"HOSPITAL WASTE GENERATION AND MANAGEMENT – A CASE STUDY FOR MAJOR HOSPITALS OF DAVANAGERE"

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Abstract - *In the present study it proposed to study the existing hospital waste management practices and disposal methods, by personally visiting the significant waste producing hospitals in city. Data is collected by visiting the D.C office regarding the hospital waste management and rules, also visit is made to Shushurutha Bio-medical Waste Management Society(R) Machenahalli, Shivamogga. to understand the process of incineration and autoclaving done for disposal of medical waste by various hospitals of shivamogga and Davanagere district. The best management practices have been suggested for hospitals and also an incinerator facility is designed for the quantity estimated for the major hospitals of Davanagere*

***Key Words*: Hospital waste, Incinerator, waste disposal, waste management, hazardous.**

1. INTRODUCTION

According to Biomedical Waste (Management and Handling) Rules, 1998 of India and it is defined as "Any waste which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals". The Government of India (notification, 1998) specifies that Hospital Waste Management is a part of hospital hygiene and maintenance activities. This involves management of range of activities, which are mainly engineering functions, such as collection, transportation, operation or treatment of processing systems, and disposal of wastes. The objectives of this paper is to collect the data from the respective hospital and to study the current management practices, strategies and Disposal methods. To quantify the total quantum of bio waste generated in the hospital

1. 1. STUDY AREA

Davanagere city has more number of hospitals and it is the vast area to cover all the hospital in a project so, two major hospitals are selected. The name of two hospitals are S.S Institute of Medical Sciences & Research Center and Chigateri District Hospital. Chigateri district hospital is a govt. hospital and it is located in a heart of a city P. J Extension. The hospital was established in the year 1961. S.S Institute of Medical Sciences & Research Center is a private hospital was established in the year 2004 and is affiliated to Rajiv Gandhi University of Health Sciences, Karnataka.

2 METHODOLOGY

A detailed survey audit form is prepared which is used to collect the crucial information related to hospital waste. Hospital wise waste collection data is obtained from the District Administration. Data collection is made by visiting personally to major hospitals in the city. Relationship is established with the type of hospital and the quantity of waste generated, using this quantification of hospital waste is done. Current hospital waste management by the hospital and districts administration is studied. An attempt is made to suggest the best management practice which can adopted in hospitals as well as by a district administration. An Incinerator facility will be designed for the quantity estimated during the analysis for major hospitals which

generates more quantity of hospital waste. Possible alternatives are explored for the recycling of hospital waste which will help to reduce the quantity of generation of hospital waste.

3. RESULTS AND DISCUSSIONS

Frequent visits were made to two major hospital for data collection. The hospitals has separate waste Management staff and they are following the guidelines of central pollution control board for handling Hospital waste according to BM waste Handling rules 1998 using different color coding bins for segregation.

3.1 Detailed Description of S.S Hospital

Type Of Hospital	General & Super Speciality
Total Number of Bed	750
Patient Usage	315
Total Quantity of Waste Generated Per Day	500-600Kg/Day
Infectious Waste Per Day	200-250Kg/Day
General Waste Per Day	300-350Kg/Day
Water Supply Per Capita Demand (No.of Beds exceeding 100)	450 Ltrs/Bed/Day
Total Quantity Of Liquid Waste Generated	450 X 750X 85x1.3 / 100= 372937.5ltrs/Day
Segregation at The Source	Yes
Type of Collection	Regular (Within 48 Hrs)
Time of Collection	8 – 12 Am

3.2 Detailed Description of Chigateri District Hospital

Type of Hospital	General
Total Number of Bed	950
Patient Usage	450 – 515
Total Quantity of Waste Generated Per Day	550-700kg/Day
Infectious Waste Per Day	200-350kg/Day
General Waste Per Day	300-450kg/Day
Water Supply Per Capita Demand For Hospitals (Number of Beds Exceeding 100)	450 Ltrs/Bed/Day
Total Quantity of Liquid Waste Generated	450 X 950x 85x1.3 / 100 = 472387.5 Ltrs/ Day
Seggregation at The Source	Yes
Type of Collection	Regular (Within 48 Hrs)
Time of Collection	8 – 12 Am

3.3 THE DESIGN OF COMMON INCINERATOR FACILITY

A common biomedical waste disposal facility is proposed at "Amaravathi colony" which is located at a distance of approximately 15 to 20 kms from the Davanagere city. At present waste from most of the hospitals of Davanagere city is burnt in combustion chamber near Amaravathi colony, which is not as per the biomedical waste handling rules.

In the Amaravathi colony a common Biomedical waste disposal facility is proposed based on the quantity of waste generated from 2 major hospitals of Davanagere city namely S.S Institute of Medical Science And Research Centre and Chigateri District Hospital

Total quantity of waste from both the hospitals is including all is 1300kg out of which 600kgs is incinerable waste, hence an incinerator is proposed for disposal and treating the incinerable waste.

Total quantity of incinerable waste = 600kgs/day from both the hospitals.

Considering the extra load on the incinerator for the future it is multiplied by 2 times the actual waste and the quantity works out to be 2*600 = 1200kgs/day

As the incinerator will operate and run for 8 hours in each shift.

The quantity of waste fed to the incinerator = 1200/8 =150kgs/hr

Technical Data & Fact Sheet of Proposed of Incinerator of Capacity of 200kg/hr

INCINERATOR DESIGN DETAILS	
Primary Chamber Volume ($M^{3)}$	4.05
Burning Capacity(kgs/hr)	200
Primary Chamber temperature(^oC)	750/850
Secondary Chamber Temperature(^oC)	1000/1100
Secondary chamber Residence Time(sec)	2.0
Refractory Insulation Thickness (mm)	225
Refractory Withstand Temperature (^0C)	1400
Ram Loader Capacity (m^3)	0.5
Operational Cycles per Day(hours)	8-16
Average Diesel Consumption(liters/hr)	30
Average Net Gas Consumption (m^3/hr)	26
Number of primary Burners & Rating	2@200kw
Number of Secondary Burner & Rating	3@350kw
Compressor Rating	0.5m3/min @ 9bar
Compressor Receiver Capacity(litres)	200
Electrical Supply(v/ph/Hz)	220/1/50
Electrical Loading(kW)	8.0

According to the above table the sizing of the incinerator chambers are decided

3.3.1 Sizing of Primary chamber:

The sizing of the primary chamber is decided based on the above table supplied by the manufacturer of incinerators and also by referring the Indian standard codes. As per the guidelines of design and construction of biomedical incinerator details the incinerator is designed for capacity more than 50 kg/hr. For 50 kg/hr capacity, the minimum hearth area shall be 0.75 sq. m. The quantity of waste incinerable is 200kg/hour so as per the requirement length is 2.25m, width is 1.5m and depth is 1.2m.

The total volume of proposed for primary chamber is -4.05m^3 and the temperature maintained in the chamber is-750-850^{0}C

Primary chamber is composed of outer cover or shell of 5mm thick, made up of High strength mild steel as per IS 2062- 1999, inside it is made up of refractory clay layer of 225mm.

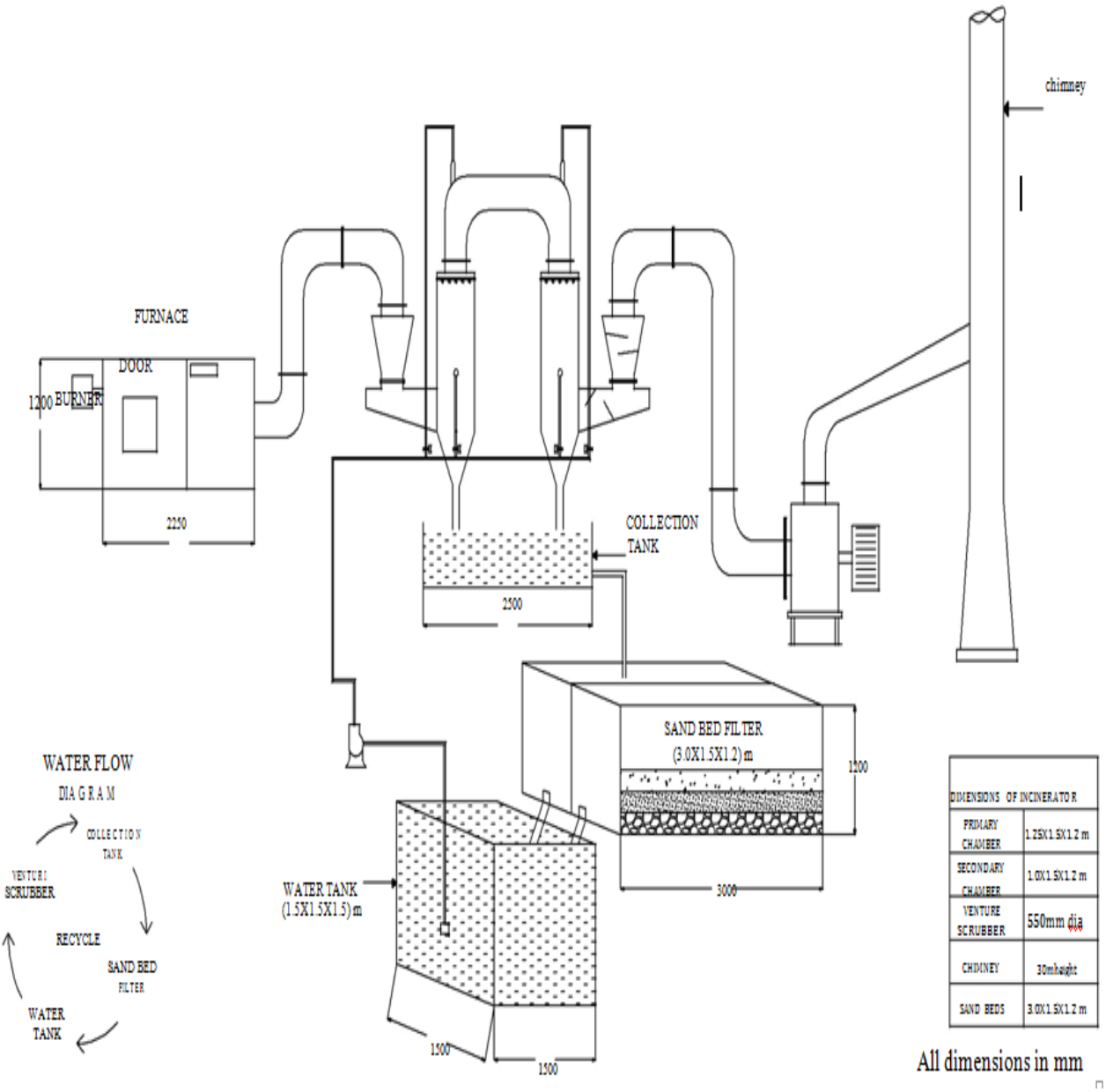
The primary chamber can be equipped with auto-feeder conveyor belt mechanism and also manual loading door for emergency loading. The primary burner is provided at the center of the hearth, the length of flame of primary burner should touch all the waste which is fed inside the primary chamber. The primary chamber is provided with high pressure air blower to number of nozzles fitted in the walls of primary chamber.

The ash which is collected at the bottom of the primary chamber is collected in the ash collection chamber with grate and is removed manually at regular intervals.

The temperature is controlled by the control panel using PLC's(Programmable Logical Controllers) and accordingly the fuel is supplied to achieve the desired temperature in the primary chamber. To achieve proper combustion and turbulence inside the chamber the waste is mixed properly manually by opening the door using Poker during the incineration process. nozzle. The burner operates automatically on the temperature set on the digital temperature controller fixed on the control panel. Fuel pressure indicator gauge is to be provided for the burner.

The 2 numbers of primary burners are used in the primary chamber having electrical rating of 200 kilowatt.

PROPOSED COMMON HOSPITAL WASTE INCINERATOR OF 200 kg/hr CAPACITY FOR MAJOR HOSPITALS OF DAVANAGERE



3.3.2 PRIMARY CHAMBER BURNER:

It is provided fully with automatic complete with ignition transformer, ignition electrodes, necessary fuel lines, photocell, blower, fuel pump and fuel oil

3.3.3 SECONDARY CHAMBER:

The secondary chamber is provided which is made up of mild steel 5mm thick as per IS2062-1999 and refractory lined with clay similar to primary chamber of 225mm.The secondary chamber should be equipped with automatic burner. The operating temperature should be 1000-1100^{o} c. The residence time of 2 seconds is maintained in the secondary chamber for gas flow. view ports are provided to absorb the flame of burner.

3.3.4 SECONDARY CHAMBER BURNER

It is provided fully with automatic complete with ignition transformer, ignition electrodes, necessary fuel lines, photocell, blower, fuel pump and fuel oil nozzle. The burner operates automatically on the temperature set on the digital temperature controller fixed on the control panel. Fuel pressure indicator gauge is to be provided for the burner.The 3 numbers of secondary burners are used in the secondary chamber having electrical grating of 350 kilowatt.

3.3.5 AIR POLLUTION CONTROL DEVICES

The appropriate air pollution control devices is provided for the control of gaseous and particulate emission which should confirm to the statutory and regulatory requirements prescribed by state pollution control board and approved by the state or central pollution control board. For the proposed incinerator approximately 240kg/day of ash is generated and 2.4m3/sec flue gases is generated. To control the gaseous and particulate matter the following APCD(Air Pollution Control Devices) are used.

3.3.6 Pressure Venturi Scrubber

The venturi scrubber shall have minimum pressure drop of 350mmWC to achieve the prescribed emission limit. The temperature of the flue gas at the outlet of the Venturi Scrubber would be approx. 700^{0}C - 800^{0}C to ensure the saturation of the flue gas.

3.3.7 Droplet Separator

The flue gases should then enter tangentially into the droplet separator, which is of cyclonic type. By the action of centrifugal force, the larger droplets present in flue gases settle down. The droplet is manufactured out of Mild Steel rubber lined 3mm thick from inside.

3.3.8 I. D. Fan

The I.D. Fan is dynamically balanced and possess a pressure of 450mmWC with an impeller of SS-316 construction. The casing made up of mild steel rubber lined from inside. The ID Fan is belt driven and connected to an electric motor of high pressure centrifugal type with 3 phase electric motor. In case ID fan fails to work, the burners and FD Fan will trip automatically.

3.3.9 Chimney

Self supported chimney of 30 m height is provided. The chimney is provided with all its accessories like port hole, platform, ladder, stack drain etc. It shall be provided with cage ladder, gas sampling platform, gas sampling nozzles, painting trolley, rain cowl, manhole, stack drain, base plate and foundation bolts. Chimney shall be connected to incinerator by an interconnecting duct.

4. CONCLUSIONS

Hospital waste is a growing concern in Davanagere city and it should be addressed properly and effectively. The total number of hospitals in Davanagere city is around 800 which includes small clinics, primary health center , major hospitals, laboratories , diagnostic centers etc., The total quantity of waste generated from S S Hospital is 500 - 600 kg/day. and from C.G Hospital is 550 -700 kg/day..Out of 500 - 600 kg/day of waste generated from S S Hospital about 200 - 250 kg/day of waste is incinerable. Out of 550 - 700 kg/day of waste generated from C.G Hospital about 200 - 350 kg/day of waste is incinerable. To treat the above waste generated a common biomedical waste incinerator of 200 kg/ hr is proposed to treat the incinerable waste effectively from both the major hospitals. Best management practices are suggested for effective hospital waste management.

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