International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2016; 4(2): 101-106

Received: 21-01-2016
Accepted: 22-02-2016

Jaswinder Singh
Assistant Professor of Chemistry, Dr. BR Ambedkar Govt. College, Mandi Dabwali, Haryana, India

Correspondence
Jaswinder Singh
Assistant Professor of Chemistry, Dr. BR Ambedkar Govt. College, Mandi Dabwali, Haryana, India

Modern waste management & environmental protection

Jaswinder Singh

Abstract
Waste Management is committed to protecting human health and the environment. This commitment is a cornerstone of all that we do, reflected in the services we provide to customers, the design and operation of our facilities, the conditions under which employees work, and our interactions with the communities where we live and do business. We are responsible stewards of the environment and protect the health and well-being of our employees and neighbours. The following principals are applicable to company operations worldwide:
Protection: We will conduct all operations in a manner that protects the environment and our employees, neighbours, and customers. We will proactively work to implement procedures and programs to prevent pollution.
Compliance: We will comply with all legal requirements, and will proactively implement programs and procedures to ensure compliance.
Conservation: We will practice and promote the conservation of nature and the earth's energy resources. The science of landfill construction has progressed remarkably from the days when waste was deposited in open, unlined "dumps." Today, modern landfills like Mill Seat are carefully designed to contain waste and protect the environmental integrity of the surrounding area – including the air, water and soil.

Keywords: Management, environmental protection, human health

1. Introduction
Municipal solid waste (MSW), commonly known as trash or garbage in the United States and as refuse or rubbish in Britain, is a waste type consisting of everyday items that are discarded by the public. "Garbage" can also refer specifically to food waste, as in a garbage disposal; the two are sometimes collected separately.

1.1 Composition
The composition of municipal solid waste varies greatly from municipality to municipality and changes significantly with time. In municipalities which have a well-developed waste recycling system, the waste stream consists mainly of intractable wastes such as plastic film, and non-recyclable packaging materials. At the start of the 20th century, the majority of domestic waste (53%) in the UK consisted of coal ash from open fires. In developed areas without significant recycling activity it predominantly includes food wastes, market wastes, yard wastes, plastic containers and product packaging materials, and other miscellaneous solid wastes from residential, commercial, institutional, and industrial sources. Most definitions of municipal solid waste do not include industrial wastes, agricultural wastes, medical waste, radioactive waste or sewage sludge. Waste collection is performed by the municipality within a given area. The term residual waste relates to waste left from household sources containing materials that have not been separated out or sent for reprocessing.

1.2 Classification: Waste can be classified in several ways but the following list represents a typical classification:

- Biodegradable waste: food and kitchen waste, green waste, paper (most can be recycled although some difficult to compost plant material may be excluded [5])
- Recyclable materials: paper, cardboard, glass, bottles, jars, tin cans, aluminium, aluminium foil, metals, certain plastics, fabrics, clothes, tires, batteries, etc.
- Inert waste: construction and demolition waste, dirt, rocks, debris

- Electrical and electronic waste (WEEE) - electrical appliances, light bulbs, washing machines, TVs, computers, screens, mobile phones, alarm clocks, watches, etc.
- Composite wastes: waste clothing, Tetra Packs, waste plastics such as toys
- Hazardous waste including most paints, chemicals, tires, batteries, light bulbs, electrical appliances, fluorescent lamps, aerosol spray cans, and fertilizers
- Toxic waste including pesticides, herbicides, and fungicides
- Biomedical waste, expired pharmaceutical drugs, etc.

2. Components of solid waste management

Bins to collect paper, aluminium, glass, PET bottles and incinerable waste

The municipal solid waste industry has four components: recycling, composting, disposal, and waste-to-energy via incineration [6]. There is no single approach that can be applied to the management of all waste streams, therefore the Environmental Protection Agency, federal agency of the United States of America, developed a hierarchy ranking strategy for municipal solid waste [7]. The Waste Management Hierarchy is made up of four levels ordered from most preferred to least preferred methods based on their environmental soundness: Source reduction and reuse; recycling or composting; energy recovery; treatment and disposal [8].

Collection

The functional element of collection includes not only the gathering of solid waste and recyclable materials, but also the transport of these materials, after collection, to the location where the collection vehicle is emptied. This location may be a material processing facility, a transfer station or a landfill disposal site.

3. Waste handling and separation, storage and processing at the source [edit]

Waste handling and separation involves activities associated with waste management until the waste is placed in storage containers for collection. Handling also encompasses the movement of loaded containers to the point of collection. Separating different types of waste components is an important step in the handling and storage of solid waste at the source.

Segregation and processing and transformation of solid wastes

The types of means and facilities that are now used for the recovery of waste materials that have been separated at the source include curb side ('kerbside' in the UK) collection, drop-off and buy-back centres. The separation and processing of wastes that have been separated at the source and the separation of commingled wastes usually occur at a materials recovery facility, transfer stations, combustion facilities and disposal sites.

Transfer and transport

This element involves two main steps. First, the waste is transferred from a smaller collection vehicle to larger transport equipment. The waste is then transported, usually over long distances, to a processing or disposal site.

Today, the disposal of wastes by land filling or land spreading is the ultimate fate of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual materials from materials recovery facilities (MRFs), residue from the combustion of solid waste, compost, or other substances from various solid waste processing facilities. A modern sanitary landfill is not a dump; it is an engineered facility used for disposing of solid wastes on land without creating nuisances or hazards to public health or safety, such as the problems of insects and the contamination of ground water.

4. Reusing

In the recent years environmental organizations, such as Freegle or Freecycle Network, have been gaining popularity for their online reuse networks. These networks provide a worldwide online registry of unwanted items that would otherwise be thrown away, for individuals and nonprofits to reuse or recycle. Therefore, this free Internet-based service reduces landfill pollution and promotes the gift economy.

Landfills

Landfills are created by land dumping. Land dumping methods vary; most commonly it involves the mass dumping of waste into a designated area, usually a hole or side hill. After the waste is dumped, it is then compacted by large machines. When the dumping cell is full, it is then "sealed" with a plastic sheet and covered in several feet of dirt. This is the primary method of dumping in the United States because of the low cost and abundance of unused land in North America. Landfills pose the threat of pollution, and can intoxicate ground water. The signs of pollution are effectively masked by disposal companies and it is often hard to see any evidence. Usually landfills are surrounded by large walls or fences hiding the mounds of debris. Large amounts of chemical odour eliminating agent are sprayed in the air surrounding landfills to hide the evidence of the rotting waste inside the plant [9].

5. Energy generation

Municipal solid waste can be used to generate energy. Several technologies have been developed that make the processing of MSW for energy generation cleaner and more economical than ever before, including landfill gas capture, combustion, paralysis, gasification, and plasma arc gasification [10]. While older waste incineration plants emitted a lot of pollutants, recent regulatory changes and new technologies have significantly reduced this concern. United States Environmental Protection Agency (EPA) regulations in 1995 and 2000 under the Clean Air Act have succeeded in reducing emissions of dioxins from waste-to-energy facilities by more than 99 percent below 1990 levels, while mercury emissions have been reduced by over 90 percent [11]. The EPA noted these improvements in 2003, citing waste-to-energy as a power source with less environmental impact than almost any other source of electricity [12].

6. Handling of Bio-Medical Waste

Medical care is vital for our life and health, but the waste generated from medical activities represents a real problem of living nature and human world. Improper management of waste generated in health care facilities causes a direct health impact on the community, the health care workers and on the environment Every day, relatively large amount of potentially infectious and hazardous waste are generated in the health care hospitals and facilities around the world. Indiscriminate

disposal of BMW or hospital waste and exposure to such waste possess serious threat to environment and to human health that requires specific treatment and management prior to its final disposal. The present article deals with the basic issues as definition, categories, problems relating to biomedical waste and procedure of handling and disposal method of Biomedical Waste Management. It also intends to create awareness amongst the personnel involved in health care unit. The proper management of biomedical waste has become a worldwide humanitarian topic today. Although hazards of poor management of biomedical waste have aroused the concern world over, especially in the light of its far-reaching effects on human, health and the environment [2].

6.1 India's Major Achievement: One of India's major achievements has been to change the attitudes of the operators of health care facilities to incorporate good HCW management practices in their daily operations and to purchase on-site waste management services from the private sector. World Health Organization states that 85% of hospital wastes are actually non-hazardous, whereas 10% are infectious and 5% are non-infectious but they are included in hazardous wastes. About 15% to 35% of Hospital waste is regulated as infectious waste. A major issue related to current Bio-Medical waste management in many hospitals is that the implementation of Bio-Waste regulation is unsatisfactory as some hospitals are disposing of waste in a haphazard, improper and indiscriminate manner, lack of segregation practices, results in mixing of hospital wastes with general waste making the whole waste stream hazardous. Inappropriate segregation ultimately results in an incorrect method of waste disposal. The problem of bio-medical waste disposal in the hospitals and other healthcare establishments has become an issue of increasing concern, prompting hospital administration to seek new ways of scientific, safe and cost effective management of the waste, and keeping their personnel informed about the advances in this area. The need of proper hospital waste management system is of prime importance and is an essential component of quality assurance in hospitals. Medical wastes should be classified according to their source, typology and risk factors associated with their handling, storage and ultimate disposal. The segregation of waste at source is the key step and reduction, reuse and recycling should be considered in proper perspectives. We need to consider innovative and radical measures to clean up the distressing picture of lack of civic concern on the part of hospitals and slackness in government implementation of bare minimum of rules, as waste generation particularly biomedical waste imposes increasing direct and indirect costs on society. The challenge before us, therefore, is to scientifically manage growing quantities of biomedical waste that go beyond past practices. If we want to protect our environment and health of community we must sensitize ourselves to this important issue not only in the interest of health managers but also in the interest of community.

7. Waste disposal

Waste management is the handling of discarded materials. Recycling and composting, which transform waste into useful products, are forms of waste management. The management of waste also includes disposal, such as land filling. Waste can be almost anything, including food, leaves, newspapers, bottles, construction debris and chemicals from a factory, candy wrappers, disposable diapers, old cars, or radioactive materials. People have always produced waste, but as industry and technology have evolved and the human population has grown, waste management has become increasingly complex. A primary objective of waste management today is to protect the public and the environment from potentially harmful effects of waste. Some waste materials are normally safe, but can become hazardous if not managed properly. For example, 1 gal (3.75 l) of used motor oil can potentially contaminate one million gal (3,790,000 l) of drinking water. Every individual, business, or organization must make decisions and take some responsibility regarding the management of his or her waste. On a larger scale, government agencies at the local, state, and federal levels enact and enforce regulations governing waste management. These agencies also educate the public about proper waste management. In addition, local government agencies may provide disposal or recycling services, or they may hire or authorize private companies to perform those functions. Throughout history, there have been four basic methods of managing waste: dumping it, burning it, finding another use for it (reuse and recycling), and not creating the waste in the first place (waste prevention). How those four methods are utilized depends on the wastes being managed. Municipal solid waste is different from industrial, agricultural, or mining waste. Hazardous waste is a category that should be handled separately, although it sometimes is generated with the other types. The first humans did not worry much about waste management. They simply left their garbage where it dropped. However, as permanent communities developed, people began to dispose of their waste in designated dumping areas. The use of such "open dumps" for garbage is still common in many parts of the world. Open dumps have major disadvantages, however, especially in heavily populated areas. Toxic chemicals can filter down through a dump and contaminate groundwater. The liquid that filters through a dump or landfill is called leach ate. Dumps may also generate methane, a flammable and explosive gas produced when organic wastes decompose under anaerobic (oxygen-poor) conditions. The landfill, also known as the "sanitary landfill," was invented in England in the 1920s. At a landfill, the garbage is compacted and covered at the end of every day with several inches of soil. Land filling became common in the United States in the 1940s. By the late 1950s, it was the dominant method for disposing municipal solid waste in the nation. Early landfills had significant problems with leach ate and methane, but those have largely been resolved at facilities built since about the early 1970s. Well-engineered landfills are lined with several feet of clay and with thick plastic sheets. Leach ate is collected at the bottom, drained through pipes, and processed. Methane gas is also safely piped out of many landfills.

7.1 The Dumping of Waste: The dumping of waste does not just take place on land. Ocean dumping, in which barges carry garbage out to sea was once used as a disposal method by some United States coastal cities and is still practiced by some nations. Sewage sludge, or waste material from sewage treatment, was dumped at sea in huge quantities by New York City as recently as 1992, but this is now prohibited in the United States. Also called bio solids, sewage sludge is not generally considered solid waste, but it is sometimes composted with organic municipal solid waste. Burning has a long history in municipal solid waste management. Some American cities began to burn their garbage in the late nineteenth century in devices called cremators. These were not very efficient, however, and cities went back to dumping and other methods. In the 1930s and 1940s, many cities built

new types of more-efficient garbage burners known as incinerators. The early incinerators were rather dirty in terms of their emissions of air pollutants, and beginning in the 1950s they were gradually shut down. However, in the 1970s, waste burning enjoyed another revival. These newer incinerators, many of which are still in operation, are called "resource recovery" or "waste-to-energy" plants. In addition to burning garbage, they produce heat or electricity that can be used in nearby buildings or residences, or sold to a utility. Many local governments became interested in waste-to-energy plants following the energy crisis in 1973. However, since the mid-1980s, it became difficult to find locations to build these facilities, mainly because of public opposition focused on air-quality issues. Another problem with incineration is that it generates ash, which must be land filled. Incinerators usually reduce the volume of garbage by 70–90%. The remainder of the incinerated waste comes out as ash that often contains high concentrations of toxic substances. Municipal solid waste will likely always be land filled or burned to some extent. In the past 25 years, however, non-disposal methods such as waste prevention and recycling have become more common. Because of public concerns and the high costs of land filling and burning (especially to build new facilities), local governments want to reduce the amount of waste that must be disposed in these ways. Municipal solid waste is a relatively small part of the overall waste generated in the United States. More than 95% of the total 4.5 billion tons of solid waste generated in the United States each year is agricultural, mining, or industrial waste. These wastes do not receive nearly as much attention as municipal solid waste, because most people do not have direct experience with them. Also, agricultural and mining wastes, which make up 88% of the overall total of solid waste, are largely handled at the places they are generated, that is, in the fields or at remote mining sites.

8. The Problem of Mining: Mining nearly always generates substantial waste, whether the material being mined is coal, clay, sand, gravel, building stone, or metallic ore. Early mining concentrated on the richest lodes of minerals. Because modern methods of mining are more efficient, they can extract the desired minerals from veins that are less rich. However, much more waste is produced in the process.

Industrial wastes that are not hazardous have traditionally been sent to landfills or incinerators. The rising cost of disposal has prompted many companies to seek alternative methods for handling these wastes, such as waste prevention and recycling. Often a manufacturing plant can reclaim certain waste materials by feeding them back into the production process.

9. Hazardous Wastes: Hazardous wastes are materials considered harmful or potentially harmful to human health or the environment. Wastes may be deemed hazardous because they are poisonous, flammable, or corrosive, or because they react with other substances in a dangerous way. Industrial operations have produced large quantities of hazardous waste for hundreds of years. Some hazardous wastes, such as mercury and dioxins, may be released as gases or vapours. Many hazardous industrial wastes are in liquid form. One of the greatest risks is that these wastes will contaminate water supplies. An estimated 60% of all hazardous industrial waste in the United States is disposed using a method called deep-well injection. With this technique, liquid wastes are injected through a well into an impervious rock formation that keeps the waste isolated from groundwater and surface water. Other methods of underground burial are also used to dispose hazardous industrial waste and other types of dangerous material.

10. The Use of Pesticides

Pesticides used in farming may contaminate agricultural waste. Because of the enormous volumes of pesticides used in agriculture, the proper handling of unused pesticides is a daunting challenge for waste managers. Certain mining techniques also utilize toxic chemicals. Piles of mining and metal-processing waste, known as waste rock and tailings, may contain hazardous substances. Because of a reaction with the oxygen in the air, large amounts of toxic acids may form in waste rock and tailings and leach into surface waters.

Public attitudes also play a pivotal role in decisions about waste management. Virtually every proposed new landfill or waste-to-energy plant is opposed by people who live near the site. Public officials and planners refer to this reaction as NIMBY, which stands for "Not In My Back-Yard." If an opposition group becomes vocal or powerful enough, a city or county council is not likely to approve a proposed waste-disposal project. The public also wields considerable influence with businesses. Recycling and waste prevention initiatives enjoy strong public support. About 19% of United States municipal solid waste was recycled or composted in 1994, 10% was incinerated, and 71% was land filled.

Preventing or reducing waste is typically the least expensive method for managing waste. Waste prevention may also reduce the amount of resources needed to manufacture or package a product. For example, most roll-on deodorants once came in a plastic bottle, which was inside a box. Beginning about 1992, deodorant manufacturers redesigned the bottle so that it would not tip-over easily on store shelves, which eliminated the need for the box as packaging. This is the type of waste prevention called source reduction. It can save businesses money, while also reducing waste. Waste prevention includes many different practices that result in using fewer materials or products, or using materials that are less toxic. For example, a chain of clothing stores can ship its products to its stores in reusable garment bags, instead of disposable plastic bags. Manufacturers of household batteries can reduce the amount of mercury in their batteries. In an office, employees can copy documents on both sides of a sheet of paper, instead of just one side. A family can use cloth instead of paper napkins. Composting grass clippings and tree leaves at home, rather than having them picked up for disposal or municipal composting is another form of waste prevention. A resident can leave grass clippings on the lawn after mowing (this is known as grass-cycling), or can compost leaves and grass in a backyard composting bin, or use them as mulch in the garden.

When the current recycling boom began in the late 1980s, markets for the recyclables were not sufficiently considered. A result was that some recyclable materials were collected in large quantities but could not be sold, and some ended up going to landfills. Today, the development of recycling markets is a high priority. "Close the loop" is a catch-phrase in recycling education; it means that true recycling (i.e., the recycling loop) has not taken place until the new product is purchased and used. To boost recycling markets, many local and state governments now require that their own agencies purchase and use products made from recycled materials. In a major step forward for recycling, President Bill Clinton issued

an executive order in 1993 requiring the federal government to use more recycled products.

Many managers of government recycling programs feel that manufacturers should take more responsibility for the disposal of their products and packaging, rather than letting municipalities bear the brunt of the disposal costs. An innovative and controversial law in Germany requires manufacturers to set up collection and recycling programs for disused packaging of their products.

The high cost of government-created recycling programs is often criticized. Supporters of recycling argue it is still less expensive than land filling or incineration, when all costs are considered. Another concern about recycling is that the recycling process itself may generate hazardous wastes that must be treated and disposed. Recycling of construction and demolition (C&D) debris is one of the growth areas for recycling. Although C&D debris is not normally considered a type of municipal solid waste, millions of tons of it have gone to municipal landfills over the years. If this material is separated at the construction or demolition site into separate piles of concrete, wood, and steel, it can usually be recycled.

Composting is considered either a form of recycling, or a close relative. Composting occurs when organic waste— such as yard waste, food waste, and paper—is broken down by microbial processes. The resulting material, known as compost, can be used by landscapers and gardeners to improve the fertility of their soil. Yard waste, primarily grass clippings and tree leaves, makes up about one-fifth of the weight of municipal solid waste. Some states do not allow this waste to be disposed. These yard-waste bans have resulted in rapid growth for municipal composting programs. In these programs, yard waste is collected by trucks (separately from garbage and recyclables) and taken to a composting plant, where it is chopped up, heaped, and regularly turned until it becomes compost. Waste from food-processing plants and produce trimmings from grocery stores are composted in some parts of the country. Residential food waste is the next frontier for composting. The city of Halifax, in Canada, collects food waste from households and composts it in large, central facilities.

Biological treatment, a technique for handling hazardous wastes, could be called a high-tech form of composting. Like composting, biological treatment employs microbes to break down wastes through a series of metabolic reactions. Many substances that are toxic, carcinogenic (cancer-causing), or undesirable in the environment for other reasons can be rendered harmless through this method.

Waste management became a particularly expensive proposition during the 1990s, especially for disposal. Consequently, waste managers constantly seek innovations that will improve efficiency and reduce costs. Several new ideas in land-filling involve the reclamation of useful resources from wastes. For example, instead of just burning or releasing the methane gas that is generated within solid-waste landfills, some operators collect this gas, and then use it to produce power locally or sell it as fuel. At a few landfills, managers have experimented with a bold but relatively untested concept known as landfill mining. This involves digging up an existing landfill to recover recyclable materials, and sometimes to re-bury the garbage more efficiently. Landfill mining has been criticized as costly and impractical, but some operators believe it can save money under certain circumstances. In the high-tech world of incineration, new designs and concepts are constantly being tried. One waste-to-energy technology for solid waste being introduced to the United States is called fluidized-bed incineration. About 40% of incinerators in Japan use this technology, which is designed to have lower emissions of some air pollutants than conventional incinerators. A 1994 United States Supreme Court ruling could increase the cost of incineration significantly. The Court ruled that some ash produced by municipal solid-waste incinerators must be treated as a hazardous waste, because of high levels of toxic substances such as lead and cadmium. This means that incinerator ash now has to be tested, and part or all of the material may have to go to a hazardous waste landfill rather than a standard landfill. A much smaller type of incinerator is used at many hospitals to burn medical wastes, such as blood, surgical waste, syringes, and laboratory waste. The safety of these medical waste incinerators has become a major issue in some communities. A study by the Environmental Protection Agency released in 1994 found that medical waste incinerators were leading sources of dioxin emissions into the air. The same study warned that dioxins, which can be formed by the burning of certain chemical compounds, pose a high risk of causing cancer and other health hazards in humans.

12. Save Resources-Reduce & Re-Use

Source reduction, also known as waste prevention, means reducing waste at the source, and is the most environmentally preferred strategy. It can take many different forms, including reusing or donating items, buying in bulk, reducing packaging, redesigning products, and reducing toxicity. Source reduction also is important in manufacturing. Light weighting of packaging, reuse, and remanufacturing are all becoming more popular business trends. Purchasing products that incorporate these features supports source reduction.

Source reduction can:

- Save natural resources,
- Conserve energy,
- Reduce pollution,
- Reduce the toxicity of our waste, and
- Save money for consumers and businesses alike.

13. Conclusions

1. The greatest impetus for waste prevention will likely come from the public. More and more citizens will come to understand that pesticides, excessive packaging, and the use of disposable rather than durable items have important environmental costs. Through the growth of the information society, knowledge about these and other environmental issues will increase. This should result in a continuing evolution towards more efficient and environmentally sensitive waste management.
2. Extensive research on biological treatment is in progress. Genetic engineering, a controversial branch of biology dealing with the modification of genetic codes, is closely linked with biological treatment, and could produce significant advances in this field.
3. Waste from food-processing plants and produce trimmings from grocery stores are composted in some parts of the country. Residential food waste is the next frontier for composting.
4. Recycling of construction and demolition (C&D) debris is one of the growth areas for recycling.

14. References

1. Environmental Protection & Management | Waste Management www.wm.com › Sustainability

2. millseatlandfill.wm.com/environmental-protection/index.jsp
3. Training in Waste Management and Environmental Protection in the ...www.conference-service.com › ... › Continuing Professional Education, Courses
4. Integrated Waste Management Facilities - Environmental Protection...www.epd.gov.hk/epd/english/environmentinhk/waste/prob.../WFdev_IWMF.
5. Problems & Solutions | Environmental Protection Department. www.epd.gov.hk/epd/english/environmentinhk/waste/prob.../WFdev_IWMFtech.html
6. Waste – Wikipedia https://en.wikipedia.org/wiki/Waste
7. Municipal solid waste – Wikipedia https://en.wikipedia.org/wiki/Municipal_solid_waste
8. Waste | Department of Housing, Planning, Community and Local... www.housing.gov.ie/environment/waste/waste
9. Non-Hazardous Materials and Waste Management Hierarchy - US EPA https://www.epa.gov/.../sustainable-materials-management-non-hazardous-materials-a...
10. Waste disposal facts, information, pictures | Encyclopedia.com articles...www.encyclopedia.com › History › United States and Canada › U.S. History