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Low Cost Sanitary Napkin Incinerator

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ABSTRACT: In rural areas, with increasing sanitation coverage in institutions, women sanitary complexes and domestic dwellings, the disposal of waste is becoming a serious problem. Both biodegradable and non-biodegradable waste can prove hazardous for health, if proper and complete disposal is not done. In schools and women sanitary complexes especially, disposal of sanitary cloth and sanitary napkins in girls' toilets is big problem. It affects the proper functioning of the toilets when disposed in the toilet and serious health problems if thrown out in garbage dumps or in the open. There is, thus an imminent need to address this important sanitary waste disposal effectively especially in terms of developing cost effective and simple technology for composite waste disposal for schools and women sanitary complexes. This paper envisages to manufacture innovative low cost technology incinerator for proper disposal of sanitary wastes. This design is simple, safe and cost effective.

KEYWORDS: Incinerator, Instrumentation, Safety, Control

I. INTRODUCTION

A study by Delhi-based NGO Chintan has found that nearly 432 million pieces or 9,000 tonnes of used sanitary napkins are generated every month in various Indian towns and cities. This is openly dumped in landfills where rag pickers, most of them children, come in contact with them, contracting diseases through various kinds of bacteria.

Further, the government has no policy on treating menstrual waste. It is neither bracketed as biomedical waste (which needs to be incinerated or given deep burial as per the Central Pollution Control Board guidelines), nor categorised as plastic waste (which puts the onus on the manufacturing company for its end disposal). As a result, they continue to choke our landfills.

A sanitary napkin comprises over 90 per cent crude oil plastic with the rest as chlorine bleached wood or cotton pulp. This multilayered product does not degenerate even after decades in the soil. Currently in India, it is neither segregated as wet nor dry waste under the Solid Waste (Management and Handling) Rules, 2000. Mixing it with general household waste, alongside other extremely harmful bodily waste such as condoms, band aids, diapers, adult diapers, cotton swabs, exposes rag pickers to a range of dangerous ailments. Physical health apart, it is also an affront to human dignity. In short, Nearly 432m dumped in landfills every month.

In the absence of proper sanitation and disposal infrastructure, the indiscriminate disposal may lead to severe health, aesthetic and social issues. Mass education campaigns are required for rural as well as urban areas for safe disposal of sanitary napkins along with providing feasible options. Incinerators with appropriate and approved technology or deep burial in pits to be covered with lime and mud can be two options.

II. CONVENTIONAL INCINERATORS USED IN SCHOOLS AND COLLEGES

Both biodegradable and non-biodegradable waste can prove hazardous for health, if proper and complete disposal is not done. In schools especially, disposal of sanitary cloth and sanitary napkins in girls toilets is a big problem. The napkins affect the proper functioning of toilets when disposed in the toilet and serious health problems if thrown out in garbage dumps or in the open. There is, thus an imminent need to address this sanitary waste disposal effectively, especially in terms of developing cost-effective and simple technology for composite waste disposal for schools.

An innovative low-cost technology incinerator has been developed for proper disposal of sanitary waste. This design is simple, safe and cost effective. It has already been installed in many rural schools and women's sanitary complexes.

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The incinerator comprises of two chambers, an emission control system along with a door for firing and removal of ash. In each incinerator, there is a spout/opening in the toilet wall for disposal of soiled napkins into the chamber. The soiled napkin drops on the wire gauze in the chamber on the other side of the toilet wall. This dropped napkin and other waste are fired on weekly basis through the door/firing inlet in the lower chamber. The entire incinerator is attached to the outer wall of the toilet. A smoke vent is provided for the disposal of gaseous substances while firing the sanitary wastes.

This simple addition to the toilets is highly appreciated by girls and teachers. The use of the incinerator has removed inhibitions among girls on attending schools during menstruation and has made them comfortable attending school during those days. There are also no blockages of toilets due to sanitary waste disposal in the toilets.

In another suggested design, an existing drum can be modified to be used as an incinerator. For this, a simple drum used in households will be lined with a perforated fire bed, as shown, where used napkins will get collected coming through the chute made on top, like in letter boxes. At the bottom of the drum, there will be an opening / space to enable firing of these napkins. There will be a smoke vent / chimney for disposal of gases while firing



III. INCINERATION

Incineration is a term used commonly to describe all systems of burning. Incineration is used to describe the process of combustion carried out in a multiple chambered incinerator that has the mechanisms for closely monitoring and controlling the combustion parameters.

Depending upon the types of waste incinerated, gaseous emissions may involve toxic gases such as hydrogen chloride, nitrogen oxides, sulphur oxides, dioxins and furans. Regular maintenance of any incinerator is therefore essential to efficient operation. This will ensure that the appropriate emission requirements are met as well as minimize the long term running costs.

A well designed and operated incinerator will destroy any infectious and toxic waste by exposing it to sufficiently high temperature for a sufficient time, with sufficient oxygen to burn organic matter.



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IV. IDEAL FEATURES OF THE PROPOSED LOW COST DESIGN

- Instant disposal of used napkin pads
- Mild steel housing
- Machine burns and automatically stops
- Electrically operated, less than 2 KW/hr when operating continuously
- Capacity up to 12 pads
- Low power consumption
- Corrosion / Rust free cabinet
- Portable system
- Auto cut off
- Complete burring of napkins only less 1 gm ash per Napkin
- Electronic Display for heating timer and napkin counter
- Ceramic insulation for excellent thermal protection
- Compact in size
- Built in smoke vent
- Duration to destroy is 10 minutes for 5 napkins
- Door type – Top open
- Accessory – Ash collection tray
- Safety - Auto thermal cut off and Emission outlet
- Power supply – 220 V/50 Hz

V. MAKING OF A SANITARY INCINERATOR

The major parts of a sanitary napkin incinerator are:

- Heating element
- Micro switch enabled Napkin counter
- Timer for controlling heating
- Counter

The soiled napkin is inputted to the incinerator. On depositing the soiled napkin, the micro switch is activated and the counting of napkin starts.

On reaching 5 pcs, the heater starts working for 15 minutes. This heating time is flexible and can be changed by adjusting the timer.

HEATING COIL

Electric heating is any process in which electrical energy is converted to heat. Common applications include space heating, cooking, water heating and industrial processes. An **electric heater** is an electrical device that converts electric current to heat.^[1] The heating element inside every electric heater is an electrical resistor, and works on the principle of Joule heating: an electric current passing through a resistor will convert that electrical energy into heat energy.

A typical heating element is usually a coil, ribbon, or strip of wire made from **nichrome** that gives off heat much like a lamp filament. When an electric current flows through it, it glows red hot and converts the electrical energy passing through it into heat, which it radiates out in all directions. Nichrome is an alloy (a mixture of metals and sometimes other chemical elements) that consists of about 80 percent nickel and 20 percent chromium (other compositions of nichrome are available, but the 80–20 mix is the most common). There are various good reasons why nichrome is the most popular material for heating elements: it has a high melting point (about 1400°C or 2550°F), doesn't oxidize (even at high temperatures), doesn't expand too much when it heats up, and has a reasonable (not too low, not too high, and



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reasonably constant) resistance (it increases only by about 10 percent between room temperature and its maximum operating temperature).



The specification of the heating coil is”

Volts: 230 V

Amps 6 A

Watts: < 2 KW

Coil diameter 14 cm

MICRO SWITCH

A micro switch, also known as miniature snap action switch, is a type of momentary contact switch used widely in automotive, industrial and medical instruments as sensor. The switch is termed as “micro” on the name of the company who first started manufacturing it commercially.

Micro switches are switch devices that can open and/or close an electrical circuit at a rapid speed. They take very little pressure or force to operate. Usually these switches are triggered by an external force, either human or by physical object, applied to the actuator. “Snap Action” occurs because of the rapid movement of the spring-assisted moving contacts from one position to another, independent of the actuator speed.

The actuator of these switches often has a hinged wheel placed above a push button. This switch is widely used in control system applications such as a door interlock, safety switches in elevators, vending machines etc. Having a diverse range of engineering applications, micro switches are available in various switch configurations, housing materials, actuator styles etc.

In the project envisaged, micro switch is placed at the hinge of the top opening door. When the door is opened, the micro switch action occurs. This action is fed to the Counter where the pulse is counted by the counter.

TIMER

Programmable Timer DT 723 is used for timing the heating time. This is flexible and user can adjust the heating time as required.

This is 3 digit timer available in 72X72mm and 48X48mm housing. This timer has 4 modes of operation. On delay, Off delay, Cyclic On first and Cyclic Off first. These modes and the timing range are selectable by user. Output offered through two changeover relay.



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The specification for the timer is as follows:

SPECIFICATION:

1. Power supply : 230 V AC.
2. Sensor supply: NPNTYPE , (inbuilt)12V D.C. regulated supply.
3. Memory backup facility to store count and settings.
4. MicroController based technique.
- 5 Input fromNPNsensor
7. Reset from front panel &from terminal strip.
8. Programming through front panel.
9. LED display- 19 mm red colour.
10. Readout - 4 digits.
11. Size- 72 x 72 x 110 mm.

TERMINAL STRIP CONNECTIONS:

1. (+)Ve - 12V DC
2. Start (To Start the Timer, short terminal No. 2 and 5)
3. Program (To go to program mode short terminal No.3 and 5)
4. External reset (To reset the timer to 0000 short terminal No.4 and 5)
5. Common (-)Ve
6. NC - Output 1
7. Phase 230V AC
8. Neutral
- 9 NO Output 2
- 10 C
- 11 NO Output 1
- 12 C

To Connect Sensor

- ConnectNPNsensor to
- Connect sensor (+)Ve wire to terminal no. 1
- Connect sensor Outputwire to terminal no. 2
- Connect sensor (-)Ve wire to terminal no. 5
- Short terminalNo.3 and 5
- Short terminalNo.2 and 5
- Short terminalNo.4 and 5

To go to ProgramMode

OPERATING MODES

1 Cyclic ON first

When start pulse receives output relay gets ON. It will turn OFF after completion of ON time. Output will again turn ON after completion of OFF time and the cycle continues.

2.Cyclic OFF first

When start pulse receives output relay is OFF. It will turn ON after completion of OFF Time. Output will again turn OFF after completion of ON time and the cycle continues.

3. OFF DELAY

When start pulse receives output relay is OFF. It will turn ON after completion of OFF time.

4.ON Delay

When start pulse receives output relay gets ON. It will turn OFF after completion of ON time.

Four Switches are provided on front panel for settings.

: It is used to enter into menu mode



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: It is used to shift the digit at right side
: It is used to increment the blinking digit
It is used to reset the counter manually or to set the program

TO SET THE VARIOUS MENUS –mode menu , time menu, memory menu and front rest menu PROCEED AS FOLLOWS:

- 1) SHORT TERMINAL NO. 3 and 5 TO GO PROGRAM MODE
- 2) SWITCH OFF THE POWER SUPPLY OF THE COUNTER
- 3) KEEP THE SWITCH ‘M’ PRESSED AND NOW SWITCH 'ON' THE SUPPLY.

Procedure

Display shows ‘MODE’. This menu is to set Mode of the timer. After release M switch display shows modes. There are 4 Modes in the timer.

1. Cyclic ON First
2. Cyclic OFF First
3. OFF Delay
4. ON Delay

Select the above required mode by using increment switch.

PRESS M switch to go to Next menu

Display shows ‘time’. This menu is to set time of the timer. After release M switch display shows time mode

1. Hour . Minute (Setupto 99 Hour .59 Minute)
2. Minute. Second (Set upto 59 Minute .59 Second)
3. Second .Millisec (Set upto 59 Sec. .99 Msec.)

Select the above required mode by using increment switch.

PRESS M switch to go to Next menu.

Display shows ‘MEMR’. This menu is to set memory enable or disable. After release M switch display shows memory status.

1. Enable (Enable means active)
2. Disable (Disable means inactive)

Memory enable means :When power gets OFF , Current time will store in memory. When power gets ON , Display shows time at last power OFF.

Memory Disable means :When power gets OFF , Current time will not store in memory. When power gets ON , Display shows program time.

Select the above required mode by using increment switch.

PRESS M switch to go to Next menu.

Display shows ‘Fr St’. This menu is to set Front Reset Enable or Disable. After release M switch display shows front reset status.

1. Enable (Enable means active)
2. Disable (Disable means inactive)

Front Reset Enable means Timer will reset through E switch also

Front Reset Disable means Timer will reset through terminal strip only.

Select the above required mode by using increment switch.

PRESS E switch to save the setting.

To Start the timer

TO SET THE ON AND OFF TIME

Short terminal No.2 and 5

To Reset the timer

RESET THE TIMER - To reset the timer to ‘0000’ , short terminal no. 4 and 5



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Press M switch to set the Time
if User select ON Delay in program mode then display shows
Set time by using and switch.
if User select OFF Delay in program mode then display shows
Set time by using and switch.
if User select Cyclic ON First in program mode then display shows
Set time by using and switch.
if User select Cyclic OFF First in program mode then display shows
Set time by using and switch.
Press E switch to store setting.
NOW TIMER IS READY TO OPERATE . REMOVE LINK BETWEEN TERMINAL 3 AND 5
TO DISABLE PROGARAMING MODE.

COUNTER

The counter used is SELEC XC 22B.

FEATURES

- Ø Reset counter
- Ø Thumbwheel setting
- Ø Auto reset
- Ø Battery backup

VI. WORKING OF THE UNIT

The unit comprises of one chamber separated by a heating coil as shown in the figure.



The unit is constructed of a double jacketed chamber with ceramic insulator filled in between the two chambers. The door is provided at the top portion and the micro switch to count the number of opening and closing of door is fixed at the hinges. A front sliding pan is provided at the bottom region from the ash is collected. The electronic circuitry and controls are provided on the top panel. The funnel for smoke emission is provided along with the top door.

The soiled napkin is deposited by opening the top door. The counter starts counting the number of times the soiled napkin is deposited. When the counter reaches 5, the heater gets ON and it remains ON for 12 minutes. Any number of



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cycles can be repeated by this procedure. However, at the end of the day or start of the day, the tray has to be opened and the ash residue has to be removed.

VII. CONCLUSION

There are, however, serious concerns about the technology of mini incinerators, which by law have to be approved by the CPCB and the State Pollution Control Board. Unfortunately as of yet, there are no provisions to monitor the emissions from these incinerators. Nor are there any independent peer-reviewed studies testifying that emissions from such incinerators do not adversely affect public health.

WHO recommends incinerating all health-related waste only at temperatures over 800 degrees, for when plastic polymer products, such as disposable pads, are burned at lower temperatures they typically release asphyxiant and irritant gases into the atmosphere. Further, the biodegradable components, such as cellulose, wood-pulp, cotton in disposable pads often contain furans and dioxins. Furans are present in pesticides that are sprayed on inorganically-grown cotton or tree plantations. And dioxins are present if a chlorine-bleach process used to bleach the cotton or wood-pulp used in sanitary napkins. Dioxins and furans are among the most deadly toxins known to science, being highly toxic even in trace quantities. When pads are burnt these toxins are released into the atmosphere and can travel a long way from the point of emission. WHO warns that “exposure to dioxins and furans may lead to the impairment of the immune system, the impairment of the development of the nervous system, the endocrine system and the reproductive functions” The Global Alliance for Incinerator Alternative recommends applying the “precautionary principle” to incinerator technology pointing out that even in high temperature incinerators (>800 °C), temperatures are not uniformly maintained, and dioxins and furans can form in cooler pockets or during start-up or shut-down periods

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