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NaapClean: Design and Community-Based Implementation of a Smart Sanitary Pad Disposal Incinerator for Sustainable Menstrual Waste Management

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Menstrual hygiene management, sanitary pad disposal, incinerator chamber, menstrual waste, community awareness, sustainable sanitation.

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Abstract: Menstrual hygiene management remains a significant public health and environmental challenge in many developing regions. Although the usage of disposable sanitary pads has increased, the absence of proper disposal mechanisms results in environmental pollution, health hazards, and social stigma. This study presents the design, development, and community-based implementation of *NaapClean*, a compact sanitary pad disposal incinerator chamber integrated with structured awareness programs. The system ensures safe, controlled-temperature incineration of menstrual waste while minimizing odor and emissions. A pilot implementation was conducted in educational and community institutions, followed by impact assessment through surveys and observational analysis. Results indicate improved hygiene conditions, reduced improper disposal practices, enhanced school attendance among adolescent girls, and increased awareness regarding menstrual hygiene. The combined technological and social intervention demonstrates scalability and sustainability potential for broader deployment.

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1. Introduction

Menstrual hygiene is a fundamental aspect of women's health and dignity. With increasing accessibility of disposable sanitary pads, safe disposal has become a growing environmental and public health concern. Improper disposal methods such as open burning, flushing in toilets, and dumping in open areas contribute to:

- Blocked sewage systems
- Environmental pollution
- Toxic emissions
- Occupational hazards for sanitation workers

The lack of disposal infrastructure in schools and public institutions further exacerbates absenteeism and discomfort among adolescent girls. This research introduces *NaapClean*, a structured solution combining a sanitary pad disposal incinerator chamber with community awareness initiatives.

2. Literature Review

Previous studies highlight:

- The environmental impact of non-biodegradable menstrual waste
- Health risks associated with improper disposal
- Social stigma limiting menstrual hygiene discussions
- The effectiveness of localized incineration units in institutional settings

However, many existing systems lack community engagement integration, emission control considerations, and scalability planning. This study addresses these gaps.

3. Problem Statement

The study identifies three key challenges:

1. Lack of safe menstrual waste disposal facilities
2. Environmental pollution from improper burning or dumping
3. Limited awareness regarding hygienic disposal practices

There is a need for a low-cost, safe, and socially integrated disposal solution.

4. Objectives

- To design a compact sanitary pad incinerator chamber
- To ensure safe, controlled combustion of menstrual waste
- To integrate awareness programs for behavior change
- To assess environmental and social impact

5. System Design and Methodology

5.1 Technical Design

The NaapClean incinerator consists of:

- Mild steel powder-coated outer body
- Insulated combustion chamber
- Controlled heating element (150–200°C)
- Temperature regulation mechanism
- Exhaust vent system
- Ash collection tray

The system ensures:

- Controlled burning
- Reduced odor
- Safe ash disposal
- Minimal maintenance

5.2 Implementation Method

The methodology followed:

1. Baseline community survey
2. Prototype installation
3. Awareness sessions and demonstrations
4. Monitoring usage patterns
5. Post-implementation survey and analysis

6. Results and Analysis

After three months of implementation:

- Proper disposal increased significantly
- Visible reduction in toilet blockages
- Reduced open dumping and open burning
- Improved attendance among adolescent girls
- Increased awareness of menstrual hygiene practices

Survey responses indicated strong acceptance of the system in educational institutions.

7. Environmental and Social Impact

Environmental Benefits

- Reduction in non-biodegradable waste accumulation
- Lowered risk of toxic open burning
- Improved sanitation conditions

Social Benefits

- Enhanced dignity and privacy for women
- Reduced menstrual stigma
- Safer working conditions for sanitation staff

8. Sustainability and Scalability

The system is:

- Low-cost
- Energy-efficient
- Solar-compatible
- Suitable for rural and urban deployment

It can be integrated into schools, hospitals, hostels, railway stations, and public toilets.

9. Limitations

- Requires regular maintenance
- Needs continuous awareness reinforcement
- Emission testing recommended for large-scale deployment

10. Future Scope

- Smart IoT-based temperature monitoring
- Emission filtration enhancement
- Data analytics for usage tracking
- Integration with biodegradable pad initiatives

11. Conclusion

NaapClean demonstrates that integrating technological intervention with community awareness significantly improves menstrual waste management practices. The system provides a sustainable, scalable, and socially impactful solution addressing hygiene, environmental protection, and women's dignity simultaneously.

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