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MediLoop: Automated Plastic Recovery System for Medical Syringe Waste

Researchers at Stanford have developed an automated, enclosed processing system that recovers recyclable plastic from single-use medical syringes at waste processing facilities.

An estimated 16 billion syringes annually go to landfills or incinerators, eliminating opportunities to recover valuable plastic materials. In regulated waste streams, "highest hazard wins" rules often mandate incineration for mixed waste, preventing recycling opportunities that downstream processing cannot address.

MediLoop separates recyclable plastic before it gets mixed into heterogeneous regulated waste streams. The system takes bulk used plastic syringes and mechanically aligns and cuts each syringe above the rubber plunger to isolate a clean plastic barrel, then shreds and sterilizes the plastic fraction so it can be handled as non-hazardous recycling feedstock. Workers pour autoclaved syringe waste into the hopper, and the process operates hands-free using computer vision detection and precision cutting.

The compact device processes approximately 7,000 syringes during an 8-hour workday with 85% accuracy in producing clean plastic output free from contamination. This enables medical waste facilities to reduce disposal volumes, generate revenue from recovered materials, and support circular economy practices in healthcare.



Image description: Medical waste facility workers pouring syringe waste into the hopper for hands-free processing (Source: inventors)

Stage of Development: Functional prototype with demonstrated 85% clean plastic separation accuracy

Applications

- Medical waste facility plastic recovery systems
- Healthcare circular economy initiatives

Advantages

- First automated system for syringe plastic recovery
- Separates recyclable materials before hazardous waste mixing
- Reduces medical waste disposal volumes
- Generates revenue streams from recovered plastic feedstock

Publications

- Gade, C., Cementon, C., Sanchez, M. I., & Grandhe, V. S. S. (2025). MediLoop: Safe, hands-free recycling of plastic syringes at medical waste facilities. Mechanical Engineering 310 Spring Design Document, Stanford University.

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