-biodegradable pots and bags. Because the level of environmental awareness elevated, the public starts recycling wastes with the help of new technology [17]. The plastic consumption in developing countries has been reported to be more than that of the world average because of the higher rate of urbanization and economic development [18]. For a variety of uses, including construction, paperboard packaging, newsprint, insulation, and building materials, recycled newspaper pulp fibres are utilised as a primary source of biofibre materials. One of these products is a bioplastic pot made of bioplastic and newspaper pulp fibres. It will serve as a substitute for other types (i.e., non-degradable plantation and seedling plant pot). can also create pots that are highly robust and biodegradable. Additionally, the use of bioplastic in these pots might lessen swelling of pots that is brought on by water absorption during manufacture and planting.

ISSN No:-2456-2165

Fig 1 Bioplastic Seedling Pots

investigations on how bio-based films made from agricultural and marine wastes affect the environment. Soy protein, a by-product of the soy industry, chitosan from the exoskeleton of crustaceans, and agar from seaweeds were some of the agro-wastes employed. The results demonstrated that, in contrast to polymers produced through oil refinery operations, bio-based films generated from agricultural waste and marine leftovers had the least detrimental effects on the environment because of their biodegradable qualities. [19]. Similar in this approach, other researchers examined the production of bio-based plastics with an emphasis on the environmental degradation of those materials. However, they demonstrated that, in addition to affecting biodegradability, the incorporation of food wastes and microalgae affected the polymer structure and hence affected the performance of the composites [20].

The generation of agricultural wastes has indirectly increased due to the increase in agricultural activity brought on by population development. The typical petroleum-based seedling and plantation plant pots, together with polybags, are regarded to be the wastes that are produced the most frequently. After use, these non-biodegradable pots and polybags are frequently discarded in landfills, which contributes to pollution. To solve this problem, the relevant businesses are seeking for alternatives to these non-biodegradable pots and bags. As environmental awareness increases, the populace is recycling garbage using innovative technology [17].

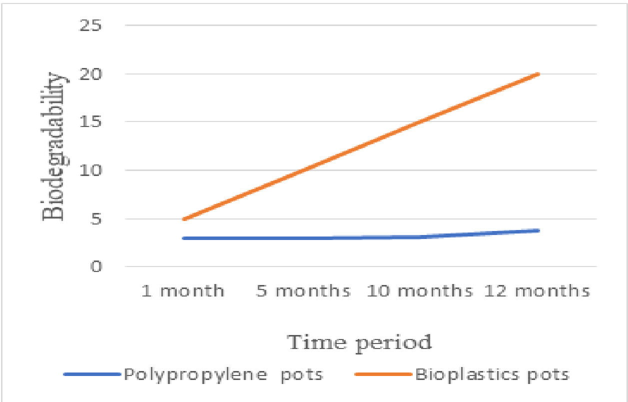

Fig 2 Biodegradability of Different Plastics

➢ *Concrete Production from Agricultural Wastes:*

Concrete is becoming the most widely used building material in the construction sector. In addition to its durability, the concrete industry has had a significant negative impact on the environment. During its manufacturing process, CO2 emissions caused a bigger carbon footprint and contaminated the air, land, and water. The concrete industry has been labelled as environmentally unfriendly and unsuited for sustainable growth because to the demolition waste of concrete and its effects. The emphasis is on finding cement substitutes, such as disposable and low-value agricultural and industrial wastes that could be used for beneficial purposes through reuse, recycling, and renewal initiatives [21]. Regarding their popularity and extensive use in contemporary construction applications, rice husk ash (RHA), sugarcane bagasse ash (SBA), coconut ash (CA), wheat straw, and bamboo leaf ash (BLA) are among the major agricultural waste sources used in the production of cement and concrete. The most popular methods for managing this agro-waste are composting, incineration, and landfill dumping, all of which cause serious environmental problems. However, recent studies have demonstrated that using agricultural waste and by-products again in the creation of construction materials, in whole or in part, is a workable and nascent answer to the problems that have been outlined [22]. Due to several environmental, economic, technological, and specialised product quality reasons, the usage of such materials in the construction material sectors has attracted considerable interest [23]. Concrete, which is a mixture of cement, fine aggregate, and coarse aggregate, is widely utilised in the building sector, which has sparked research on the use of alternative agro-waste resources to manufacture concrete as an environmentally benign method of mitigating climate change [24]. As shown in Fig. 5, an imprint of bamboo reinforcement in the cementitious material improved their durability based on the results of tests, such as freeze-thaw resistance, carbonation depth, and permeability [25]. The study showed that a variety of vegetable fibres, including sisal, coconut, bamboo, and hemp, among others, may be employed as reinforcement in cement-based products.

Fig 3 Sugarcane Bagasse Ash Concrete

investigations into the effects of substituting fine aggregate for untreated sugarcane bagasse ash (SCBA) in concrete at varying ratios of 0%, 10%, 20%, 30%, and 40%. The casted concrete specimens were cured under conventional laboratory circumstances and tested for compressive strength, sorptivity test, and tensile strength

ISSN No:-2456-2165

for 7 days and 28 days with a water-cement ratio of 0.40 and a superplasticizer dose maintained at 0.8 percent. The results showed that a specimen with a 10% replacement of SCBA performed better than those with a 0% SCBA replacement in terms of compressive strength. Due to the pozzolanic qualities, the strength of the mixes containing SCBA increased over longer times [26].

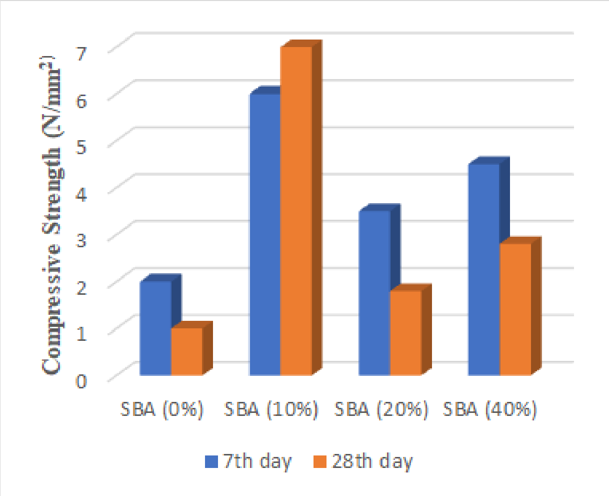

Fig 4 Compressive Strength for Concrete Mixes

Despite the many benefits of using agricultural waste to create building materials, a number of problems were also found, with the main one being the light weight of the agro-waste-based building materials. Some researchers contended that bricks made with clay, rice husk ash (RHA), and sugarcane bagasse ash (SBA) could only be applied in situations where buildings needed to withstand lesser structural stresses [27]. The necessity for high knowledge in their fabrication and the limited availability of highly skilled labour in the development of the materials were further identified as challenges that must be overcome to speed up the adoption of this green technology.

➢ *Composting:*

The treatment of organic wastes, such as composting, has seen significant innovation in recent decades as waste management has emerged as a major problem. Despite the fact that composting reduces trash in landfills and has a low economic cost, some wastes (such as oils) cannot be composted [28]. The following are the main breakthroughs in waste management systems using various technologies that are depicted in Fig. 6:

- Open dumping is still permitted in many low-income nations.
- Unregulated landfill
- Composting of waste

The controlled landfill and recycling. Waste-to-energy technologies became the fifth wave of waste management systems in the 20th century, while zero waste technologies became the sixth wave and the most comprehensive innovation for waste management systems in the 21st century to achieve a true sense of sustainability in the waste management systems. [29,30].

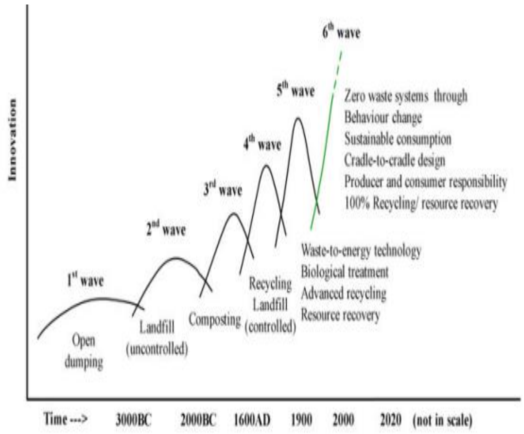

Fig 5 Innovation in Waste Management

In order to get the best results for resource use and the environment, waste management systems are prioritised according to the waste management hierarchy, which is accepted both nationally and internationally. From most to least desired, it lists waste prevention, reusing, recycling, composting, incineration, and final landfill as the order of waste management practises. As a result, this hierarchy serves as one of the zero-waste system's guiding principles [31]. A paper claims that through increasing resource efficiency, the waste hierarchy approach (prevention, reuse, recycling, energy recovery, and disposal, as the least preferred choice) and waste prevention are crucial components of the green economy.

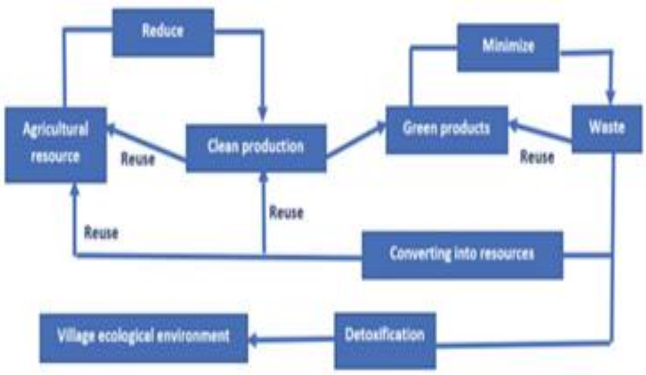

Fig 6 Waste Management Hierarchy

- Goals for managing agricultural wastes include maximising the economic return from the waste resource: To optimise farmers' profits and the overall return on agricultural production, attention must be paid to raising the value of these wastes.
- Upholding appropriate environmental standards: Improper waste management can cause air pollution, surface and groundwater pollution, and other problems. In light of this, effective waste management lowers the anticipated environmental hazards for farmers as well as the dangers of environmental contamination and the waste of its many components [33, 34].

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✓ *Vermicomposting:*

The use of sustainable farming practises has significantly increased in recent years as a result of growing consumer concern about concerns including food quality, environmental safety, and soil conservation. Vermicomposting is a biotechnological technique that uses specialised earthworms to turn organic waste into compost. Following many types of studies on their capability to effectively convert organic waste into nutrient-rich compost known as vermicast, earthworms have recently become quite advantageous. Because the vermicast is nutrient-rich and also contains high-quality humus, plant growth hormones, enzymes, and substances that can protect plants against pests and diseases, it has been demonstrated that it significantly increases crop growth and yield when compared to conventional compost and chemical fertilisers. Earthworms decompose complex organic materials like food waste, municipal solid waste (MSW), animal waste (poultry, cattle, etc.), and domestic waste (paper, fibre), among others, acting as mechanical blenders. By fragmenting the organic material, earthworms change its physical and chemical status by gradually lowering the C:N ratio and increasing the surface area exposed to microorganisms, making it much more conducive to microbial activity and further decomposition. Earthworms, commonly referred to as the "new black gold," have specialised cellulose-degrading bacteria in their intestines that facilitate the quick breakdown of organic waste. About 5 to 10 percent of the substrate consumed by an earthworm is assimilated, with the remainder passing through the alimentary canal and being expelled as cast. African Night Crawler (*Eudrilus eugeniae*) and Red Wriggler worms (*Eisenia fetida*) are two promising worms used to produce vermicompost. There are difficulties with vermicomposting, including Odors: An overabundance of "greens" in the trash can causes ammonia to be created when nitrogen and hydrogen combine. We can add sources of carbon, such as paper and dried leaves, to neutralise the odours. Pests: Unpleasant odours can draw pests like flies and rodents. Install plastic nets around the trash cans. In undeveloped places, the *Eisenia foetida* can target local worms [35].


Fig 7 Vermicomposting

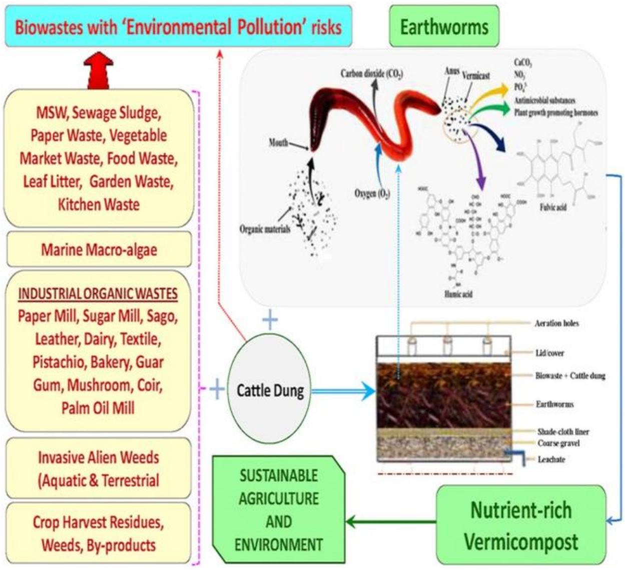

Fig 8 Waste Management using Vermicompost to Reduce Soil Pollution

➢ *Solar Photovoltaic Water Pumping System:*

An excellent substitute for water pumping systems powered by electricity or fuel is the solar photovoltaic water pumping system (SPVWPS).

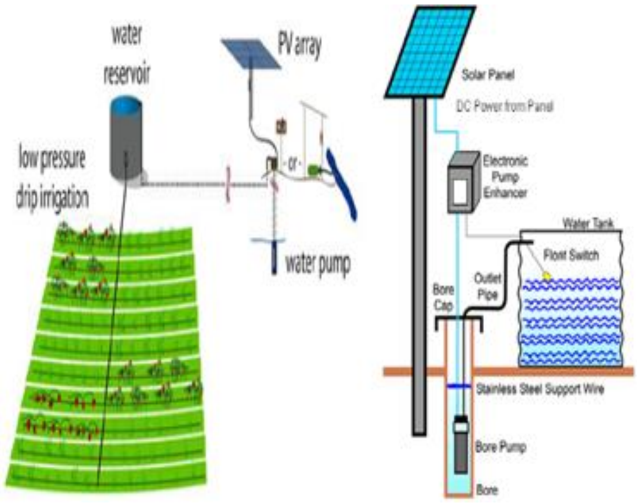

Fig 9 Solar Photovoltaic Water Pump

Devices that "collect light and transform it into power" are called photovoltaic cells. The cells are supported inside a metal frame, wired in series, and sandwiched between sheets of glass or plastic. Solar modules or panels are the names of these frames. Thin silicon wafers, a semi-conducting material like to that used in computer chips, are utilised to make PV cells. These materials absorb sunlight, which causes electrons to get freed from their atoms and move through the substance to generate electricity. The "photovoltaic effect" is the conversion of light (photons) to electricity (voltage). The panels, support structure with tracking mechanism, electronic control components, wires, pipes, and the actual pump make up the entire solar pumping system. A 12-volt pump that can move 1,300 to 2,600 L/h can be powered by a 50-watt photovoltaic solar panel. A water-saving tank of

ISSN No:-2456-2165

500 to 1,000 L is connected to these components using standard plastic connectors and half-inch piping. The water tank should be placed on a robust platform to allow gravity flow, and a frame should be made to support the solar panels at the ideal angle. To prolong the pump's life and reduce clogging in sprinkler emitters and tubes, multiple filters are required. Use of a solar pump in conjunction with inexpensive drip irrigation kits is possible with numerous. The installation of a PV system has a number of benefits, including flexibility, low operating costs, low maintenance requirements, and an environmentally friendly approach. India has a potential of 9 to 70 million solar PV pump sets for irrigation, which would save at least 255 billion litres of diesel annually. Low yield is a serious issue for the SPVWPS since solar pumping is inefficient in situations with high demand. Solar energy's greatest capacity is really little. However, the solar DC pump's output is higher than that of a standard pump. Variable yield: The solar pump's water production varies with the intensity of the sun. In the early morning and late at night, it is lowest and highest about noon. Therefore, it should be used at midday), Theft (theft of solar panels might be an issue in some places). The solar system should ideally be protected from both natural disasters like lightning and theft [35].

- *Green Nanotechnology in Phyto Formulation Research:*

A subset of green technology known as "green nanotechnology" makes use of the ideas behind "green chemistry" and "green engineering." Through the use of less material and renewable inputs when available, it decreases the consumption of energy and fuel. Through the creation of nanoparticles and nanoproducts, green nanotechnology, used in phyto-formulations, greatly helps to environmental sustainability without endangering human health or the environment. Plants are included in nanoparticle formulations because they are widely available and contain a variety of metabolites, including vitamins, antioxidants, and nucleotides [36]. The key benefits of green nanotechnology include increased energy efficiency, lower waste and greenhouse gas emissions, and decreased consumption of non-renewable raw resources. Green nanotechnology is a fantastic opportunity to prevent negative impacts from happening in the first place [37].

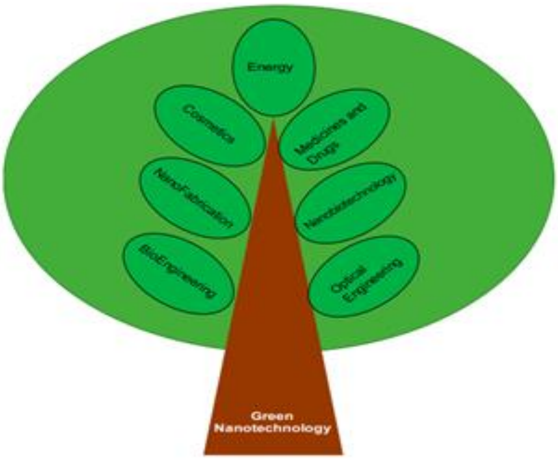

Fig 10 Green Nanotechnology

It is well known that plants have the capacity for both biological reduction and hyper-accumulation of metallic ions [38]. Plants have been regarded as a more environmentally benign biological method for the manufacture of metallic nanoparticles because of these outstanding qualities, and they are also useful for detoxifying applications [39]. As depicted in Fig. 8, plant extracts contain a variety of bioactives, including proteins, phenolic acids, sugars, terpenoids, and polyphenols, which have been demonstrated to have a significant role in first decreasing and then stabilising the metallic ions.

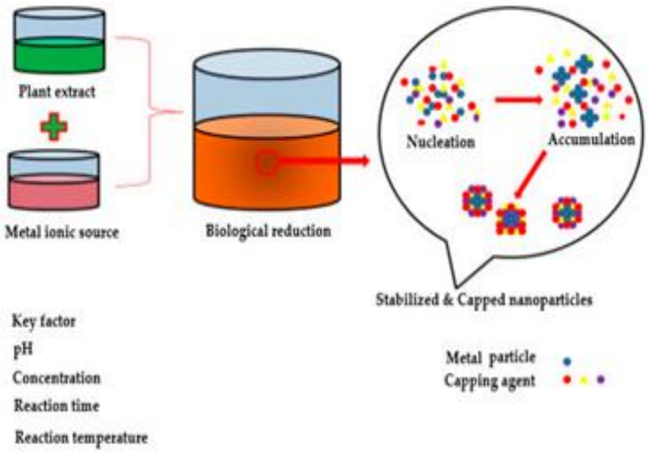

Fig 11 Biological Synthesis of Nanoparticles using Plant Extracts

The content, concentration, and interaction of the active biomolecules of various plants with the aqueous metal ions determine the form and size of nanoparticles to a large extent. The concentration of active biomolecules from various plants in the reaction mixture and their interaction with the aqueous metal ions cause the colour of the reaction mixture to change, especially in chemical and biological synthesis of nanoparticles. Especially in chemical and biological synthesis of nanoparticles, the aqueous metal ion precursors from metal salts are reduced, which results in colour change of the reaction mixture and provides a quantitative indication of nanoparticle formation. More significantly, the salt solution's nanoparticle biochemical reduction process begins right away, and the reaction mixture's colour changes to show that nanoparticles have formed. Metal ions are first activated throughout the synthesis process from their monovalent or divalent oxidation states to zero-valent states, allowing the nucleation of such reduced metal atoms [40]. The integration of smaller neighbouring particles to create larger, thermodynamically stable nanoparticles occurs after the process of nanoparticle formation, and the metal ions are then reduced physiologically as a result. Growth proceeds in this way, and nanoparticles assemble into a variety of shapes, including spheres, cubes, triangles, rods, wires, hexagons, and pentagons. The final step of the process determines the stable morphology of the nanoparticle based on the plant extract's capacity to stabilise it. Significantly, the characteristics of the plant extracts—specifically their content, reaction time, metal salt concentration, reaction solution pH, and temperature—

have an impact on the quality, size, and morphology of the nanoparticles [41]. The impact of nanomaterials on workers' health and safety has been a difficulty for nanotechnology, but it can be overcome by recognising potential worker exposure, measuring it, and analysing how it might vary based on the task at hand. The next step in exposure control is risk management, which includes the use of personal protective equipment (PPE), such as lab coats, gloves, and respiratory and eye protection.

- *Vertical Gardening:*

People are gradually realising the importance of green architecture as new elements and technologies for green buildings emerge with the advent of modernization and urbanisation. The necessity of the age is to give land life, and the only way to go from grey to green walls is through landscaping. Since there is no room for horizontal expansion, the only available space for vertical gardens is vertical. By increasing ecological values by providing habitat for birds and insects, it will increase carbon capture, improve aesthetics, improve indoor and outdoor climate, reduce greenhouse gases like carbon dioxide (CO_2), carbon monoxide (CO), and nitrogen dioxide (NO_2), all of which will help us better adapt to climate change. Green walls, living walls, and bio walls are further names for vertical gardens. A wall that is partially or entirely covered with vegetation is referred to as a "green wall," whether it is freestanding or a component of a building. Designing, installing, and maintaining green walls are all included in the construction process. A metal framework, a PVC layer, and a felt layer make up the Vertical Garden. The metal frame is either wall-mounted or free-standing. The PVC sheet is riveted to the metal frame at a thickness of 1.00 cm. This layer gives the entire construction stiffness and makes it watertight. The PVC is covered with a polyamide felt layer that is stapled on. This felt is resistant to decay, and thanks to its high capillarity and ability to evenly distribute water, plants can grow effectively on it. To make pockets for the plants, slits are carved into the outer felt covering. On top of this felt layer, plants are installed as seeds, cuttings, or fully established plants. About thirty plants are present in each square metre. Nutrient supplements are added to the irrigation that is delivered from the top. Both fertilisation and irrigation are automated. Nutrient-rich water is supplied by a pump and drip irrigation system, which slowly cascades down the wall through layers of felt material until it reaches the bottom, where a collector collects any extra for reusing. The vertical garden weighs less than 25 kg per square metre when the plants and metal structure are included. As a result, the vertical garden can be installed on any wall, regardless of its height or size [42]. It is impossible to create massive, long-lasting facade compositions using the current techniques. Due to the high cost of the vertical garden system and the inability of the planting material to be continuously restored as a result of weather conditions that destroyed the vertical garden, customers and designers have chosen to use imported, non-climatized planting materials instead of plants from the local flora, which are less expensive [43].

Fig 12 Vertical Gardening

II. RESULTS AND CONCLUSION

Environmental safety and public health have long been under pressure due to the growing amount of agricultural waste and its improper disposal or burning, particularly in developing countries. Additionally, it causes an increase in global GHG emissions, as well as affects on global warming and climate change. Technologies can increase our economy's resilience to existential climate hazards. Understanding climate change adaption technologies is crucial:

- Historical trends and the potential for innovation;
- Requirements in science and technology for creating and applying technologies for coping with climate change;

Technologies that can help with climate change adaptation and mitigation. For the purpose of advancing the transfer of environmentally friendly technologies for utilising agricultural wastes and turning them into useful resources, CCATs analyse scientific and technological knowledge. This is crucial for mitigating climate change. On the other side, green nanotechnology is commercialising more and has the potential to grow into a very green business. It may be claimed that the pharmaceutical business faces difficult tasks as a result of green nanotechnology. But in the end, it raises ethical standards in the field of nanotechnology, encourages environmentally beneficial methods, and enhances quality of life. Numerous indirect benefits of vermicompost on plant growth have been identified, including the reduction or suppression of plant diseases and an increase in plant growth. Over time, the technology has been most popular for the reasons listed below: restores the soil ecosystem's honour by fostering soil microbial activity due to its nitrogen-fixing capabilities, increases the soil's ability to hold water, when applied for uptake, the nutrients in earthworm cast are rapidly available to the plant. increases crop development and growth, resulting in an increase in agricultural production, decreases field crop infection with pests and diseases offers a productive substitute for controlling farm waste, provides more nutrients than traditional compost and inorganic fertiliser, Vermicompost will more than make up for the careless application of chemical fertilisers to crop areas. Another element of green technology that helps to transform grey to green walls and

ISSN No:-2456-2165

give life to land is vertical planting. Vertical gardens are created in unused vertical space. By establishing habitats for birds and insects, it will increase ecological values while improving climate change adaptation and carbon capture. It will also improve aesthetics, indoor and outdoor climate, and reduce greenhouse gases like carbon dioxide (CO_2), carbon monoxide (CO), and nitrogen dioxide (NO_2). Building efficiency, ecology, and environmental advantages can all be significantly enhanced by integrating vegetation on them through a process called vertical greening. Agrowastes can be used as sustainable and eco-efficient pozzolans for upcoming concrete companies. The addition of wastes not only benefits the environment, but also improves the performance of concrete qualities, as shown by the incorporation of these residues into cementitious materials. Currently, it is acknowledged that rice husk ash is the most suitable substitute for volcanic ash, however other agricultural wastes are also being extensively researched. The modification of agro-cement with a superplasticizer, large-scale real use, life cycle assessment of agro-cement, and appropriate schemes for mixing various agricultural residues with cement are all areas that future research should pay greater attention to. As a result, it should be possible to dispose of agricultural waste in a responsible manner and use it in the best ways possible.

➢ *Compliance with Ethical Standards Acknowledgments:*

The authors thank the reviewers for their insightful suggestions.

➢ *Disclosure of Conflict of Interest:*

The authors declare there is no conflict of interest in this study.

➢ *Statement of Informed Consent:*

Informed consent was obtained from all individual participants included in the study.

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