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Review Article

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HOSPITAL WASTE INCINERATION: BOON OR BANE AND "DIOXINS AND FURANS - THE TOXINS"

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ABSTRACT

This article reviews about hospital waste incineration and the toxins- dioxins and furans. The waste generated from hospital carries a higher potential for infections and injuries. BMW are defined as wastes generated during the laboratory diagnosis, treatment or immunization of humans or animals, or during research activities or in the production of biological. The novel and ingenious method for BMWM aims at avoiding generation of waste or recovering as much as waste possible rather than disposing off. The first solution for the disposal of BMW was to burn the waste. It is a controlled combustion process. It is based on high temperature (800-1000°C) dry oxidation process that reduces organic and combustible waste into nonorganic incombustible matter, resulting in very significant reduction of waste volume and waste. Dioxins are unintentional toxic product released during this operation. Noisome effects of dioxins and furans are decrease in immune response, allergic respiratory disease, mutagenic, carcinogenesis, hypothyroidism, wasting of body-mass etc. In this review article there is a brief discussion about beneficial and harmful effects of incineration and a brief about of dioxins and furans the toxins released during the process of incineration.

KEYWORDS: Biomedical waste, incineration, dioxins, furans.

INTRODUCTION

The waste generated from hospital carries a higher potential for infections and injuries. The amount of hospital waste generated varies from ½kg to 2kg/bed. It is divided into 2 categories according to World health organization (WHO):[1]

1) General (non-hazardous solid waste, 85%) and
2) Biomedical wastes (BMW) (15%): infectious waste (10%) and chemical/radioactive waste (5%).

Definition

BMW is a threat to global public environmental health. BMW are defined as wastes generated during the laboratory diagnosis, treatment or immunization of humans or animals, or during research activities or in the production of biological.

Health care waste implies discarded and untreated materials from health-care activities (diagnosis, treatment and prevention of disease, assessment of health status or identification purposes, which have been in contact with blood and its derivatives, tissues, tissue fluids or excreta, or wastes from infection wards) on humans or animals, having the potential of transmitting infectious agents.[2]

Hierarchy for BMW management (BMWM)

The novel and ingenious method for BMWM aims at avoiding generation of waste or recovering as much as waste possible rather than disposing off. Therefore, waste should be tackle at source rather than end of pipe approach.[3]

Wastes that cannot be recycled or recovered, is subjected to treatment by various methods such as incineration, autoclave, chemical disinfection, effluent treatment plant, microwaving, shredder, sanitary landfill, encapsulation, inertization, plasma pyrolysis.

The first solution for the disposal of BMW was to burn the waste. In the late 1990s the first BMW rule was implemented and India saw a boom in the number of incinerator being installed. Incineration is the most common method of BMWM. It is a controlled combustion process. It is based on high temperature (800-1000°C) dry oxidation process that reduces organic and combustible waste into nonorganic incombustible matter, resulting in very significant reduction of waste volume and waste. The pathogen is killed and the material is destroyed. Residues from the incineration process must be landfill. Generation of electricity and hot water/steam as by-products has the dual advantages of this process. Therefore, incineration is the most widely used method of BMWM all over the world.[4]

Types of incinerators

1) Rotary kiln: it is a pyro-processing device.
2) Fluidized bed incinerator: converts granular material in solid-state into fluid like state by giving fluid to it. It is commonly used in sewage and industrial areas.
3) Liquid injection incineration: based on high pressure. Converts liquid waste into tiny droplets resulting in easier combustion.
4) Multiple hearth incineration: it is used for continuous production of calcining of material.
5) Catalytic combustion incinerator: its target is to reinforce specific oxidation reaction of a fuel. It is widely used all over the world.
6) Waste gas flare incinerator: it is a combustion process. It is a primary source of green house gas emission.
7) Direct flame incineration: waste is directly treated by combustion process.

Incineration doesn't produce methane gas and reduces methane from landfills. It provides better control over odor and noise and it requires less area for installation. Incineration decreases the quantity of waste by 95% and reduces the dependency on landfills. A single plant can burn a trash of over 300 million tons every year. Incineration plants are near to the hospital unit, so waste doesn't have to be navigating for long distances for dumping. It has a computerized monitoring system and it can function in any type of weather.[5]

The major pitfall of incineration is it emits toxic smoke and toxic ash. During the process of incineration and post-combustion cooling, waste components dissociate and recombine to form new particles called products of incomplete combustion (PIC) which are toxic. Dioxins are another unintentional toxic product released during this operation. These were first discovered in emission of Irash incineration by Olie *et al* in 1977. These are group of organic chemical compounds or their derivatives called polychlorinated dibenzodioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs). A total of 210 compounds have been identified. Medical devices made of polyvinyl chloride (PVC) are the largest dioxin producers in the environment. Metals act as a catalyst for dioxin formation. Metals get dispersed into the environment causing serious health issues.[6,7]

PCDDs/PCDFs are[8-11]

- Non-biodegradable
- Persist in the environment for a period of 15-20 years
- Dioxins accumulate in the fatty tissue in higher concentration
- Dairy products (cow milk) contain high concentration
- Concentration shows seasonal variations [higher in winters and lower in summers]
- Blood concentration may increase following exposure to slag and fly ashes from municipal waste incinerators
- Areas where burning is done on regular basis (slum areas etc), lower levels of thyroid hormone have been found in the people

Noisome effects of dioxins and furans are decrease in immune response, allergic respiratory disease, mutagenic, carcinogenesis, hypothyroidism, wasting of body-mass, increased mortality, chloracne (a skin condition with both hyper keratotic and hyper proliferative response of the epidermis).[12]

CONCLUSION

Incineration is a boon as well as bane because on one hand waste incinerator provide an alternative for reducing pressure on landfill and in generation of electricity and on the other incinerator systems have traditionally been associated with emission of toxic pollutants, impacting human and environmental health. A precautionary approach is required. Newer waste incinerator technologies are claimed to run more cleanly and with less environmental impact. Nevertheless, pollutants are still produced, with upgraded facilities requiring regular service to maintain emission levels. Waste reduction is the key recommendation.

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