

Green Technologies and Environmental Laws: Insights from Biomedical Waste Management

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Abstract- *Green technology is prime to promote environmental justice at present circumstances. It is vital to help the new sustainable innovation. Green technology is basically the mix use of technology and science to develop sustainable innovation and eco-friendly environment. Through the environmental laws and regulations, it is comparatively easy to develop green technologies which further create ways to sustainable development. Environmental regulations can adopt the green technologies to minimize the waste which are health hazards and control the pollution.*

Green technology can promote waste management and recycling policies, sustainable development etc to lead a future sustainable innovation and the environmental regulations and legal solutions can help on this matter. Environmental regulations and green technologies are interlinked or harmonious systems which are beneficial to the future sustainability. In this research paper an attempt has been made by the researcher to analyse the concept of green technologies and its importance regarding environmental justice and its role on management of waste reduction. Besides this, the role of environmental laws and regulations on sustainable innovation are also discussed by the researcher. At the end of this paper, the researcher put some recommendations in this regard.

Key words: Green technology, environmental law, Regulations, sustainable development, waste management system.

1.1 INTRODUCTION

Green technology is a vital equipment to the environmental needs which ultimately aims to develop sustainability. Green technology and environmental laws are related as their main motos is to create sustainability. Green technology includes the waste management by several ways however the purpose behind the environmental laws is to reduces the waste generation. Both environmental laws and green technology directly or indirectly helps to manage the biomedical or health care waste. Biomedical waste is a health hazard waste and also decreases the environmental quality. So, it is

important to properly manage the biomedical waste through the help of green technology and environmental laws and regulations.

Green tech emphasizes the entire lifecycle of products, from raw materials to disposal, aiming for a circular economy and promoting social equity. Key elements include environmentally responsible supply chains, corporate social responsibility (CSR), and zero waste management, which eliminates waste and conserves resources. These strategies support research and development to advance eco-friendly solutions and sustainable practices.

1.2 OBJECTIVES

1. To examine the concept of green technology
2. To navigate the relationship between green technology and environmental law
3. To understand the impact of green technology to achieve the environmental justice
4. To analyse the green Technologies role for the management of biomedical waste
5. To scrutinize the role of environmental laws and regulations to minimize the biomedical waste for sustainability
6. To study the benefits of green Technologies and environmental laws towards the management of biomedical waste
7. To navigate the justice of Sustainable Innovations by the help of green technology
8. To scrutinize the effects of green technology on environmental justice and sustainability.

1.3 RESEARCH METHODOLOGY

The methodology adopted for the preparation of this research paper by the researchers is mainly doctrinal in nature. Because all the relevant data used in this research paper is collected from different secondary sources. The secondary source includes various Articles, journals, books, newspapers, websites etc. In this research paper, the researcher makes an attempt to conduct a study on the role of green technologies and environmental laws towards the

management of biomedical waste which paved the way for environmental justice and sustainability.

2.1 MEANING OF GREEN TECHNOLOGY

Green Technology (Green Tech) refers to innovative technologies aimed at addressing environmental challenges and promoting sustainability. It involves creating and using products, services, and practices that minimize environmental harm and encourage the responsible use of natural resources.

Key Aspects:

- Purpose: Reduce environmental impact and foster sustainable development.
- Scope: Encompasses a wide range of technologies and practices that benefit the environment and society.

Types of Green Technology:

- Renewable Energy: Harnessing sustainable energy sources like solar, wind, and hydropower.
- Energy Efficiency: Enhancing energy use efficiency to reduce waste.
- Waste Management: Innovations in recycling, composting, and reducing waste.
- Transportation: Eco-friendly transport solutions, including electric vehicles and public transit systems.

Importance:

- Financial Savings: Cost reductions through energy efficiency and waste reduction.
- Economic Gains: Job creation and economic growth in green industries.
- Public Health: Cleaner air, water, and reduced pollution.
- Environmental Benefits: Mitigating climate change and conserving resources.

Green technology plays a crucial role in shaping a sustainable and eco-friendly future.

2.2 GREEN TECHNOLOGY AND ENVIRONMENTAL LAWS: STUDY ON THEIR RELATIONSHIP

The relationship between green technology and environmental law is pivotal in addressing global environmental challenges. Green (technical) innovation plays a crucial role in mitigating environmental crises, but its success may depend on the nature of environmental regulations in place. Green technologies are vital for achieving

sustainable development and transitioning to a low-carbon economy, and environmental laws can help promote these technologies by encouraging sustainable business practices that reduce pollution and resource wastage.

Proponents argue that environmental regulations can foster green technology innovation (GTI) in several ways:

- Incentivizing innovation: Well-structured environmental regulations can motivate businesses to innovate, often leading to cost-effective solutions that surpass basic compliance requirements.
- Enhancing business performance: Regulations may improve the performance of high-pollution industries by offering benefits such as reduced corporate tax obligations, encouraging firms to adopt greener practices.
- Phasing out polluting firms: By raising the operational costs of heavily polluting companies, regulations can push them to either innovate or exit the market, thus reducing overall environmental harm.

On the other hand, some argue that environmental regulations may hinder GTI due to:

- Increased production costs: Regulations can raise the cost of production, limiting available funds for investment in innovation.
- Crowding-out effects: High compliance costs associated with pollution control may reduce businesses' willingness to invest in green technologies.

Additional factors that influence the relationship between environmental regulations and GTI include:

- The size, age, and financial leverage of the enterprise.
- The density and complexity of regulations.
- The stability and predictability of environmental policies.

In conclusion, while environmental laws have the potential to stimulate green technology innovation, the exact impact depends on a variety of factors, including the design and implementation of the regulations themselves.

2.3 MANAGEMENT OF BIO-MEDICAL WASTE THROUGH GREEN TECHNOLOGIES

Green technology plays a critical role in making the disposal of resources and products more sustainable. In the field of biomedical waste management, advanced technologies help convert waste into valuable resources such as energy or raw materials for manufacturing. Waste-to-energy systems, for example, use controlled incineration to transform biomedical waste into power.

The primary goal of green technology is to protect the environment, repair past damage, and conserve Earth's natural resources. As an emerging industry, it has attracted significant investment and has become central to sustainability efforts.

In biomedical waste management, green technology supports practices that focus on sustainability, efficiency, and environmental conservation. Below are the key roles that green technology plays in this sector:

- **Biomedical Waste Minimization and Smart Waste Management Systems**
 1. **Devices and Sensors:** These technologies help optimize biomedical waste collection by ensuring that waste is collected based on the actual level of disposal in bins. This reduces unnecessary trips and related emissions.
 2. **Recyclable Materials Innovation:** New technologies enable the design of products made from recyclable or biodegradable materials, which reduces biomedical waste and supports sustainability.
 3. **Waste-to-Resource Conversion and Upcycling:** This process transforms biomedical waste into valuable products, reducing reliance on landfills and promoting resource recovery.
- **Recycling and Resource Recovery**
 1. **Advanced Recycling Technologies:** Automation, AI-based sorting, and chemical recycling improve the efficiency of waste sorting and recycling processes.
 2. **E-waste Management:** Green technology aids in the collection, recycling, and destruction of electronic waste, reclaiming valuable metals and materials while reducing the environmental impact of mining.
 3. **Circular Economy Support:** By promoting reuse and recycling, green technology

extends the lifecycle of materials and reduces waste.

- **Energy Recovery**
 1. **Waste-to-Energy Plants:** Processes like anaerobic digestion, incineration, and gasification convert organic waste and non-recyclable materials into biogas, electricity, or other forms of renewable energy.
 2. **Landfill Gas Recovery:** Methane recovered from landfills can be used to generate energy, reducing greenhouse gas emissions in the process.
- **Biodegradable Solutions**
 1. **Composting Technologies:** Modern composting systems, such as in-vessel composters, convert organic waste into high-quality fertilizers, benefiting agriculture.
 2. **Development of Bioplastics:** Using biodegradable materials instead of conventional plastics reduces long-term environmental pollution.
- **Environmental Pollution Mitigation**

Green Chemistry: Green processes reduce the toxicity of industrial waste, minimizing environmental harm.

Leachate Management: Advanced systems prevent harmful chemicals from leaching into soil and water sources, reducing contamination risks.
- **Data and Monitoring**
 1. **AI and Data Analytics:** AI-powered analytics help to understand waste patterns, enabling smarter waste management and more informed decision-making.
 2. **Blockchain for Waste Tracking:** Blockchain technology ensures transparency in waste processing, promoting accountability and trust.
- **Public Awareness and Engagement**
 1. **Educational Tools:** Apps and platforms increase public awareness about waste segregation, recycling, and the benefits of green technologies.

2.4 THE MANAGEMENT OF BIO- MEDICAL WASTE THROUGH ENVIRONMENTAL LAWS: Environmental laws are essential for preserving ecosystems, promoting human health, and addressing global concerns such as climate change and hazardous waste.

Effective implementation of these regulations is essential to prevent environmental pollution, reduce exposure to toxic substances and infectious agents, and ensure the safety of healthcare workers and the public. Compliance by healthcare facilities and stakeholders is critical for sustainable waste management practices.

Environmental regulations aim to balance between environment development and environmental protection by promoting sustainable growth through guidelines that require industries to conduct environmental impact assessments, adopt pollution control measures, and manage waste effectively. These measures ensure development does not compromise ecosystems or future generations.

Environmental laws for biomedical waste management are crucial for protecting public health and the environment. These guidelines, often set by public health authorities, outline standards for the safe handling, packaging, transportation, treatment, and disposal of biomedical waste. Their primary goal is to minimize risks associated with hazardous materials.

Key ideas that are involved in environmental laws for the medical waste management:

- **Waste Segregation:** Proper separation of biomedical waste into categories based on type and hazard level.
- **Appropriate Containers:** Use of suitable, clearly labeled containers for waste storage and transport.
- **Treatment and Decontamination:** Reduction of microbial load through regulated treatment methods before disposal.
- **Safe Disposal:** Ensuring waste is disposed of using environmentally sound practices.
- **Training and Education:** Healthcare workers must be trained in safe handling and disposal practices.
- **Authorization:** Facilities managing biomedical waste must obtain approval from regulatory authorities.
- **Monitoring and Compliance:** Oversight by environmental bodies, including annual reviews and district-level compliance checks.
- **Record Maintenance:** Tracking the entire waste management process from generation to final disposal.

International environmental law addresses global challenges like biodiversity loss and transboundary pollution through agreements such as the UNFCCC,

CBD, and Basel Convention. These treaties establish standards, reporting mechanisms, and platforms for collaboration, though compliance can be difficult due to weaker enforcement mechanisms compared to domestic laws. To enhance adherence, international agreements often include financial support, capacity-building initiatives, and dispute resolution methods.

Through international cooperation, these laws play a crucial role in fostering global sustainability.

Biomedical waste management is an essential component of environmental law, addressing the handling of solid, hazardous, and nuclear waste. Regulations like the Resource Conservation and Recovery Act (RCRA) provide guidelines for the proper generation, transportation, treatment, storage, and disposal of biomedical waste to protect the environment and public health.

Proper and appropriate management of hazardous biomedical waste is critical to prevent environmental contamination and reduce risks to human health.

2.5 PROBLEMS THAT FACE ON THE MANAGEMENT OF BIO- MEDICAL WASTE BY GREEN TECHNOLOGY AND ENVIRONMENTAL LAWS

1. Inappropriate following of the norms by some authorities
2. Improper Waste shipment process
3. Lack of proper awareness
4. Lack of adequate training
5. Improper management system
6. Lack of proper norms and guidelines
7. Infrastructure inequalities
8. Resources limitations
9. Time consuming
10. Expensive
11. Ineffective policies
12. Lack of adequate capital

3.1 CONCLUSION AND SUGGESTIONS

In conclusion, guiding green innovation through well-designed environmental laws is essential for promoting sustainability and effective waste management. These laws not only set clear standards and expectations but also drive innovation, encourage responsible practices, and ensure accountability among all stakeholders. With strong legal frameworks, governments and

businesses can work together to tackle urgent global issues such as climate change and resource depletion, paving the way toward a more sustainable future. As the world continues to evolve, it will be crucial to regularly update and enforce these laws to balance economic growth with environmental protection, ensuring the long-term and fair distribution of the benefits of green innovation.

1. **Raise Awareness and Provide Training:** Awareness is the first step in adopting green technologies. Provide necessary training on green technology implementation and biomedical waste management to healthcare professionals and industry stakeholders.
2. **Develop and Strengthen Laws and Regulations:** Formulate and enforce laws, rules, and legislative measures at national and state levels to promote green technologies and manage biomedical waste effectively.
3. **Encourage Support from Government and NGOs:** State governments should introduce schemes to support green technologies. NGOs and other organizations should actively participate in developing and promoting environmental regulations.
4. **Identify and Address Barriers:** Identify key challenges and barriers to the implementation of green technologies and develop strategies to overcome them.
5. **Promote Through Seminars, Media, and Resource Allocation:** Organize seminars and meetings, involve media in spreading awareness, allocate proper budgets, and ensure the availability of necessary resources for sustainable waste management practices.

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