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DESIGN OF SANITARY NAPKIN DISPOSAL SYSTEM AT THRISSUR MUNCIPALITY

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Abstract - *The improper disposal of menstrual waste is an obstacle for public hygiene. Heaps of sanitary napkins with a large amount of disease causing bacteria on them pose a significant threat to the public hygiene in the surrounding area. Incineration is one of the best methods among various disposal facilities to menstrual napkin pads waste. Implementation of modern techniques like incineration can help in safe disposal of menstrual pads and to promote public hygiene. Here the heat is produced by incinerating the sanitary napkin waste which is dumped into incinerator. The incinerator body is designed to incinerate 100 kg of menstrual pads per hour. The menstrual pads while burning produce temperature around 360°C and the flue gas temperature is around 160°C which is transfer heat from flue gas to the water. A shell and tube heat exchanger is designed with stainless steel (AISI304). After getting heated by the flue gas hot water at a temperature around 100°C can be used for domestic purpose for Thrissur Muncipality. The disposal system is designed for Thrissur municipality for hygienic environment.*

***Key Words*: Incinerator, design, analysis, menstrual napkins, fuel.**

1. INTRODUCTION

Menstruation and menstrual practices still face many social, cultural, and religious restrictions which are a big barrier in the path of menstrual hygiene management. In many parts of the country especially in rural areas girls are not prepared and aware about menstruation so they face many difficulties and challenges at home, schools, and work places. The present research work deals with an effective solution to dump and dispose the menstrual waste with the help of an incinerator. The principle of heat being generated when current is passed through a resistance is employed in various household appliances like electric iron, water heaters. Although the disclosed device has the same principle of operation, here the heat produced is used to burn the sanitary napkin which is dumped into the incinerator. For this purpose, the most commonly used heating coil made up of Ni-Chrome alloy is used. The sanitary napkins will have an ignition temperature of around 250°C to 400°C. When the sanitary napkin burns, it is reduced to ashes. The burnt ashes will be collected at the removable ash collector being rigidly tightened to the upper part of the incinerator. A tube heat exchanger is connected with combustion champer and produce heat which is used for heating water which is passing through near by pipes and used for domestic purpose of municipality. Heaps of sanitary napkins with a large amount of disease causing bacteria on them pose a significant threat to the hygiene in the surrounding area. In this current research work is focused on the design and analysis of a typical incinerator to produce the heat energy by burning the waste menstrual napkin pads, for Thrissur municipality for hygienic environment and producing boiled water using for domestic purpose of municipality.

1.1 OBJECTIVE OF THE STUDY

- The main objective of this research is to design a smart sanitary napkin disposal system, which could be used to reduce the problem of disposing of sanitary waste.
- Also reduce spread of infection due to unhygienic disposal of sanitary napkins, redude environmental pollution due to non-biodegradable sanitary napkins and reduce clogging of public drainage system due to spongy nature of napkins.

2. LITERATURE REVIEW

- 16 lakhs girls and women of reproductive age, most of whom experience menstruation every month
- 24%of school girls report missing school days during menstruation
- 52 % of adolescent girls are not aware of menstruation before menarche (first menses)
- 54 % of adolescents state that mothers are their main source of information on menstruation. 70% of mothers consider menstruation as dirty

- 57.6 % of young women between 15-24 years currently use safe, hygienic menstrual absorbents,
- 60 thousands pads (approximately) disposed monthly, majority of which are not biodegradable
- Risk associated with use of unclean cloth is 2.5 times higher for the development of cervical abnormalities (CIN III) and malignancy compared to the use of clean cloth or sanitary napkins
- 63 % girls do not change their absorbent in school

Fig-1: Menstrual Health Management (MHM) Value Chain1

Table -1: Menstrual waste disposal practices among adolescent girls in India

Disposal of menstrual absorbent	Total pooled proportion	Rural pooled proportion *	Concerns
Throw with routine waste/dustbin	45	28	Unsegregated menstrual waste enters the solid waste stream and is subject to the same treatment as other solid waste – placed in landfills to disintegrate over hundreds of years
Thrown away in the open (open spaces, rivers, lakes, wells, roadside etc.)	23	28	Menstrual waste can contaminate water sources, clog drains and sewerage systems
Burning (open)	17	15	Burning of commercially available pads at low temperatures can release toxins such as dioxins and furans into the surrounding atmosphere
Burying	25	33	Shallow burial is often practiced, and products can be easily exposed or dug up by animals. Not all products disintegrate when buried
In toilets (flushing down the toilet, throwing in pit latrine)	9	10	Used pads mixed with faecal sludge, complicates removal and disposal of that sludge (in the case of septic tanks) or interferes with the production of usable manure (in the case of leach pits). They can also clog up sewerage systems

Fig-2: Different Types of Sanitory Pads

Table-2: Comparison between sanitory pads

Reusables	Compostable Disposable	Non Compostable Disposable
•Cloth pads, Hybrid pads (with non cloth barrier) and Menstrual Cups •Products that can be used multiple times. •Life span of 1-10 years resulting in waste reduction. •Hygienic use requires care and maintenance. •One time cost maybe high but life cycle cost is usually lower than disposables	•Sanitary pads with compostable raw materials and Tampons •Disposable products with high degree of compostable content. •One time use and materials conducive to composting; limited impact on disposal. •Layers sealing aborbent layer should have high degree of compostability. •Limited players in India with only one product variant each. •Currently higher cost than noncompostable versions	•Sanitary pads and panty liners with noncompostable raw materials like plastic barriers, super absorbent polymers etc. •Disposable products with minimal compostability. •One time use with compostable absorbent layer typically sealed within non-compostable layers. •Can take 250 years to fully decompose. •Largest market share and reach in India with multiple players

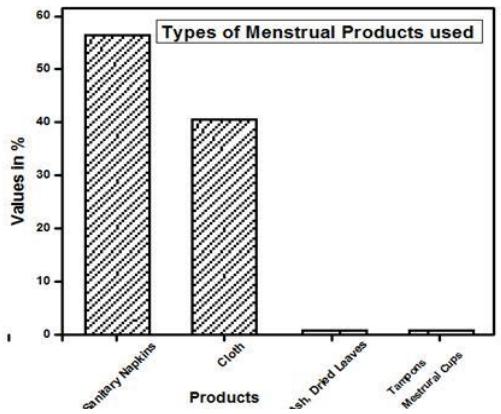


Fig-3: Different menstrual products used by women/girls

2.1 CONSIDERATIONS FOR INCINERATORS

- Type, composition, volume of product disposed of
- Setting for use and placement of incinerator
- Minimum and maximum burning temperatures
- Adherence to CPCB standards for emissions
- Operations and maintenance

Table-3: Procurement process for incinerators

Phase	Elements
Program Planning	Defining incinerator requirements
	Settings specifications: ➢ Product information ➢ Regulations ➢ quality assurance provisions ➢ Construction ➢ Training and maintenance
	Selecting equipment based on: ➢ Capacity and expertise of the company to provide quality control andprocure materials required to build and operate the incinerator ➢ Local availability of appropriate materials required to build the Incinerator ➢ Availability of local agencies with technical capacity to correctly and accurately construct the incinerator ➢ The number of incinerators purchased and the ability of the manufacturer to meet supply needs
	Budgeting and planning for funding: ➢ Cost of equipment ➢ Cost of running equipment (fuel costs, electricity) ➢ Operations and maintenance costs
Procurement	Planning for procurement
	Development of tender documents and inviting proposals
	Selecting supplied (according to set criteria)
	Developing and signing of contract

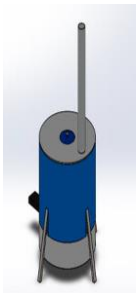
Performance	Contracting performance monitoring and maintenance

2.2 WHEN SELECTING AN INCINERATOR DESIGN, FOLLOW THESE STEPS:

- Familiarize self with incinerator considerations in terms of design and CPCB standards
- Determine the district's needs for treatment and disposal of menstrual waste solutions
- Assess the existing infrastructure of the institutional or community setting
- Determine availability of local resources to support construction and operation of Incinerators
- Assess policy environment (budgetary allocations for incinerators)
- Develop cost estimate
- Identify incinerator designs that meet standards and determine which units to procure

A list of commercially available incinerators is provided. However, before purchasing such incinerators, procurers much ensure that they meet design standards (Annexure 8) and emission standards as specified by CPCB.

Table-4: Types of Incinerators

TYPES OF INCINERATORS			
Incinerator type	**Description**	**Advantages**	**Disadvantages**
Clay pots (*matka*) 	1.Made of terracotta 2. Typically placed in the house	1. Low-cost 2.*Matka*seasily available in neighbourhood markets 3. Easy to use, particularly in rural households 4. Use locally available fuel (e.g., paper, kerosene, wood)	1. No measures to control toxic emissions produced when burning plastics and chlorinated products used in bleaching cellulose. Toxic emissions potentially harmful to human health, especially when incinerator is stalled in populated areas or in households, schools 2. Burns at low temperatures not exceeding 300 degrees Celsius and may not be efficient burners (residues may include ash, crystals, and even charred plastic). Depending on moisture content, may take considerable time to burn. 3. Ash may not be safe to use for gardening purposes 4. High variability in design- do not adhere to Central Pollution Control Board (CPCB) standards for emissions 5. Best suited for napkins with high
Low-cost, locally made incinerators 1. Terracotta 2. Reinforced cement incinerator 3. Brick or tin incinerator (MHM Guidelines, Technical Guide 2 showcases these incinerator types) 	1. Made of terracotta, brick or tin 2. Manually operated, fire/fuel based incinerators (not electric or solar energy based) 3.May adhere to simple design features such as a single combustion chamber, loading door, chimney 4. Often found in schools	1. Low-cost 2. Easy to install in institutional settings: schools, community toilet complexes 3. Easy to use and maintain 4. Use locally available fuel (e.g., paper, kerosene)	

			cellulose content, not those that with super absorbent polymers (SAP)
Electric incinerators (small scale and large scale)	1.Wall mounted incinerators 2. Standing incinerators 3. Runs on electricity 4. Often found in schools	1. The more expensive incinerators have emission control features (e.g., filters) 2. Runs on electricity, no need for other fuels 3. Some models may have quality certifications 4. If safe, can be installed in institutional settings (schools, colleges) and community toilet complexes.	1. Dependent on electricity supply 2. Costly (especially those with high capacity) 3. Unclear whether they can efficiently burn napkins with high moisture content and SAP (lack of evidence) 4. High variability in design, variation in the extent to which these incinerators adhere to CPCB standards 5. Require trained operator and routine operations and maintenance 6. No standard quality certification
High-temperature incinerators for biomedical waste	1. Specifically designed to incinerate bio-medical or health care waste at scale	1. Waste burned in large scale incinerators designed to deal with bio-medical waste 2. Waste burned together at a central incinerator facility typically located away from populated areas	1.Requires collection, transportation, and storage of segregated menstrual waste to the central bio-medical waste treatment facility for incineration. Limited facilities exist in India at present
Bio-medical waste treatment facilities	1. High-tech models that deal with all types of bio-medical waste	1. Can incinerate all types of napkins (those with high cellulose content, high moisture content, and those with SAP) 2. Clear CPCB guidelines exist for such incinerators	1. Would necessitate classification of menstrual waste as bio-medical waste requiring treatment by all stakeholders
Incinerators with waste to energy technology	1. A **waste-to-energy** plant is a waste management facility that combusts wastes to produce electricity or energy for productive use	1.Waste is incinerated to produce energy/electricity (i.e., productive use of waste) 2. Combustion happens in highly controlled environments carefully regulating temperature and pressure, potentially controlling for emissions even at low temperatures 3. Innovations in waste to energy	1.Few waste to energy plants exist in the country, and those that do operate at a large scale at select locations 2. Lack of clarity on design features and emission controls 3. Costly 4. Waste to energy innovations applicable to community and

		incinerators for community and institutional use are underway. 4. Can incinerate all types of napkins (those with high cellulose content and those with SAP)	institutional settings are still under development and will take time to pilot, test for efficiency and safety, and be available in the market

2.3 DESIGN AND OPERATIONAL FEATURES FOR SMALL-SCALE BIO-MEDICAL INCINERATORS (WORLD HEALTH ORGANIZATION)

1. Operate within a temperature range of 650° to 1,000°C
2. Have at least two incinerator chambers
3. Have a minimum of one second of smoke-residence time
4. Effective waste reduction and waste segregation
5. Training of incinerator operators on appropriate start-up and cool-down procedures,
maintenance of optimal operating temperatures, visible emission monitoring, appropriate loading/charging rates, proper ash disposal, recordkeeping to track quantities of waste destroyed and auxiliary fuel used, and occupational safety.
6. Periodic maintenance to replace or repair defective components (e.g., inspection and spare parts inventory).
7. Placement of incinerators away from populated areas or where food is grown.
8. Enhanced training and management; the availability of an operating and maintenance manual, management oversight, and maintenance programs.

Table-5: Emission standards for incinerators

Guidelines	Details	Source
CPCB standards for Common hazardous waste incineration	Specifies emission standards of various gasses. However, this is for a common incineration facilities aggregating waste from several industries	http://mpcb.gov.in/images/hwincinerator.pdf
CPCB standards for biomedical waste incinerator	Specifies standards for treatment and disposal of biomedical waste by incineration	http://cpcb.nic.in/biomedical-incinerators/
Municipal Solid Waste Rules 2015	Specifies emissions standards and standards for incinerators for incineration of municipal solid waste	http://cpcb.nic.in/displaypdf.php?id=TkdUL1N0YW5kYXJkX0luY2luZXJhdG9yc19NU1cucGRm

Table-6: Difference between direct combustion and incineration

COMBUSTIION VS INCINERATION		
	COMBUSTION	INCINERATION
DEFINITION	Combustion is a reaction in which substances react with oxygen, producing energy	Incineration is the process of destroying something through burning
FINAL PRODUCT	Complete combustion of fuel gives carbondioxide, water, and heat.Incomblete combustion gives carbon monoxide, carbon dioxide, water, heat.	Gives ash, flue gas, and heat.

SPECIFICATION	Burning something. Not specified	Burning organic matter in waste
APPLICATION	Important in industries and in produsing fire.	Important as a waste treatment process

2.4 STACK HEIGHT

- Stack height shall not be less than 30 meters, in any case.
- Stack height requirement based on sulphur dioxide emissions by using the equation

stack height = 14 $(Q)^{0.3}$ [where, Q is the emission rate of SO_2 in kg/hr]

- By using simple Gaussian plume model to maintain ambient air quality requirements for all concerned parameters, in the receiving environment.

The required stack height shall be the maximum of the above three considerations.

A.Chourasia Sandhya Bhagawat, Dr. Tambolishabanam, Mali Satish (2019): This project gives a solution for destroying napkin waste in a very hygienic way. This is portable system to destroy napkin waste, using Incinerator. These systems also help to achieve the "Swachha Bharat" mission and avoid the large amount of diseases. Napkin disposer too can be fabricated and integrated with the vending machine, so that dispensing and disposing can be achieved in a single unit.

B. Madheshwar Subhramaniyan; Anandha Moorthy Appusamy; Prakash Eswaran (2019): The present research deals with an effective solution to dump and dispose the menstrual waste with the help of an incinerator. The system involves an incinerator which uses electricity to heat the heating coil which in turn will lit up the sanitary napkins when dumped into the incinerator. As a responsible citizen of our country is to maintain the environment neatly ,taking it in mind the model has been designed and also ensures the performance of it.[2]

C. Rutujakulkarni, Rajnandini Lohar, Neha Wani (2018): The problem of improper waste is major road block to our achieving 'Swachha Bharat' missions goal to create a clean India. This waste is problematic for several reasons. This project gives a solution for destroy napniks waste in a very hygienic way. This is portable system for destroy napkins waste using Incinerator. This system also helps to achieving the 'Swachha Bharat' mission and avoid the large amount of diseases. Insufficient information is available to women on the environmental impacts of menstrual waste and on alternative behaviors which reduce the impact. With no knowledge of how to dispose napkin's, most women just throw them in the garbage bin which usually gets mixed up with dry, wet and hazardous waste. [3]

D. K. Samba Siva Rao, K. Harish, M. Kavin Kumar, D. Vishnu Harish (2018): The system works on the automatic napkin dispenser in toilets and places that keep track of available napkins and inform the person concern when fewer napkins are available. Napkin Disposer too can be fabricated and integrated with vending mahine, so that dispenser and disposing can be achieved in a single unit. [4]

E. Pooja G. Nidoni (2017): municipal waste is one of the major problems in modern societies even though the significant efforts to prevent, reduce, reuse and recycle. At present municipal solid waste incineration in waste-to-energy plants is one of the main management options in most of the developed countries. The attempt is made to utilize these byproducts effectively for the welfare of living beings. [5]

3. MATERIALS AND METHODS

3.1 SOLID WASTE MANAGEMENT OF CORPORATION OF THRISSUR

Solid Waste Management works of Thrissur Corporation at Laloor mainly includes the proposal of developing the waste processing and disposal facility of 30 tones per day .The proposed site for sanitary landfill development is located at Laloor (about 4 km from city centre) spreading over an area of 4.53 Hectares. The site is being used by the Municipal Corporation for the past two decades, for waste processing and disposal.

The design of waste processing and disposal facility comprise of following components:

- Re engineering the existing waste deposits at the present disposal area.
- Developing a sanitary landfill facility for the future waste disposal.
- Upgrading the existing waste processing facility
- Environmental protection.

Fig-4: Removal of waste in segment B

Fig-5: View of Excavated Material in segment B

Fig-6: View of Segment B after removing the haphazardly dumped waste up to ground level

3.2 DATA COLLECTION

The **Thrissur Municipal Corporation** is the civic body that governs the Thrissur city in Kerala, India. It is the third largest city Corporation in the state of Kerala by area and fourth largest in population. Established as a Municipality since 1921 under the Cochin Municipal Regulations, it is responsible for civic infrastructure and administration; the distribution of electricity and water for Thrissur city. The Corporation manages 101.42 km of Thrissur city limits of through 55 wards through five zones Ayyanthole, Vilvattom, Ollukkara, Ollur and Koorkanchery.

Table-7: Thrissur Corporation Wards

NO	THRISSUR CORPORATION WARDS
1	Punkunnam
2	Kuttankulangara
3	Patturaikkal
4	Viyyur
5	Peringavu
6	Ramavarmapuram
7	Kuttumukku
8	Villadam
9	Cherur
10	Mukkattukara
11	Gandhinagar
12	Chembukavu
13	Kizhakkumpattukara
14	Paravattani
15	Ollukara
16	Nettisery
17	Mullakkara
18	Mannuthy
19	Krishnapuram
20	Kalathodu
21	Nadathara
22	Chelakkottukara
23	Mission Quarters
24	Valarkavu
25	Kuriachira
26	Ancheri
27	Kuttanellur
28	Patavarad
29	Edakunni
30	Thaikattussery
31	Ollur
32	Chiyarum South
33	Chiyarum North
34	Kannmkulangara
35	Pallikulam
36	Thekkinkadu

37	Kottapuram
38	Poothole
39	Kokkalai
40	Vadookara
41	Koorkenchery
42	Kanimangalam
43	Panamukku
44	Nedupuzha
45	Karyattukara
46	Chettupuzha
47	Pullazhi
48	Olarikara
49	Elthuruth
50	Laloor
51	Aranttukara
52	Kanattukara
53	Ayyanthole
54	Civil Station
55	Puthurkkara

Table-8: Quantity of waste generation

SI.NO	TYPES OF ESTABLISHMENT	NO OF ESTABLISHMENTS	QUANTITY OF WASTE GENERATION/DAY
1	collages	22	58 kg
2	schools	27	37 kg
3	textiles	16	9 kg
4	Govt offices	19	6.5 kg
5	Villas	15	25 kg
6	Housing colony	20	25 kg
	GRAND TOTAL		160.5Kg

3.3 PROPOSED WORK

The current dilemma of sanitary waste management can be resolved using a solar based sanitary waste disposer system, discarding both sanitary napkins and diapers. The apparatus can run on both electric power and organic energy. Additionally, solar power is utilized by means of solar panel for the working of this system. The salient features of the designed prototype are:

- Simple installation
- Wall and floor mountable
- Electrically operated
- Grinder
- Auto thermal cut off for safety
- Stainless steel body
- CO2 filter
- Ni- Chrome coil
- Ash collecting tray
- Napkin weighing system
- Heat tube exchanger
- LCD display with temperature and timer
- Sensors
- Computerized network

The immediate impact of the proposed project is to provide hygienic and safe disposal of sanitary napkins and diapers through the installment of eco – friendly sanitary waste incinerator machines at Thrissur Muncipality. The system aims at the reduction of air and soil pollution. The outcome of the proposed work is that it helps to reduce the sanitary waste disposal to a large extent.

3.4 IMPLEMENTATION

The various steps involved in the Solar based sanitary waste disposer is depicted in fig. 4. Some of the major components of the system are explained below:

3.4.1 Battery

The battery is used to supply electric power. The battery gets charged via the solar panel and supplies power to the devices. The proposed work uses a12 V battery to store the energy.

3.4.2 Grinder

The napkins are first grinded and downed to furnace.

3.4.3 Sterilizer

A sterilizer is used to destroy microorganisms, by bringing to a high temperature with steam, dry heat or boiling liquid. It destroys the ability of the production of microbes. The human wastes from the diaper are first sterilized and then send to the furnace.

3.4.4 Tube heat exchanger

Two fluids, of different starting temperatures, flow through the heat exchanger. One flows through the tubes (the tube side) and the other flows outside the tubes but inside the shell (the shell side). Heat is transferred from one fluid to the other through the tube walls, either from tube side to shell side or vice versa. The fluids can be either liquids or gases on either the shell or the tube side. In order to transfer heat efficiently, a large heat transfer area should be used, leading to the use of many tubes. In this way, waste heat can be put to use. This is an efficient way to conserve energy.

3.4.5 Furnace

A furnace is a device used for high-temperature heating. The name is derived from Greek word Fornax, which means oven. The furnace is designed such that it withstands high temperatures and has a longer life. Inside the furnace is a tray wound with coil. This coil burns the napkin and diaper to ashes. The furnace houses a removable tray at the bottom, which collects the ash. The collected ash is disposed manually.

3.4.6 Spider coil

Spider coil serve as the heating element for the device and are responsible for burning the sanitary waste to ashes. They are easy to use. The coil should be strong enough to withstand the force offered by the napkin and diaper when it is dropped by the user. The coil should be thick so that it gets heated quickly with consuming lot of power.

3.4.7 Carbon filter

Carbon filtering is a method of filtering that uses a bed of activated carbon to remove impurities from a fluid using adsorption. Carbon filtering works by adsorption, in which pollutants in the fluid to be treated are trapped inside the pore structure of a carbon substrate. The substrate is made of many carbon granules, each of which is itself highly porous. As a result, the substrate has a large surface area within which contaminants can be trapped. Activated carbon is typically used in filters, as it has been treated to have a much higher surface area than non treated carbon. One gram of activated carbon has a surface area in excess of 3,000 m^2 (32,000 sq ft). Each carbon filter is typically given a *micron rating* that specifies the size of particle which the filter can remove from a fluid. Typical particle sizes which can be removed by carbon filters range from 0.5-50 µm. The efficacy of a carbon filter depends not only on its particle size, but also on the rate of flow of fluid through the filter. For example, if a fluid is allowed to flow through the filter at a slower rate, the contaminants will be exposed to the filter media for a longer amount of time, which will tend to result in fewer impurities.

3.3.8 Stainless steel

In order to analyze the effect of heat energy which is produced inside the incinerator, stainless steel (AISI 304) has chosen as an incinerator material. The properties of the material are shown in table 9.

Table-9: Properties of Stainless Steel (AISI 304)

Property	Thermal conductivity	Elastic modulus	Density	Tensile strength	Specific heat	Rockwell hardnessnumber
Unit	W/mK	GPa	kg/m3	MPa	J/kg K	-
Values	16.20	193	8000	515	500	92

3.4 DESIGN OF INCINERATOR

3.4.1 Design of combustion chamber

For designing the primary chamber, initially volume of the chamber is to be found out. For finding out the volume 100kg of waste is dumped as a heap and the volume of the volume of the heap is considered.

Volume of the heap = 5m3

Assuming a suitable depth of 2.2m, we can find out the area of the chamber

Area = v/depth = 5/2.2 = 2.3m2

Assume length and breadth as 1.5:1

Therefore L/B =1.5/1

L =1.5B

Dimensions of the primary chamber = L*B*H

Therefore A = L*B

2.3 = 1.5B*B

2.3 = 1.5B2

B = 1.238m

L = 1.857

Table-10: Designed Parameters of Incinerator

Capacity	60kilogramm
Charging rate(when necessary)	20kg/minute
Primary chamber	1.2m3
Insulator thickness	0.05m

Expected heat release from waste	1,101,471.85kJ
Amount of stoichiometry oxygen require	100.5kg
Amount of air needed at 21 percentage O2	478.571kg
Natural gas require for auxiliary heat supply	27.063m3
Temperature of primary chamber	400-700 0c
Outer wall temperature	31 0c
Stack Height	30m

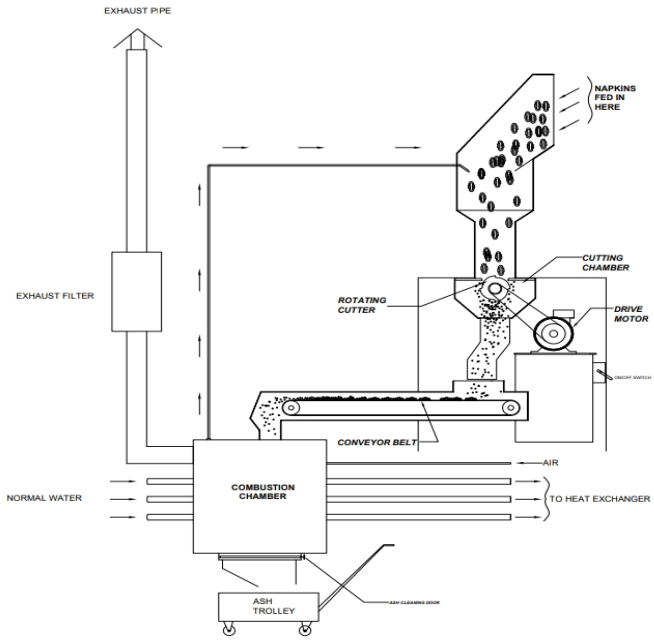


Fig-7: Autocad drawing of Napkin Disposal System

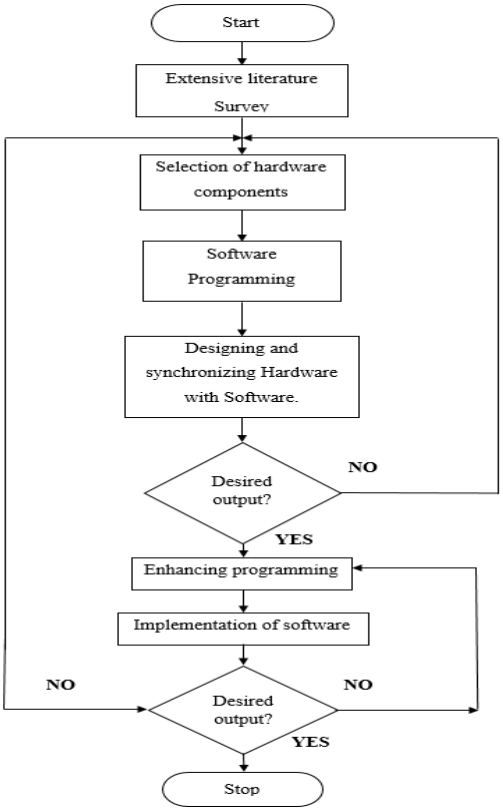


Fig-8: Machine process flow

3.5.3 Working of Napkin Incinerator

Background of The Invention: The disposal of sanitary napkins has been problemsome, especially in public facilities such as lavatories. Attempts to dispose of these items by flushing them down the toilet have resulted in clogging of the toilet or of the plumbing associated therewith. Further attempts to provide ordinary receptacles in the public lavatories have also not met with success since these receptacles have not been used by the general public. While attempts have been made to solve the problem of disposing of sanitary waste, such as human excrement, by incinerator systems, no prior attempts have been made to satisfactorily dispose of sanitary napkins in such systems. Furthermore, the systems of the prior art concerned with sanitary waste disposal in general have been found to be cumbersome in construction and too costly for practical adaptation to dispose of sanitary napkins in public lavatories.

The Invention :This invention relates to a portable sanitary napkin incinerator comprising a chamber having therein a heating unit arranged in grid fashion for supporting the sanitary napkin. The chamber has heat reflecting surfaces for concentrating the heat to a central portion in the chamber. The chamber also is provided with a napkin inlet and a removable tray, positioned below the heating unit. Communicating with the chamber, there is positioned tube heat exchanger to heat water inside the tubes whish from a water inlet.and positioned a filter assembly to filter the undesirable odors and fumes emanat ing from the chamber

so that the filtering gas may be routed out of this incinerator in a clean and harmless state.

This present invention thereby contemplates an essentially simple portable construction adapted to be hung on any wall in a lavatory in order to thereby conveniently, efficiently and economically dispose of sanitary napkins.

- After switching on the incinerator the first process that takes places is grinding.The grider grinds the napkin to small pieces of about 0.5 cm.The grinded pieces are the passed on to conveyor belt
- The grinded pieces are the passed on to combustion chamber via conveyor belt.
- At the combustion chamber a nichrome coil which is preheated when the system is on receives the grinded napkins
- The napkins piece thus get burnt at the preheated coil and converts to ash it is collected in the ash trolly.
- A heat tube exchanger is used to utilize the heat inside the chamber to receive heat water
- The gases from the burning of the napkins is passed to the environment through exhaust pipe .
- A gas passes through carbon filter to undergo filteration process before it reaches the environment

1. A sanitary napkin incinerator comprising:
(a) a heating chamber having (i) a heating unit therein arranged for supporting and heating the napkin;
(ii) heat reflecting plates having surfaces arranged therein to reflect the concentrated heat from the heating unit to a central portion of the chamber; and
(iii) an inlet means for introducing the napkin to the heating unit;
(b) a removable tray positioned below the heating unit; and
(c) a filter assembly positioned in communication with chamber and an outlet in chamber to filter undesirable odors and fumes emanating there from through said outlet.

2. The sanitary napkin incinerator of wherein said reflecting surfaces are spaced from one another and are positioned outwardly of said heating unit, said surfaces diverging upwardly from a point below the heating unit.

3. The sanitary napkin incinerator of wherein said chamber also is provided with a hood arranged above said heating unit, said hood communicating with the filter assembly, and a door into the incinerator operatively connected to means for opening and closing said material inlet.

4. The sanitary napkin incinerator of wherein said hood comprises a pair of walls which converge upwardly towards the filter assembly.

5. The sanitary napkin incinerator of wherein said filter assembly comprises at least two filter elements arranged in juxtaposition, such that the odors and fumes pass through both filter elements, one of said filter elements characterized by being susceptible to retaining undesirable odors, the other being susceptible to retaining undesirable fumes.

6. The sanitary napkin incinerator of including a switch connected to said heating unit for activating and deactivating it.

7. The sanitary napkin incinerator of claim 6 wherein said switch is provided with a temperature sensitive means for deactivating the heating unit in response to a temperature in the heating chamber.

8. The sanitary napkin incinerator of wherein said switch is provided with a timer for deactivating the heating unit in response to a specified time interval.

9. The sanitary napkin incinerator of wherein said switch is provided with a means for activating the heating unit in response to the closure of said inlet means.

10. A sanitary napkin incinerator comprising (a) a chamber having (i) a heating coil therein arranged in a grid form to support and heat a sanitary napkin; and
(ii) a pair of spaced plates having planar surfaces which are positioned outwardly of heating coil and diverge upwardly from a point below the heating coil for reflecting and concentrating heat from the heating coil to a central portion in the chamber;
(b) a removable tray positioned below the heating (c) a filter assembly comprising two filter elements arranged in juxtaposition such that any odors and fumes from any burning in the chamber pass through both filters, one of said filters characterized by being susceptible to retaining undesirable odors, the other being characterized by being susceptible to retaining undesirable fumes;
(d) a hood arranged above the heating coil, hood comprising a pair of walls which converge upwardly toward the filter assembly to provide communication therewith;
(e) a clean gas outlet situated above the filter assembly;
(f) a fan, positioned between the filter assembly and the clean gas outlet to aid in the removal of the gas passing through the filter assembly from the chamber; and
g) an electrical switching mechanism connected to the heating coil for activating and deactivating the heating coil in response to a predetermined condition.

Table-11: Cost & Quantity for Sanitary Napkin Disposal Machine Unit

	Item	Size	Quantity	Price per Item	Total
1	Al sheet-ASTM/ AASME SB209	1220mmX2440mm,5mm thicknes	15 nos	150/kg	6000
2	L-section	50X50X5	100nos	36/kg	82800
3	Heat-Exchan	Dia-18mm,length	12	93.95/	6200

	ger	120 cm	nos	m	
4	Motor-Blade size 510mm ,Belt size-B-102,Rpm-1440.Capacity -360kG/Hr	580X870X1300, 75Kg	1	12372	12327
5	DeWalt cutting blade	B-102,510mm	4	1478	5912
6	GI Hollow pipe	Dia-18mm, length,5.5m	30	93.95/m	15480
7	Steel pipe Exhaust	63.5mm dia, 3.3m	1	185/kg	5735
8	INTBUYING Flat conveyor Belt System	7.8 inch width	1	58000	58000
9	GI 90ELL	90ELL-1.5XW	18	50	900
10	Screws and fittings		2 kg		2000
11	Installation cost				10000
12	Transportation cost				3000
	Total				208283
	10% profit				20828.3
	GRANT TOTAL				**RS.229111.3**

4. RESULT AND DISCUSSIONS

4.1 QUANTITY OF WASTE GENERATION

Table-12: QUANTITY OF WASTE GENERATION

SI.NO	TYPES OF ESTABLISHMENT	NO OF ESTABLISHMENTS	QUANTITY OF WASTE GENERATION/DAY
1	collages	22	58 kg
2	schools	27	37 kg
3	textiles	16	9 kg
4	Govt offices	19	6.5 kg
5	Villas	15	25 kg
6	Housing colony	20	25 kg

In surveying, 160 kg /days sanitary napkin wastes are produsedin thrissur municipality. It contains 22 collages, 27 schools, 16 textiles, 19 govt offices and 35 hosing colony and villas. So disposal of sanitary napkin is major issue in thrissur municipality. Current disposal takeplace on Laloor, mainly includes the proposal of developing the waste processing and disposal facility, which is cause for more environment and soil pollution.

Table-13: Specifications of Napkin Incinerator

Capacity	100kilogramm
Charging rate(when necessary)	20kg/minute
Primary chamber	1.2m3
Insulator thickness	0.05m
Expected heat release from waste	1,101,471.85kJ
Amount of stoichiometry oxygen require	100.5kg
Temperature of primary chamber	400^0c
Outerwall temperature	31^0c
Hotwater output per hour	500l/h
Ash output per hour	10.5 kg/h

Speed of grinter	1440RPM
Speed of conveyor belt	65FPM

4.2 DESIGN TEMPERATURE

According to the heating value of parts of the napkin we designed and calculated the temperature is 400^0c.The theoretical temperature for napkin waste is 800^0c which is given from journals for fully combustion. But in our project, napkin is grinded, so the temperature requirement is less. So the fully combustion takeplace and temperature is 400^0c.

4.4 2D MODEL OF NAPKIN INCINERATOR

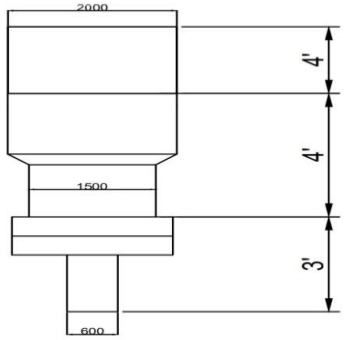


Fig-8: 2D Model side view of napkin incinerator

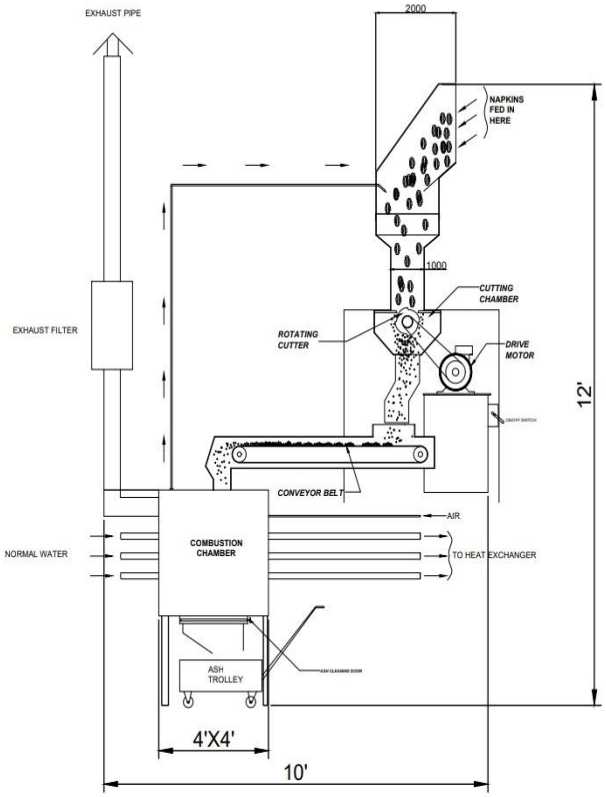


Fig-9: 2D Model of napkin incinerator

4.3 3D MODEL OF NAPKIN INCINERATOR

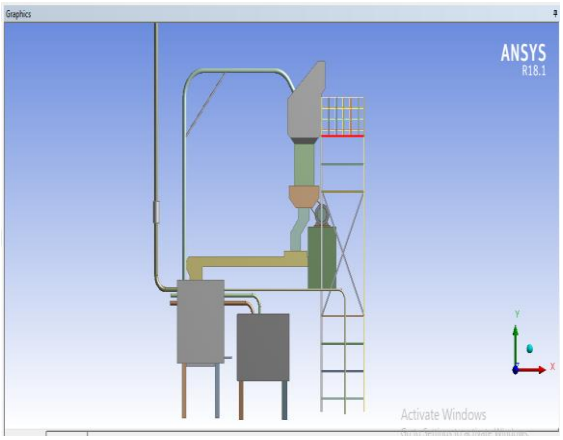


Fig-10: 3D Model of napkin incinerator

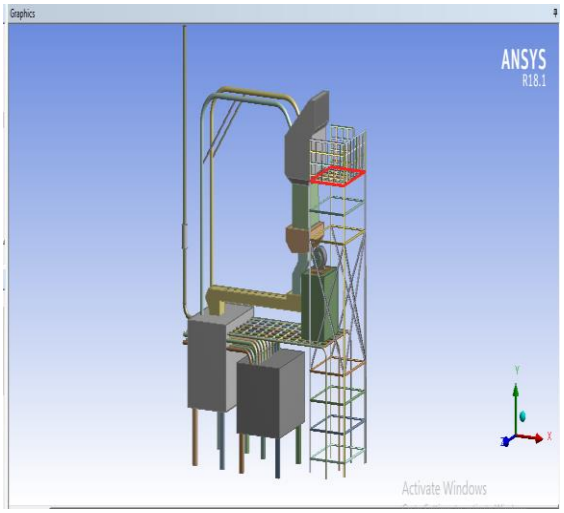


Fig-11:3D Right side view of napkin incinerator

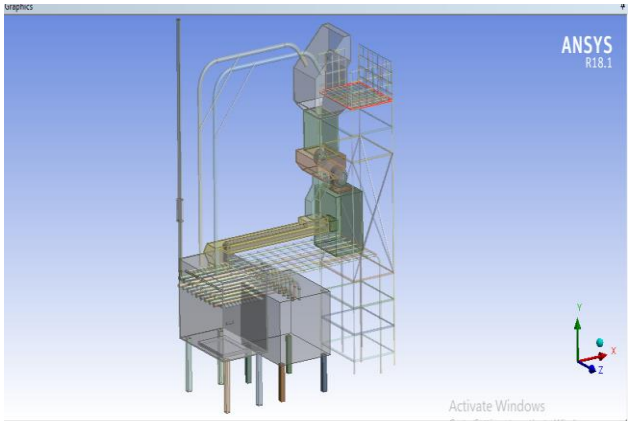


Fig-12: Representation of coil and heat exchanger in sanitarynNapkin incinerator

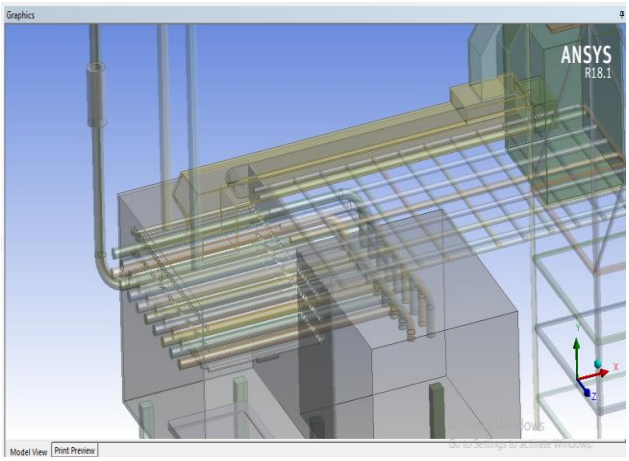


Fig-13: Distribution of coil and heat exchanger in sanitary napkin incinerator

4.4 OUTPUT OF NAPKIN INCINERATOR

Due to the grinding the napkin waste and coil heating, the complete combustion is takeplace. So it is produced ash, flue gas and heat. There is no produced carbon monoxide,carbon dioxide, and water due to the incomplete combustion. The combustion of napkin waste will complete in 40 min due to the fast combustion for 100 kg.

4.4.1 Flue gas of Napkin Incinerator

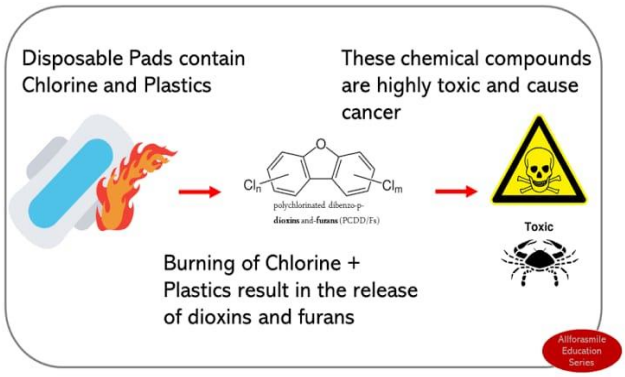


Fig -14: Flue gas of napkin incinerator

The gas output of the napkin incinerator is dioxins and furnans. It is filtered through carbon filter which is completely purified and exposed to environment efficiently.95%of purification is takeplace in carbon filter. The substrate is made of many carbon granules, each of which is itself highly porous. As a result, the substrate has a large surface area within which contaminants can be trapped. Activated carbon is typically used in filters, as it has been treated to have a much higher surface area than non treated carbon. One gram of activated carbon has a surface area in excess of 3,000 m^2 (32,000 sq ft). Each carbon filter is typically given a *micron rating* that specifies the size of particle which the filter can remove from a fluid. Typical particle sizes which can be removed by carbon filters range from 0.5-50 µm. The efficacy of a carbon filter depends not only on its particle size, but also on the rate of flow of fluid through the filter. For example, if a fluid is allowed to flow through the filter at a slower rate, the contaminants will be exposed to the filter media for a longer amount of time, which will tend to result in fewer impurities.

4.5 HOT WATER OUTPUT OF NAPKIN INCINARATOR

The hot water from the heat exchanger tube of incinerator is produced 1000l/h water. The water inlet is outside of chamber and collected in water collection chamber which is used for domestic purpose for hospitals, hotels, schools, and hostels.

4.6 ADVANTAGES

- User-friendly interface.
- Higher burning ability within short time.
- Residues will be directly flushed out into drainage.
- Exhaust is released in the drainage.
- Processes is fully automatic.

4.7 APPLICATIONS

- The napkin Incinerator has a New Automatic Flush Technology, which will flush the

waste ash residue just after the napkins are combust completely.

- In The napkin Incinerator, smoke passing from drainage is purified and the pollution

contents are efficiently reduced with the help of Carbon Filter. The outlet is passed through
the drainage pipe only.

- The napkin Incinerator has a smart display, which requires no manual tasks, and the

combustion takes place automatically. The waste ash and smoke is drained out via flush and
Carbon filters. The display indicates the status of the machine.

- The napkin Incinerator has a Foul Odor Emitting Technology, which removes the foul

odor of the vicinity.

- The napkin Incinerator is lightweight and most importantly is cheap and affordable by

various NGOs.

5. CONCLUSION

The purpose of our job is to keep environment clean by means sanitary napkin disposal method, we also should provide solution to dispose sanitary napkin and steer clear of present ways of disposal such as sanitary napkins are blended with regular trash, and it isn't easy to distinguish them and remove off them. Incinerating that this napkin is the sole method of eliminating these problems, therefore installation of the system is manufactured. Scientific, sterile, a safe and quick way of disposal of sanitary napkin is disposing them in temperature to ash that is low. The system will also clean the hazardous fumes before they are released

to atmosphere through chimney. This system will use wet scrubber for that purpose. Also the material used for insulation will make the system more compact.

The improper disposal of menstrual waste in open environmental condition will affect the health of the surrounding population in a great manner. With the intention that, this proposed setup is to overcome the tremendous hazard of disposal of these wastes.

1. Waste generation rate in Thrissur muncipality varies from 100-150kg/day.

2. Current disposal of solid waste at laloor which is 7.6 km away from thrissur.

3. An incinerator has been designed to treat the sanitary napkin waste which is being generated in thrissur muncipality with a capacity of 100kg/day.

4. Design temperature is 400^0c.

5. Size of combustion chamber is 4'x4'x4'.

6. 2D model of napkin incinerator created.

7. 3D model of napkin incinerator created.

8. cost estimation created

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