

Waste Management in Dental Offices

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Abstract

Proper handling, treatment and disposal of biomedical wastes are important elements of health care office infection control programme. Properly designed and applied, waste management can be a relatively effective and an efficient compliance-

related practice. Some waste from healthcare facilities, however, is contaminated. If not disposed of properly, contaminated wastes may carry microorganisms that can infect the people who come in contact with the waste as well as the community at large.

Introduction

The waste produced in the course of healthcare activities carries a higher potential for infection and injury than any other type of waste. In the persuasion of the aim of reducing health problems, eliminating potential risks, and treating sick people, healthcare services inevitably create waste which itself maybe hazardous to the health. Even though the consequences of discarding such waste carelessly are well known, it is only recently that adequate initiatives to manage this waste in a scientific manner are being taken in India. Unscientific disposal of health care waste may lead to the transmission of communicable diseases such as gastro-enteric infections, respiratory infections, spreading through air water and direct human contact with the blood and infectious body fluids. These could be responsible for transmission of Hepatitis B, C, E and AIDS within the community. Health care professionals and the general public are at risk due to this. Diseases are spread by improper treatment and disposal of waste. Rag pickers expose themselves to diseases like Hepatitis B, Tetanus, Staphylococci, etc. while handling items like needles, surgical gloves, blood bags etc.¹

“Bio-Medical Waste” means any waste, which is generated during the diagnosis, treatment or immunisation of human beings or animals or in research activities pertaining to or in the production or testing of biologicals.^{2,3}

Clinical Waste: Any waste which consists wholly or partly of human or animal tissue, blood or other bodily fluids, excretions, drugs or other pharmaceutical products, swabs or dressings, syringes, needles or other sharp instruments, being waste which unless rendered safe may prove hazardous to any person coming into contact with it.⁴

Biohazardous waste includes waste which contains recognizable fluid blood,

containers or equipment containing blood that is fluid and several other categories of waste, such as chemotherapeutic waste (trace amounts) and bacterial cultures that are not normally generated in a general dental practice. (Fig. 1)

Classification of Waste (W.H.O)⁶

General waste- These wastes are by & large generated from the offices, administration areas, stores, kitchen, laundry etc.

Sharps- Hypodermic needles, scalpel blades, razors etc.

Infected waste - Equipment & instruments used in various diagnostic & therapeutic procedures, laboratory waste e.g. cultures, samples, waste generated from surgeries (tissues & organs removed from surgery).

Chemical waste- Formaldehyde used for preserving tissues, Fixer & developer used in radiology department, solvents used in laboratories, e.g.- xylene, acetone, ethanol, methanol, chloroform etc.

Radioactive waste- generated from research activities, clinical laboratories, and nuclear medicine laboratories.

Cytotoxic drugs- various anticancerous drugs used for treating malignant conditions are corrosive to human skin & tissue. (Fig. 2)

Benefits of Waste Management

Waste management leads to cleaner and healthier surroundings. Which in turn reduces the incidence of nosocomial infections. The cost of infection control within the hospital reduces. Disease and death due to reuse and repackaging of infectious disposables is eliminated. Segregation and appropriate treatment of medical waste reduces cost of waste management and generates revenue.

Sources of Healthcare Waste

Major sources of Healthcare wastes

- Hospitals
- Clinics
- Nursing homes
- Dispensaries
- Laboratories

- Medical Colleges and research centres
- Veterinary colleges and animal research centres
- Blood banks
- Mortuaries
- Paramedic services
- Autopsy centers
- Old age homes

Minor Sources of Healthcare wastes

- Doctors' offices
- Dentists
- Ophthalmologists
- Homes
- Acupuncturists
- Psychiatric clinics
- Cosmetic piercing
- Funeral services
- Institutions for disabled persons.
- Blood donation camps

(Fig. 3 & Table 1 & 2)

Categories of Waste Generated in Dental Clinics⁷

- **Biomedical waste:** non anatomical waste, anatomic wastes, sharps
- **Silver containing wastes:** used fixer solutions and unused x ray films
- **Lead containing wastes:** lead aprons and lead foils inside a x ray film.
- **Mercury containing wastes:** elemental mercury, scrap amalgam.
- Chemicals, disinfectants and sterilizing agents.

There are some “Best Management Practices” and some “Good Management Practices” to be used as a guide for hazardous waste disposal.

Best Management Practice⁸

This is the best option available to the dental office reflecting current commercially available technology and methods. This often reflects pollution prevention principles and goes beyond the minimum required by law. BMPs should be the goals against which current practices are measured.

Good Management Practice

These are generally accepted technologies and procedures for handling and

treating waste.

These behaviors will manage or reduce the release of materials into the environment but are not as effective as Best Management Practices. They represent average behaviours and are usually designed to meet existing legal requirements and established clinical procedures. (Fig. 4)

Disposal of Biomedical Waste^{7,9,10}

Non - Anatomic Waste: Blood soaked materials, dressings, cotton, gauze contaminated with blood and body fluids. Separate the blood soaked materials from other wastes and use a yellow biomedical waste bag to collect non anatomic waste. Double bag the waste and label the bag with a biohazard symbol. Fill the bag till three fourth level and tie it tightly and contact a certified waste carrier for disposal. Don't throw blood soaked material into the garbage or place blood soaked materials along sharps.

Disposal of Anatomic Waste: Excised tissues, organs, tumors, extracted teeth Separate the materials from other wastes and use a yellow biomedical waste bag to collect the anatomic waste. Double bag the waste and lable it with a biohazard symbol. Fill the bag till three fourth level and tie it tightly and contact a certified waste carrier. Don't throw human anatomic wastes into garbage. Extracted teeth containing amalgam are hazardous waste and the presence of amalgam means that these teeth cannot be incinerated, so they must not be put into the sharps box. They should be collected and disposed of separately in a suitable container provided by the waste collection company.

Disposal of Waste Sharp: Needles, syringes, blades, glass, endodontic files, ortho bands and wires, sharp instruments. Collect "sharp" in a blue or white, transparent, puncture proof container with a lid, that cannot be removed easily. Don't throw sharp materials into the regular garbage **Amalgam^{8,11}**

There are several ways that mercury from dental amalgam can get into the environment:

Wastewater: Amalgam that is rinsed down drains or escapes from poorly maintained chairside traps and vacuum pump filters enters the wastewater stream and eventually the wastewater treatment plant or the septic system. Any mercury contained in treated wastewater will either end up in the sewage sludge, which may be land applied (under an appropriate permit), or in the liquid to be discharged into lakes or rivers.

Medical Waste: Scrap amalgam, both contact and non-contact, should not be treated as medical waste. Amalgam that is improperly put into red biohazard bags might be either incinerated or autoclaved. If amalgam is present in waste that is incinerated, the mercury will volatilize and enter the atmosphere. The volatilized mercury then precipitates to the ground or a waterbody. If amalgam is present in waste that is autoclaved, the volatilized mercury will escape from the autoclave when the door is opened, presenting an immediate health

hazard to dental office staff.

Garbage: If amalgam scrap is discarded into ordinary trash, it may eventually be incinerated or placed in a landfill. If discarded amalgam scrap ends up in a landfill, it may lead to soil and/or water contamination. Most landfills are outfitted with leachate collection systems. Leachate results from the normal decomposition of the garbage in landfills. The collected leachate is piped to the local publicly owned treatment works (POTW), where it can be released to the environment through wastewater

Antiquated Techniques: Older techniques that use bottles to dispense elemental (also referred to as free, bulk, or raw) mercury for amalgam production can lead to accidental spills and increase the chances that elemental mercury will end up in the wastestream. In addition, if the elemental mercury is poured into the drain, it may settle in sink traps, gradually releasing into the wastewater over time.

Scrap Amalgam

Salvage and store all contact and non-contact scrap amalgam in separate, appropriately labeled, tightly closed containers. Recycle scrap amalgam through an amalgam recycler. Never put scrap amalgam in the sharps container. Never put scrap amalgam where it will end up in the red biohazard bag. Never discard scrap amalgam in the trash. Never rinse scrap amalgam down the drain. Never remove excess amalgam from the amalgam well with the high-speed suction (the vacuum line). Never clean up a mercury spill using a vacuum cleaner. Never place extracted teeth with amalgam restorations in the red biohazard bag. They should be placed in the CONTACT AMALGAM container.

Elemental Mercury

It is also referred to as free, bulk, or raw mercury. Use preencapsulated alloy to eliminate the possibility of an elemental mercury spill. Recycle unused elemental mercury. If a small amount of elemental mercury is to be disposed of, initiate a reaction with amalgam alloy to form scrap amalgam, which can then be recycled through amalgam recycler. In the event that elemental mercury is present in dental office, it should be properly handled. Never rinse elemental mercury down the drain. Never dispose of elemental mercury in the trash. Never dispose of elemental mercury in the sharps container, or as medical waste.

Amalgam Separation

The basic types of amalgam separation technologies-

Sedimentation units reduce the speed of the downflow of water with baffles or tanks to allow amalgam particles to settle. Centrifuge units spin the water out to the sides of the unit. These units offer good amalgam removal but cause some foaming with American vacuum systems. Ion Exchange units use polymers to capture small particles; these are often used in series with sedimentation units. Other wastewater treatment technologies such as electrolysis and chemical additions have been

adapted for dental applications. (Fig. 5)

Photochemical Waste

Dental offices generate two separate types of waste from x ray processing solutions-

- Radiographic fixer
- Radiographic developer (Fig. 6)
- Used fixer is the solution left over from X-ray processing.
- The used fixer is considered a hazardous waste because of its high silver content. In the environment free ionic silver acts as an enzyme inhibitor by interfering with the metabolic process of organisms

There are two basic options for its management in the dental office-

- On site treatment
- Off site treatment

On site treatment requires the installation of silver recovery systems to remove toxic silver from the solution. The de-silvered fixer solution can be mixed with developer and water and disposed of down the sewer or septic system. It is permitted to be discharged into the sewer or septic systems provided it is diluted with water. If the dental office is on a septic system, do not wash the liquid that has gone through the silver recovery process down the drain. The recovery process waste may disrupt the proper functioning of the septic system. Therefore, recovery systems may not be a viable option for offices on septic systems. Utilize a digital X-ray unit to minimize the need for fixer solutions.

Off site treatment involves storing the used fixer and contacting the disposal company to have it picked up. Collect the fixer/developer solution in a container provided by the disposal company. Label the container "Hazardous Waste; Used fixer/developer Solution." Use a certified waste carrier for recycling or disposal Ask the supplier about returning any date-expired unused developer. Recovered silver from these devices can be sold to precious metal recyclers or returned for credit to x-ray film suppliers.

X-Ray Developer

The developer solution can typically go into the wastewater drain. Do not mix X-ray developer and used X-ray fixer. The silver-laden used X-ray fixer is considered hazardous waste and can not be flushed down the drain. If X-ray developer is accidentally mixed with used X-ray fixer, the mixture must be disposed of through a hazardous waste hauler.¹²

Cleaners for X-Ray Developer Systems

Many cleaners for X-ray developer systems contain chromium. Chromium is considered a toxic substance that must be managed as a hazardous waste. Dispose of chromium-containing cleaners through a hazardous waste hauler. If possible use a non-chromium cleaner. Never put a cleaning solution, disinfectant or any other process waste into a septic system, regardless of its concentration. It may disrupt the proper functioning of the septic system.

Lead Foils, Shields & Aprons



The lead foil inside each x ray packet is a leachable toxin and can contaminate the soil and groundwater in landfill sites. Lead is a heavy metal that affects neurological development and functions. Do not put the lead foil that shields X-ray film, protective lead shields, and lead aprons into the trash or into biohazard bags. The pure lead content of these items makes them hazardous waste, even if they are recycled for their scrap metal content. Dispose of lead foils, shields and aprons through a hazardous waste hauler. Check with the manufacturer for recycling possibilities for lead aprons that become worn out or damaged.¹¹

Chemicleave/Chemical Sterilant Solutions

Spent chemicleave solution is the liquid left over from the chemical sterilization of dental instruments. This used solution is an ignitable waste because it contains more than 24% alcohol and has a flashpoint below 140°F. Dilute the spent chemicleave solution with at least 4 parts of water (4 parts water to one part chemicleave solution) or more before discharging down the drain. Do not wash the chemicleave solution down the drain undiluted, or put in the garbage. Never put a cleaning solution, disinfectant or any other process waste into a septic system, regardless of its concentration. It may disrupt the proper functioning of the septic system.¹¹

Disinfectants, Cleaners & Other Chemicals¹¹

Follow the label directions on the product container for guidance on the proper handling and disposal of used disinfectants and cleaners, along with the residue remaining in the product containers. Recycle the empty container through your local program or dispose of it in the trash.

Alcohols, ethers, and peroxides are considered ignitable and must not be

discarded down the drain because they could explode. These materials are considered to be hazardous waste. Unused products should be disposed of through a hazardous waste hauler. Never put a cleaning solution, disinfectant or any other process waste into a septic system, regardless of its concentration. It may disrupt the proper functioning of the septic system.

Office Waste¹¹

General Office Waste: Recycle aluminum, glass, plastics, newspaper, corrugated cardboard, paperboard, and office paper through your trash hauler or local recycling program. Due to confidential patient information you may want to have office paper shredded prior to recycling. Recycle spent toner cartridges that have been used in printers and copiers.¹¹

Fluorescent Bulbs: Fluorescent bulbs are hazardous waste and a significant source of mercury. They should not be placed in the trash.

Batteries: Recycle all types of batteries. Most, if not all, batteries have hazardous properties and should be recycled. Do not place batteries in the trash, biohazard bag, or sharps container.

Single Use Batteries: As a result of federal and state legislation, mercury is no longer added to domestically produced alkaline batteries.

Certain other kinds of batteries including certain button batteries, some medical batteries, small sealed lead-acid batteries, and other specialty batteries continue to contain mercury and other metals that are intentionally added.

Rechargeable Batteries: Batteries such as nickel/cadmium (Ni/Cd) that are no longer useful are hazardous waste and should also be recycled since they contain lead and

cadmium.¹¹

Steps in Waste Management¹³

- Waste Survey: quantification and differentiation of waste.
- Waste segregation: placing different wastes in different containers.
- Waste accumulation and storage: accumulation temporary holding, storage longer holding.
- Waste transportation: wastes are carried in special containers in vehicles
- Waste treatment: a process that modifies waste to disinfect or decontaminate it so that they are no longer a source of pathogens and can be handled, transported and stored safely.
- Waste disposal: incineration, chemical disinfection, wet and dry thermal treatment, microwave irradiation, land disposal and inertization
- Waste inertization: rendering the wastes safe by mixing them with calculated proportions of cement, water, lime etc.
- Waste minimization: following reduce, reuse, recycle methods.

Conclusion

Never dispose biomedical waste into the garbage. All infectious waste disposed into the yellow container/bag. Waste that can be disinfected by treatment and recycled into the red bag container. Sharps into the blue container/bag. Puncture proof. Drugs, discard medicines into the black bag. Never dispose chemicals into the drain before diluting or rendering them safe. Minimize the quantity of waste generated in the clinic.

References

References are available on request at editor@healtalkt.com

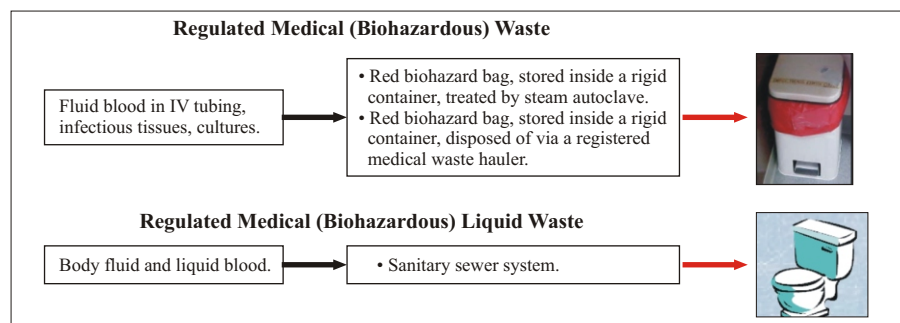


Fig. 1: Dental Waste Disposal Guide.⁵

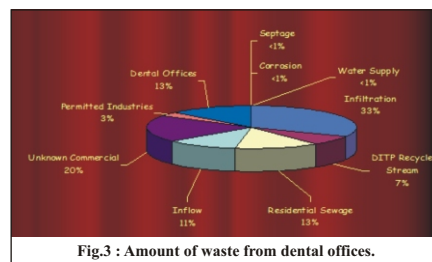


Fig.3 : Amount of waste from dental offices.

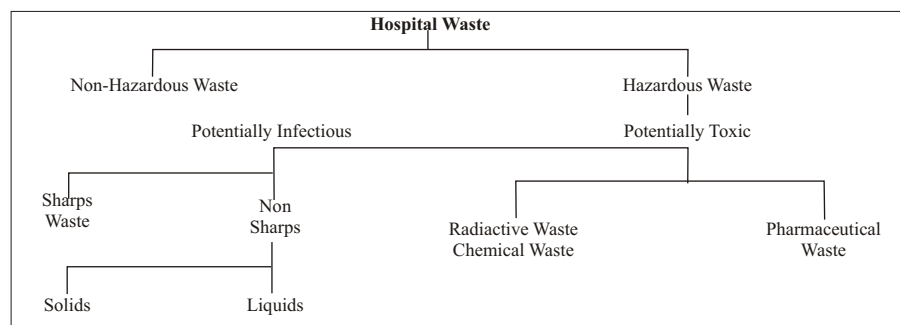


Fig. 2 : Classification of Waste⁷

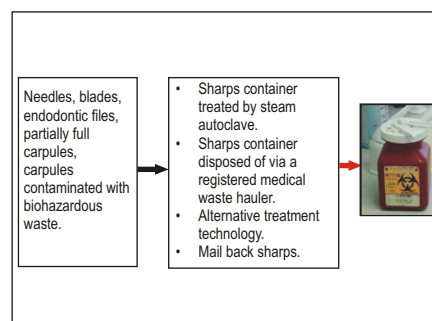


Fig. 4 : Regulated Medical (Sharps) Waste



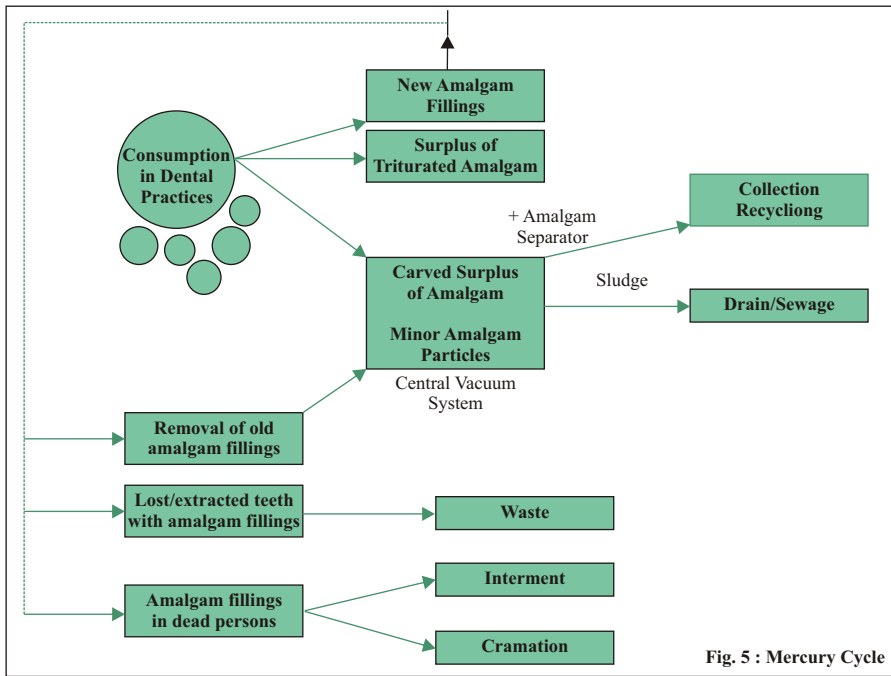


Fig. 5 : Mercury Cycle

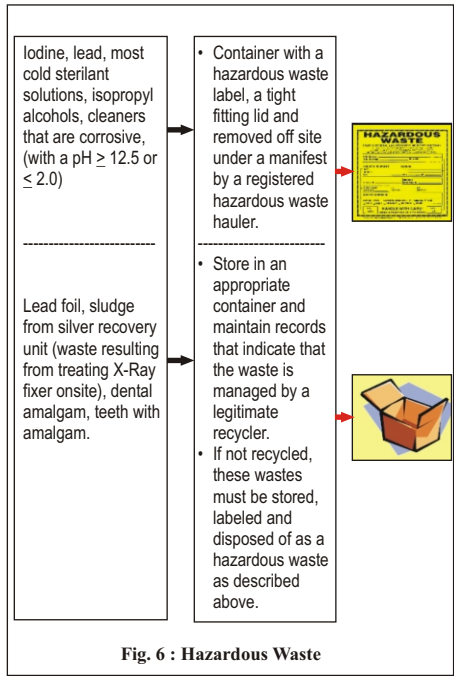


Fig. 6 : Hazardous Waste

Table 1 : Categories of Biomedical Waste²

Waste Category No.	Waste Category (Type)	Treatment and Disposal (Option+)
Category No. 1	Human Anatomical Waste (Human tissues, organs, body parts)	Incineration@/deep burial*
Category No. 2	Animals Waste (Animal tissues, organs, body parts carcasses, bleeding parts, fluid, blood and experimental animals used in research, waste generated by veterinary hospitals colleges, discharge from hospitals, animal houses)	incineration@/deep burial*
Category No. 3	Microbiology & Biotechnology Waste (Wastes from laboratory cultures, stocks or specimens of micro-organisms live or attenuated vaccines, human and animal cell-culture used in research and infectious agents from research and industrial laboratories, wastes from production of biologicals, toxins, dishes and devices used for transfer of cultures)	Local autoclaving/micro-waving/incineration@
Category No. 4	Waste Sharps (Needles, syringes, scalpels, blades, glass, etc. that may cause puncture and cuts. This includes both used and unused sharps)	Disinfection (chemical treatment@01/auto claving/micro-waving and mutilation/shredding"
Category No. 5	Discarded Medicines and Cytotoxic Drugs (Wastes comprising of outdated, contaminated and discarded medicines)	Inc incineration@/destruction and drugs disposal in secured landfills
Category No. 6	Solid Waste (Items contaminated with blood, and body fluids including cotton, dressings, soiled plaster casts, lines, beddings, other material contaminated with blood)	Incineration@ auto claving/micro-waving
Category No. 7	Solid Waste (Wastes generated from disposable items other than the waste (sharps) such as tubings, catheters, intravenous sets etc).	Disinfection by chemical treatment@@ autoclaving/micro-waving and mutilation/shredding##
Category No. 8	Liquid Waste (Waste generated from laboratory and washing, cleaning house-keeping and disinfecting activities)	Disinfection by chemical treatment@@ and discharge
Category No. 9	Incineration Ash (Ash from incineration of any bio-medical waste)	Disposal in municipal landfill
Category No. 10	Chemical Waste (Chemicals used in production of biologicals, chemicals used in disinfection, as insecticides, etc)	Chemical treatment@@ and discharge into drains for liquids and secured landfill for solids.

@ Chemicals treatment using at least 1% hypochlorite solution or any other equivalent chemical reagent. It must be ensured that chemical treatment ensures disinfection.
 ## Mutilation/shredding must be such so as to prevent unauthorised reuse.
 @@ There will be no chemical pretreatment before incineration. Chlorinated plastics shall not be incinerated.
 * Deep burial shall be an option available only in towns with population less than five lakhs and in rural areas.

Table 2 : Categories and Color Coding of the Container

Colour Coding	Type of Container-I Waste Category	Treatment Options as per Schedule-I
Yellow	Plastic bag Cat. 1, Cat. 2, and Cat. 3, Cat. 6	Incineration/deep burial
Red	Disinfected container/plastic bag Cat. 3, Cat. 6, Cat. 7	Autoclaving/Microwaving/Chemical Treatment
Blue/White translucent	Plastic bag/puncture proof Cat. 4, Cat. 7, Container	Autoclaving/Microwaving/Chemical Treatment and destruction/ shredding
Black	Plastic bag Cat. 5 and Cat. 9 and Cat. 10 (Solid)	Disposal in secured landfill