



SYNOPSIS: SUSTAINABLE BIOCHEMICAL SYSTEM FOR NON-THERMAL MENSTRUAL WASTE DECOMPOSITION

1. Introduction

Traditional sanitary pads are composed of up to **90% plastic** and synthetic polymers that can take **500–800 years** to decompose. In many urban and rural street environments, improper disposal leads to clogged drainage systems, environmental pollution, and severe health risks for waste pickers. Current mainstream solutions primarily rely on high-heat incineration, which often releases toxic dioxins and furans into the atmosphere. This project proposes a decentralized, non-thermal system that utilizes mechanical shredding and eco-friendly biochemical agents to transform used pads into a harmless, decontaminated powder.

2. Literature Review

Recent advancements in 2025 and early 2026 have shifted focus toward "green" disposal:

Chemical Breakdown: Research has demonstrated that **sodium bicarbonate** and dry steam can dissolve approximately 30% of Super Absorbent Polymers (SAPs) within 25 minutes, neutralizing them without fire.

Bioremediation: Specific cellulase-producing bacteria (e.g., *Isolate G+D* consortia) have shown a significant ability to degrade the cellulosic core of pads.

Industrial Benchmarks: Technologies like **PadCareX** use a 5D process (disinfection, deodorization, decolorization, disintegration, and deactivation) to recover 99.5% of materials as secondary raw materials for packaging and agriculture.

3. Problem Statement

The accumulation of non-biodegradable menstrual waste in public spaces creates a "hidden crisis." Existing disposal methods are either environmentally damaging (incineration) or slow and infectious (landfilling). There is a critical lack of on-site, user-friendly systems that can immediately process pads into a manageable, non-hazardous form without requiring high-energy thermal processes or specialized large-scale infrastructure.

4. Gap Analysis

While large-scale recycling centers exist, there is a gap in **decentralized, low-energy street-level technology**. Most "disposal machines" are still essentially small incinerators. Current

biochemical methods are largely confined to laboratory settings and have not been integrated into a robust, automated mechanical unit capable of handling mixed-material pads (plastic, pulp, and SAPs) in a single "crush-and-dissolve" cycle suitable for public use.

5. Objectives

- a. To design a mechanical shredder optimized for the multi-layered polymeric structure of sanitary pads.
- b. To formulate a biodegradable chemical solution (e.g., utilizing sodium bicarbonate or enzymatic consortia) that deactivates SAPs and accelerates decomposition into powder.
- c. To develop a non-thermal "bio-digester" unit that operates on solar or low-voltage power.
- d. To evaluate the safety and environmental impact of the resulting byproduct for potential use as a secondary raw material.

6. Methodology

1. **System Design:** Fabricate a compact unit featuring a high-torque mechanical shredder to increase the surface area of the waste.
2. **Biochemical Integration:** Implement a sprayer system that applies a disinfecting and decomposing formula (cytoslate or sodium bicarbonate base) during the shredding process.
3. **Experimental Trials:** Test the degradation rate of various commercial pad brands using different chemical concentrations and microbial consortia (e.g., cellulase-producing bacteria).
4. **Operational Testing:** Validate the system's ability to operate without heat, focusing on odor control via patented bacteriostatic solutions and aeration.

7. Expected Output

- a. A prototype **Bio-Crushing Unit** capable of reducing pad volume by over 70% within minutes without incineration.
- b. A decontaminated, odorless organic-plastic powder byproduct that can be safely handled or further processed for industrial recycling.

- c. A reduction in local street-level pollution and a decrease in the carbon footprint compared to traditional landfilling or burning.

8. Conclusion

The proposed system addresses the urgent need for a dignified and environmentally sustainable menstrual waste solution. By replacing fire with biochemical "breaking" and mechanical "crushing," this technology aligns with 2026 circular economy goals, protecting both public health and the environment while promoting the recovery of valuable resources from waste.