Sanitary Pad Disposal Machine

Sonam Mishra ,NarendraSonvatkar, Nikhil Naraje, Shrikrushna Gawande

Abstract-Sanitary waste is non-biodegradable in nature and there is no effective way available to deal with this waste and also due to social stigmas attached to mensuration in our country, the sanitary waste ends up in a dustbin. In present work the system involves an incinerator which uses electricity to heat the heating coil which in turn will lit up the sanitary napkins which when put into it. The principal 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 principal 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 nichrome alloy is used. The material used for the body of the incinerator is stainless steel as it is poor conductor of heat therefore it will not get heated up quickly during the use of the incinerator. The sanitary napkins primarily surrounded by papers will have an ignition temperature of around 250-to-300-degree Celsius. When the 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. The disclosed pot is scalable in all aspects because the materials preferred for this investigation is easily reachable in the marketplace. This system can be used in all schools, colleges, hospitals and offices etc.

1 INTRODUCTION

Every month sanitary waste disposal has become an increasing problem in the world as the plastic used in disposable sanitary napkins are not bio-degradable and lead to health and environmental hazards. The impact is more pronounced because of the unorganized ways of municipal solid waste management and poor community collection disposal and transportation networks in the cities and villages and also due to social stigmas attached to mensuration in our country,the sanitary waste ends up in a dustbin. Further one major issue of sanitary waste has always been their categorization, i.e., whether it is biomedical or plastic waste. Soiled napkins, diapers, tampons and blood-soaked cotton, which are household waste according to Solid Waste Management (SWM) Rules 2016 are being disposed after segregation into biodegradable and non-biodegradable components.

However, the Bio-Medical Waste Management Rules,2016 indicate that items contaminated with blood and bodily fluids, including cotton, dressings, soiled plaster casts, lines and bedding, are bio-medical waste and should be incinerated, autoclaved or microwaved to destroy pathogens. The lack of concern for sanitary waste management in our country is reflected in the fact that there is no reliable statistics on the subjects. Due to the lack of segregation of waste, there is hardly any documentation in this area, so through instructions for handling and management of sanitary waste are essential. As per the study conducted in 2011, titled 'Sanitary Protection: Every woman's health right' estimated that only 12% of the 335 million mensurating women have access to disposable sanitary napkins. Environment portal Down to Earth estimated that 432 million pads are disposed. This waste if not treated in a proper way, is toxic and hazardous to human health.

Statistic in India

Acc. To NHFS

Use of sanitary product

In rural area - 48.2%

In urban area – 77.5%

Total – 57.6%Consider case of India

- Population of women in India – 497 million
- Menstruating women- 335 million 35.5 crore
- Total no. of women uses pads- 20.448 crore
- Average Pads used per periods ~=13

◎ Therefore, pad used per month=20.448*13=266.34 Cr.

◎ Per day use of pads=266.34/30=8.87 crore/day

That is huge number, therefore it means, if we do not address this at single day the growth of problem will take leads in crores.

- Now if we imagine this for the year,

Therefore, pads used per year=266.34*12

=3196.08

crore/yr.

- Now let's relate it with area wise

Area of India- 3.287 million km^2

(3,287,263 square kilometres)

Therefore, pads/km= 3067.2/3,287,263

=9330 pads per km^2

For understanding purpose let's relate with human

Density of human per km^2=426.1/km^2

It means =(pads/km^2)/(density/km^2)

=9330/426.10

=22

Hence there will be 22 pads between two people.

If there are 22 pads around a single man in open condition it causes a big health issue.

If they are left in the open, they are sore sight. May lead transmission of infections like hepatitis B and hepatitis C.

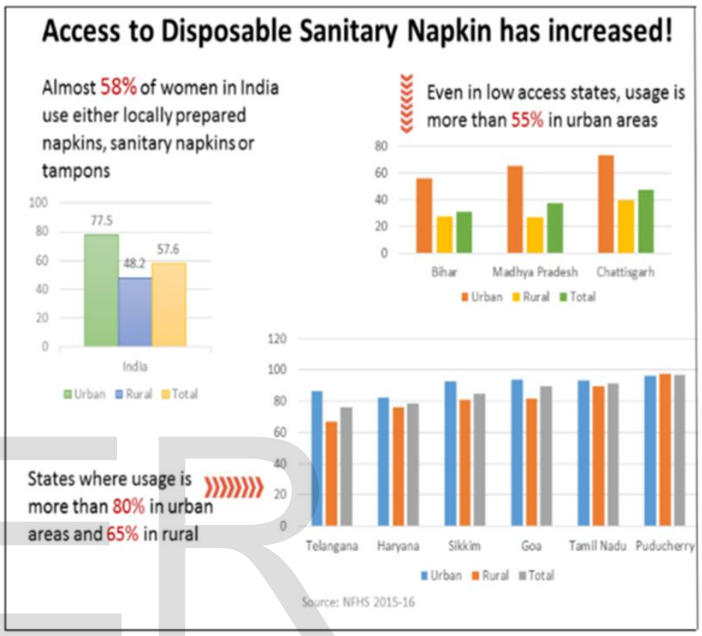


Figure no.1.1 Bar Graphs of Use of Sanitary Napkin Around India

2 LITERATURE REVIEW

In theirpaper,Anna Maria Van Eijik,GaraziZulaika,MadelineLenchner,Linda Mason, studied the women, girls and transgender people require hygienic menstrual products monthly to live healthy and productive lives. During this analysis,they assessed the menstrual cup, combining information from medical and grey literature to inform choice and strengthen the evidence base for programmes supporting menstrual health, such as for schoolgirls in low-income and middle-income countries or among refugees. Leakage was similar or less when using menstrual cup than when using disposable pads and tampons. The adoption of a menstrual required a

familiarisation phase and peer support seemed to be important for uptake in low-income and middle income countries. Challenges in resource constrained settings(e.g. lack of sanitation, hygiene and privacy) did not stop women from using the cup. They concluded that around 70% of participants in 13 studies declared wanting to continue use. They also identified several incidental case reports of vaginal damage, toxic shock syndrome or urinary track complaints after menstrual cup use, and difficulty retrieving the menstrual cup was also reported.

Sirisha Deepthi Sornapaudi,MeenuShrivastava,ShaliniSoni and Shweta Jha, owing to gaps in research studies regarding menstrual hygiene among college going students, this study was planned to gather information regarding awareness of feminine hygiene products (FHP).They found that very few of college going students knew of the environmental hazards of FHP. Respondents were unwilling to switch over to other types of FHP; reasons for non-adoption were also indicated. A majority of the respondents knew of the environmental hazards of FHP. Respondants indicated that proper disposal is the need of the hour. There is an urgent need to formulate an ideal disposal is the need of the hour. There is an urgent need to formulate an ideal disposal pattern than simply wrapping the used sanitary pads and throwing in the dustbin. A year's worth of a typical feminine hygiene product leaves a carbon footprint of 5.3Kg CO2 equivalents. They concluded that efforts are needed to promote the use of sustainable alternatives and to educate the community at large regarding the appropriate usage, disposal which may help in reducing the environmental pollution.

Barman A,Katkar P, Asagekar SD performed experimental work on cotton as healthy production of jute in eastern India facilitates this fibre nature has encompassed every solution within itself. With more with 65-70%cellulose content and highwater affinity. Jute is having and more use of natural fibre in hygiene product will make it eco-lower price than cotton fibre than cotton is that the fibre length is the product will lower accessible to low income group women. As the much shorter case of jute easing the preparation of cellulose pulp product is biodegrable,prevent non-biodegrablewatsegeneration.They also found that Sanitary pads from banana fibre were developed by SHE(Sustainable Health enterprise)a non-profitable NGO, their intention was to make we as technologist have a find a sustainable way so that we endow a better world for next generation.

R Boroorah, H.N. Chanakya,S.Dasappa studied the performance of two commercially available sanitary napkin incinerators.On detailed preliminary investigations both the incinerator were found to have shortcomings to meet emission norms as per Indian Standards for MSW incinerators.Parameters for the comparison were combustion efficiency and emissions,basically CO and CO2,to assess the quality of combustion.They also investigation into the performance of single chamber sanitary napkin incinerators with emphasis on CO and CO2 emissions.

Shyamala Guruvarec,VasudevGuddattud performed experiment to investigate to enable better combustion inside the combustion chamber, it was established that airflow distribution and mixing was necessary. The paper analyses the performance of the incinerators towards optimizing the air flow location and the air flow rate in the combustion chamber. Based on these studies it was evident that the commercially available designs are not suitable for five napkin batches, as claimed by the manufactures. A higher starting temperature(>600 C)is essential for quick heating and optimum an air supply(~10 LPM) Is necessary for reducing environmentally sensitive emissions. Results indicated higher combustion efficiency and a need for meeting the emissions norms as per Indian Standards for MSW incinerators.

Arathi P. Raoa,Hiteshshabb,etc all researched on puberty among girls with cerebral palsy esepically from India.Knowledge of sexual development and menstrual issues can guide towards better care for these girls.To study the onset of sexual development and patterns of

menstrual issues among girls with cerebral palsy who attended cerebral palsy clinic.

Marni Sommera,ChantalFigueroab,ChristinaKwauke,etc worked on, attention to menstrual hygiene management in schools, an analysis of education policy documents in low- and middle-income countries. We conducted an analysis of select education policy documents in 21 countries, including a frequency count and narrative analysis of relevant keywords. Findings suggest that existing national education policies inadequately provide for sufficient water and sanitation facilities or other menstruation related improvements needed in schools. More recently developed WASH in schools policies present examples of potential approaches for education stakeholders to better address girls menstrual needs in school through policy and program responses.

Central Pollution Control Board Ministry of Environment ,Forest and climate change ,Govt. of India has reserched on how sanitary waste disposal has become an increasing problem in india as the plastic used in disposal sanitary napkins are not biodegradable and lead health and environmental hazards.The impact is more pronounced because of the unorganized ways of municipal solid waste management and poor community collection,disposal and transportation networks in the cities and villages.Further,one major issue of sanitary waste has always been their categorization i.e.,whether it is biomedical or plastic waste. Soiled napkins,diapers,tampons and blood soaked cotton,which are household waste according to solid wate management(SWM)Rules,2016 indicate that items contaminated with blood and body fluids,includingcotton,dressings,soiled plaster casts, lines and bedding, are bio medical waste and should be incinerated, autoclaved or microwaved to destroy pathogens. The lack of concern for sanitary wate management in our country is reflected in the fact that there is no reliable statistics on the subject. They concluded that due to the lack of segregation of waste, there is hardly any documentation in this area, so through instruction for handling and management of sanitary waste are essential. As per the study conducted in 2011,titled"Sanitary Protection: Every women's health right' estimated that only 12% of the 335 million mensurating women have access to disposable sanitary napking.Environment portal down to earth estimated that 432 million pads are disposed every month.

National Aeronautics and space administration John C. Stennis Space Centre Science and Technology Labortary Stennis Space Centre, has studied the leaves,roots,soil and associated microorganisms of plants have been evaluated as a possible means of reducing indoor air pollutants. Additionally, a novel approach of using plant systems for removing high concentration of indoor air pollutants such as cigarette smoke, organic solvents and possibly radon has been designed from this work.The air filter design combines plants with an activated carbon filter in this study. The rational for this design ,which evolved from wastewater treatment studies is based on moving large volumes of contaminated air through an activated carboned where smoke ,organic chemicals ,pathogenic microorganisms(if present) and possibly radon are absorbed by the carbon filter.Plant roots and their associated microorganisms then destroy the pathogens viruses, bacteria and the organic chemicals eventually converting all those air pollutants into new plant tissue. It is believed that the decayed radon products would be taken up by the plant roots and retained in the plant tissue. Experiments are currently being conducted to test this hypothesis for NASA at the department Oak Ridge National Laboratories in Oak Ridge,Tennesse.

RutujaKulkarni,RajnandiniLohar 2,Neha wani Department of electronics and telecommunication highlighted the problem of improper disposal of menstrual waste is measure road block to our achieving "Swatchhbharat" mission goal to create a clean India.This waste is problematic for several reasons. 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. Young

girls and even certain older women's are not aware of the hygiene problems cause by improper disposal of napkins. This system is one of the best way to dispose menstrual waste is to burn napkin using electrical fire based burner without allowing smoke generate in the processes to escape into the atmosphere. This steps must be taken to solve the problems that improper disposal of napkins causes to the environment and to the public health.

MadheswaranSubramianium,Anandha Moorthy Appuswamy,PrakashEshwaram,KarthikShanmugave,Santhana Kumar Sadaiappan,MaheshwaranPeriyasamy researched on 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. 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 nichrome alloy is used. The sanitary napkins primarily surrounded by papers will have an ignition temperature of around 250 to 300 degree Celsius. 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 the incinerator. The incinerator is surrounded by a refractive material, primarily silicone di-oxide. The outer most layer of the incinerator is made up of Bakelite for easy handling. The disclosed device is scalable in all aspects because the materials preferred for this investigation is easily reachable in the marketplace .Thisdeviece can be used in all schools,colleges,hospitals and offices.

Oisín Ó. Briain, Ana Mendes, Stephen McCarron, Mark G. Healy, Liam Morrison studied that the source elements of the ocean plastic crisis is key to effective pollution reduction management and policy. The ubiquity of microplastic (MP) fibres in the oceans is considered to derive primarily from clothing fibres released in grey water. Microplastic fibres degraded from widely flushed personal care textile products (wet wipes and sanitary towels) have not been clearly identified in aquatic systems to date. Unregulated personal hygiene and sanitary product labelling fails to identify textile materials. This study demonstrated that white MP fibres in sediments adjacent to a wastewater treatment plant (WWTP) are comparable with white fibres from sewage-related waste and commercially available consumer sanitary products. Commercially available non-flushable wipes are manufactured from either polyethylene terephthalate (PET), polypropylene (PP), or a combination of PET and cellulose. Fifty percent of brands labelled flushable are comprised of a mixture of PET and cellulose and the remainder of cellulose alone. Sanitary towels are made from PP, PE, or a combination of high-density polyethylene (HDPE) and PP. The accumulation of large quantities of washed-up sewage-related macro-debris (including wet wipes and sanitary towels) intermingled with seaweed biomass adjacent to the WWTP and was associated with a combined sewer overflow. Microplastic fibres extracted from this waste were similar to those extracted from intertidal sediments in close proximity to the WWTP over a ten-month period. In comparison, fibres extracted from locations spatially removed from the WWTP were primarily comprised of ABS, PP and polystyrene. They concluded that wet wipes and sanitary towels flushed down toilets are an underestimated source of white MP fibres in the environment. Given the global distribution and projected growth of the non-woven textile industry, there is a need for increased public awareness of MP pollution in the marine environment from the inappropriate disposal of sanitary products down the toilet, instead of diversion to alternative land-based waste management.

Yuan Chen, Abhishek Kumar Awasthi , Fan Wei , Quanyin Tan , Jinhui Li studied on Single-use plastics (SUPs), invented for the modern "throwaway society," are intended to be used

only once. They are being increasingly produced and used globally, most notably as packaging or consumables, such as SUP shopping bags or disposable tableware. We discuss how most SUPs are landfilled or incinerated, which causes pollution, consumes valuable land, and squanders limited natural resources. Only relatively small amounts are currently recycled, a hindrance to the concept of a circular economy. Moreover, SUP litter aggregation in the natural environment is a major concern. They briefly reviewed SUP contamination in various environmental media including soil, rivers, lakes and oceans around the world. In the face of mounting evidence regarding the threat posed to plant growth, soil invertebrates and other land animals, (sea) birds, and marine ecosystems,there is a growing push to minimize SUPs. Regulatory tools and voluntary actions to reduce SUP usage have been put forward, with some suggestions for minimizing SUP waste.

Matthew L. Schafer , Kyle A. Clavier , Timothy G. Townsend , Ramana Kari, Robert F.Worobel studied about the total and leachable metal content from mixtures of weathered municipal solid waste incinerator bottom ash (MSWI BA) and conventional natural or recycled aggregates was investigated with a focus on utilization of MSWI BA as a partial component in a road base. Two weathered bottom ashes were combined with various aggregates in multiple replacement percentages of up to 85% traditional aggregate, with the goal of mitigating leaching and direct human exposure risk. Al leaching was found to decrease proportionally to the mass of bottom ash included in the blended products, with over 90% reduction in blends with 85% recycled concrete aggregate (RCA). Release of Sb from the bottom ashes was predominantly controlled by solubility. Sb concentrations were reduced from 0.043 and 0.037 mg/L to 0.006 and 0.007 mg/L for facility A and B respectively blended with the highest tested proportion of RCA, near compliance drinking water standards of 0.006 mg/L. The high pH and presence of calcium-bearing minerals in recycled concrete appeared to facilitate significant immobilization of Sb in comparison to other aggregates. They observed similar results for several other elements and material blends. Results indicated that blending MSWI BA with conventional aggregates is a feasible recycling application. Blending effectively mitigates environmental risk associated with the un-encapsulated use of MSWI BA in road construction.

3 DESCRIPTIONS OF SANITARY PAD

Conventional structure and material used in sanitary napkin:

a.Top sheet:

It is designed to transfer fluid from the top sheet to secondary layers. The top sheet contains thermoplastic fibre to prevent capillary collapse of this layer, and small amount of hydrophilic absorbent fibre to allow fluid to absorb. Commercially available top.

b.Absorbent sheet:

It is interposed between top sheet and barrier layer main function is to absorb and retain the fluid. Moreover, to have comfort, absorbent core needs to be thin, soft and pliable. The core was made up of wood pulp traditionally but there is constant effort to replace it by air laid wood pulp and SAP to improve its absorption efficiency. SAP turns the absorbed liquid into a jelly-like state so that it would not retract back.

c.Barrier Sheet:

It seals the fluid from staining or leakages. It is breathable but fluid impermeable film made up of polyethylene. Few components of sanitary pad will disintegrate and be attacked by the bacteria in a public or private sewage disposal system but polyethylene or polymeric films used as a barrier sheet remain intact as this polymer are inert and are not broken down by bacteria down by

bacteria and thus pollutes the environment.

Conventional structure and material used in sanitary napkin

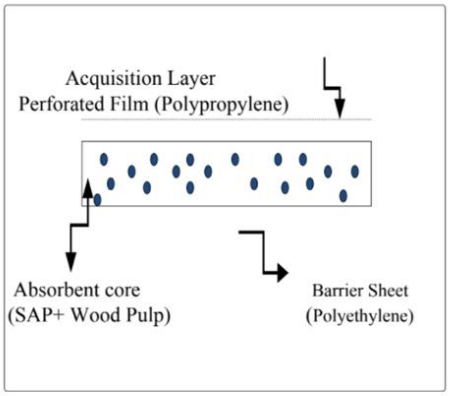


Figure No.3.1 layers of sanitary napkin

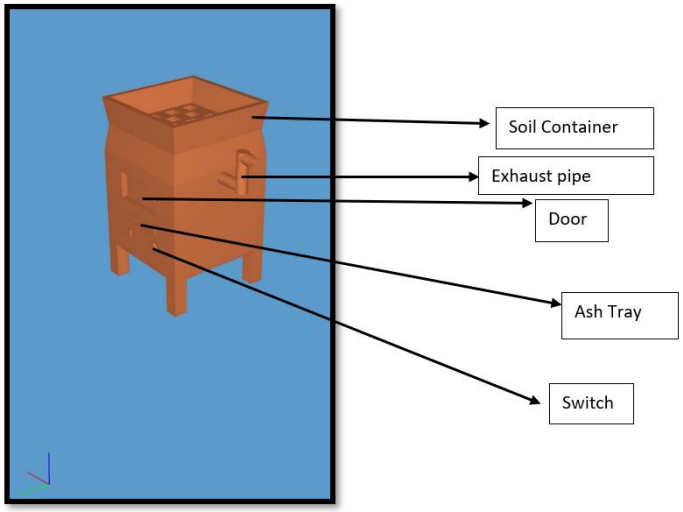
4 DESIGN STAGE

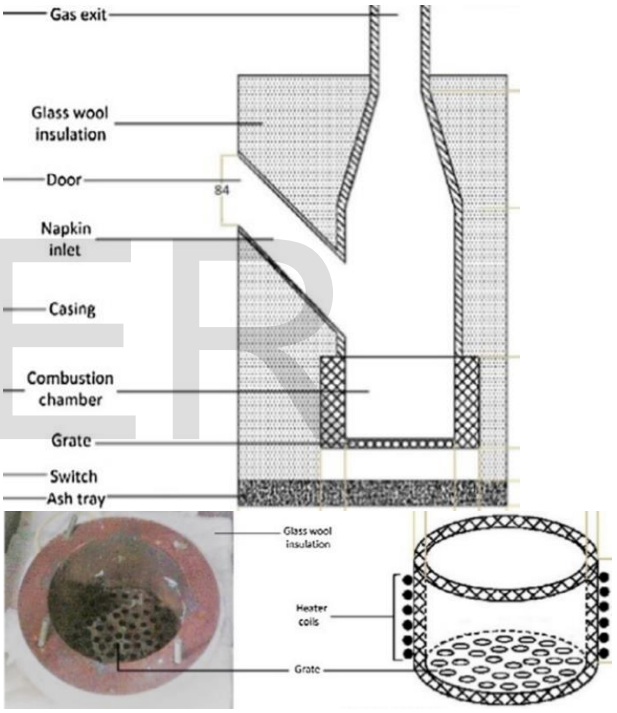
4.1 Incinerator

The innovative low-cost technology incinerator design has been proposed for proper disposal of sanitary wastes. This design is simple, secure and cost effective. The incinerator incinerates the waste like fibre in sanitary pads, cotton, sanitary wood pulp, paper etc. The waste gets rehabilitee into ash and other non-hazardous dregs. The incinerator is consumer responsive and manually operated.

4.2 Design of incinerator

The utility of the research work can be explained with the help of detailed design of the final product. The Catia software has been used to design the whole setup of the incinerator as shown in fig 1. With the intention that, it is easy to explain the project function.





4.3 Specification of Incinerator

1.Incinerator Size:

height =1m

width=1m

2. Material used: Stainless steel

3.Heating coil Material: Nichrome

4.Size of wire: 18 AWG

5.Max Temp: 760°C

6.Power capacity: 1800W

7.Input Power: 240 Volt 15 Amps

5 OPERATING PROCEDURE OF THE INCENERATOR

Open the input window at the neck of pot and put the used sanitary napkins into it. Then close the input window and switch on the power supply so that the 240 volt and 15 Amps current passes through the heating coil which gets heated up. After the attainment of auto ignition temperature of rayon(420°C) which is the major component of sanitary napkins the burning gets started then wait for 25-30 minutes. Remove the bottom ash collector as shown in fig5.1. using the handle given to the ash collector. Take away the collected waste at the bottom of incinerator in the form of ashes. Once it is cleaned then refit it properly to avoid ash leakage during the next process. The chimney tube is provided for the safe and distant exhaust of smoke out of our machine.At the top of the machine soil is put in a net mesh some of the exhaust gas is also absorbed by the soil. The entire apparatus is lined with refractory lining so that it prevents the heat transfer to the environment.

5.2 Ease of maintenance

The main concern to the success of every product is the maintenance of the product. Here the incorporated materials in this design requires low maintenance. In the outer side wall of this product is built with Stainless steel, which is heat resistant material and also overcomes the problem of rusting. Inner side of the incinerator is equipped with Silicon Dioxide (SiO2) as refractory material which has longer life and also a low cost material. The heating coil is manufactured by Nichrome which the most common is heating element used in all type of heating elements.

5.3 Sustainability

The proposed design is rigidly construct with heat resistant and corrosion resistant material to ensure the longer life of the product. Since it is a stationary operating machine, it does not subject to external loads. The main component which is responsible for proper operation of the system is heating element. Heating coil can operate at high voltage deflections and coil will not affect by oxidation .

5.4 Environment friendliness

Since the project is concerned about to minimize the environmental pollution produced by the disposal of hazardous bio medical waste such as sanitary napkins. It was ensured that the proposed model does not degrade at any circumstances and it will not affect the environment. The final product from this incinerator is biodegradable ash.

5.5 Affordability

The proposed model has developed with simple in construction and low cost materials are selected [10].Manufacturing of this product requires less time as compared with other designs which are readily available in the market.

6 CONCLUSION

Still there are many village women in India are suffer a lot because of this problem even some will omit schools during those menstruation days. And there is no proper solution for the disposal of those wastes. 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. 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.

References

[1] Sirisha Deepthi Sornapaudi, Meenu Shrivastava, Shalini Soni and Shweta Jha- Adoption, Use and Environment Impact of Feminine Hygiene Products among college Going Girls of Udaipur, India.

[2] Farage MA (2007) A Behind the scenes look at the safety assessment of the key reason is its natural porosity. Banana fibre is an eco-friendly

feminine hygiene pads. The New York academy of sciences fibre like jute fibre. It is bio degradable and no negative effect on Teli MD, Mallick A, Srivastasva A (2015) Parameters of choice of sanitary environment and thus can be categorized as eco-friendly fibre .Banana fibre is mainly cultivated for fruit. The fibres are harvested from the napkins a techno commercial survey Journal of the Textile Association.

[3] Anna Maria van Eijk, GaraziZulaika, Madeline Lenchner, Linda Mason Menstrual cup use, Leakage, acceptability, safety and availability a systematic review and meta-analysis.

[4] Shreya, The Ecological Impact of Feminine Van Eijik AM Sivakami M< Thakkar MB Hygiene products. Available at Menstrual hygiene management among adolescent girls in Indian ecological -impact-of-feminine hygiene systematic review and meta-analysis.

[5] Guidelines for management of sanitary waste as per solid waste management rules,2016

[6] Barman A. Katkar PM and Asagekar SD natural and Sustainable Raw Materials for Sanitary Napkin.

[7] World population review (2017) World population by country and women in developing country. Banana is a natural absorbent fibre.

[8] Central pollution control board ministry of environment forest and climate change, govt. of India.

[9] Rutuja Kulkarni, RajnandiniLohar, Neha Wani -Sanitary Napkin's Disposal System (APRIL 2018)

[10] R.boorah, H.N.Chankya, S.dasappa-Investigation into the performance of single chamber sanitary napkin incinerator with emphasis on co and co2 emission (2019)

[11] https://rctom.hbs.org/submission

[12] https://doi.org/10.20546/ijemas.2018.709.461

[13] www.sciencedirect.com