The Biofuel Autoclave: A Medical Waste Solution for the Developing World?

by

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Executive Summary

Background: Inappropriate disposal of medical waste in the developing world has caused a myriad of negative public health and environmental consequences. While there are safe medical waste sterilization technologies available, their high cost and reliance on resources, such as consistent electrical supplies, have prevented them from being a solution for the developing world. Instove and Wisconsin Aluminum Foundry Co. have paired their technologies to create the Biofuel Autoclave, a medical waste sterilizer designed for the developing world. The Biofuel Autoclave is a low-cost, flexible autoclave technology that can operate on a variety of biofuels to eliminate the risk of medical waste.

Objective: Experiments were designed to validate the Biofuel Autoclave as a suitable technology for the management of medical waste in the context of the developing world. Specific features of this technology were explored to determine the best operating procedures and identify possible fuel sources.

Methods: The Biofuel Autoclave was piloted at Bir Hospital and the National Kidney Center in Kathmandu, Nepal. Various fuel sources were tested including wood, paper briquettes, sawdust briquettes, and biogas. Bio-indicators and steam integrators packed inside of waste loads were used to determine if successful sterilization had been achieved and temperature and pressure conditions were recorded to track the sterilization process.

Results: Experimentation validated the Biofuel Autoclave as a suitable technology for sterilizing medical waste. The Biofuel Autoclave was successful using a variety of fuel sources, including wood, biogas produced from Bir Hospital's biogas system, paper briquettes with kerosene, wood supplemented with paper briquettes, and sawdust briquettes. Key factors for decreasing cycle time and ensuring sterilization included an appropriate fuel feeding schedule, incorporating manual steam flushes, and ensuring that there was no steam leakage during the trial.

Discussion: Steam leakage from the lid was a major issue during testing and was a recurring occurrence in failed trials. A new locking mechanism for the autoclave or technology replacement will minimize user difficulty in the field. The second major consideration is selecting appropriate fuel types. While a variety of fuel sources can be used within the Biofuel Autoclave, different forms may be more suitable and sustainable depending on availability and the interest of healthcare facilities in the development of new fuel types.

Conclusion: The Biofuel Autoclave is an innovative solution for medical waste management in the developing world. It has a wide variety of possible uses: it is suitable for health facilities without consistent electricity, and for transient events such as natural and human disasters and immunization campaigns. However, it must be integrated into an entire medical waste management system in order to be a sustainable treatment method. The Biofuel Autoclave is a flexible design and should be adjusted to each of its contexts to maximize cost recovery, increase efficiencies, and to eliminate risk from its surrounding communities.