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ROLE OF CHEMISTRY ON WASTE MANAGEMENT

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ABSTRACT

Chemical processes designed to reduce or eliminate negative environmental impacts. The usage and re-production of the chemicals produces reduced waste products, non-toxic components and improved quality. Green chemistry is a highly effective motivation in pollution prevention because it applies innovative scientific approaches in real-world environmental situations. Chemical products and processes should be designed to the highest level of this phenomenon and be cost-competitive as well as cost-effective in the world market. Green Chemistry applications: Source of Reduction & Prevention of Chemical Hazards, Design of chemical products which are less hazardous to human health and the environment, Use of feedstock's and reagents that are less hazardous to human health and the environment, Design of syntheses and other processes to be of less energy consumption and materials intensive with high atom economy & low E-factor), Use of feedstock's derived from annually renewable resources or from abundant waste, Design of chemical products for increased, more facile reuse or recycling, Reuse or Recycle of Chemicals, Treatment of Chemicals to make them less hazardous, Disposal of Chemicals Properly including radioactive wastes. The chemicals that are less hazardous to human health and the environment are less toxic to organisms and ecosystems, not persistent or bio-accumulative in organisms or the environment and inherently safer with respect to handling and use to make green ecosystem.

Key words: *Recycling Process, Chemical waste, Municipal Waste*

INTRODUCTION

India, the world's second highest populated country with population exceeding a billion and one of the fastest urbanizing countries, is a land of physical, climatic, geographic, ecological, social, cultural and linguistic diversity. India currently is facing a municipal solid waste dilemma, for which all elements of the society are responsible. The community sensitization and public awareness is low. There is no system of segregation of organic, inorganic and recyclable wastes at the household level. Today more than 45 million tonnes/year of solid waste is generated from the urban centers of India which are collected inefficiently, transported inadequately and disposed unscientifically. The generation is expected to raise 125 million tonnes/year by the year 2025. According to Ministry of Urban Affairs, Govt. of India estimate, India is generating approximately 100,000 metric tons of solid waste every day of which 90 % is dumped in the open place. Rapid increase in population and change in lifestyle in India have resulted in a drastic increase in the generation of Municipal Solid Waste (MSW). It includes domestic as well as commercial waste that accounts for a relatively small part of the total solid waste stream in developed countries. Accumulation of a large amount of waste may create several problems to inhabiting populations. 2 Population growth has been contributing to increase the quantity and variety of waste. Collection, transportation and handling of the waste must also be properly dealt with, if not the waste creates a number of problems, many of which

are related to human health and environment Waste is defined as any unwanted material intentionally thrown away for disposal. However, certain wastes may eventually become resources valuable to others once they are removed from our ways of life and they are generated at every stage during the process of production and development. The knowledge of the sources and types of waste in an area is required to design and operate appropriate solid waste management systems. Solid waste can be defined as garbage, refuse and other discarded materials including waste resulting from industrial, commercial and agricultural operations and from community activities or waste that are normally solid and that are discarded as useless or unwanted. Waste typically includes a mix of biogenic containing materials (e.g., paper, wood, food waste), manmade carbon-containing materials (e.g., plastics, tires, synthetic textiles) and non-carbon-containing materials (e.g., metal, glass, stone). In general, municipal solid waste consists of household and commercial wastes. It may also include wastes derived from civic amenities, street sweeping and construction & demolition wastes from local authority sources. It can vary from one country to another and even vary from one region to another within the same country. It is highly heterogeneous and its composition depends on factors such as living standards, geographical 3 locations including cultural habits of individuals, type of housing and seasons. Once waste is generated at the household level, it has to be handled in a manner that facilitates easy disposal. Waste handling and separation involve activities that are associated with the management of waste until they are placed in storage containers for collection (http://nswaienvis.nic.in). The two leading innovative mechanisms of waste disposal being adopted in India include composting (aerobic composting and vermicomposting) and Waste To Energy (WTE) (incineration, pelletization, biomethanation). Biogenic CO2 emissions are viewed as having a neutral greenhouse gas impact because they result from biological processes in which emissions from the decomposition or burning of waste are balanced by the uptake of carbon dioxide from living and growing plant materials. Burning manmade (anthropogenic) carbon-containing materials such as plastics or synthetic textiles releases carbon that was stored eons ago in fossil fuel deposits. Likewise, burning fossil fuels releases carbon dioxide that is not balanced by the biosphere and is thought to be the primary source of the greenhouse effect.

OBJECTIVE

1. To evaluate current waste management procedures (cradle to grave), i.e., how trash travels from sources of waste creation, primary and secondary collection, temporary storage at treatment facility, treatment, and open landfill disposal.
2. To carry out qualitative and quantitative analyses of municipal¬ solid waste during pre-monsoon, monsoon, winter and summer seasons at Mettupalayam.

To carry out a comparative study of physico-chemical¬ characteristics among all the seasons, how seasons influence the rate of waste generation and variation in physical and chemical characteristics

Specific Waste Management Requirements

Chemical Waste Management

On campus, there is no treatment of chemical waste; rather, the vast majority of it is recycled. Through a variety of industrial procedures, each and every one of the organic wastes that are created are recycled. There is also recycling of between 50 and 75 percent of the inorganic chemical waste, depending on the composition. External contractors are responsible for the treatment of any substances that are unable to be recycled.

Definition

Solids, liquids, and gases in addition to their gaseous counterparts that include or are polluted with any of the following are considered chemical waste.:

- combustible solvents (e.g., acetone, alcohols, acetonitrile);

- release harmful elements into the groundwater, such as heavy metals and pesticides;
- corrosives (e.g., hydrochloric acid, potassium hydroxide pellets);
- substances that are reactive, such as oxidizers, cyanides, sulphides, explosives, unstable compounds, and water-reactive substances (for example, sodium metal and benzoyl peroxide);
- compounds that are hazardous, including those that are mutagenic, carcinogenic, acute or chronic in their toxicity (for example, chloroform and ethidium bromide);
- polychlorinated biphenyls at concentrations more than 50 ppm;
- gas cylinders that are non-returnable.

packaging

In addition to the basic packing standards described in, one must adhere to the following special criteria for chemical waste:

- Never combine components that are incompatible with one another in the same container.
- The chemicals that are being kept must be compatible with the containers used to store the waste. For instance, waste hydrofluoric acid should not be stored in containers made of glass; similarly, corrosive chemicals should not be stored in containers made of metal, etc.
- Solvent safety cans should be used to collect and temporarily store significant quantities (10–20 litres) of flammable organic waste solvents. These cans are designed specifically for this purpose. These cans are the researcher's responsibility to bring to the lab when they are needed. Cans that have been given in for disposal will have their contents drained, and they will be returned to the laboratory as soon as possible, providing that the building and laboratory room number have been clearly written on the cans.
- It is imperative that precipitates, solids, and any other wastes that are not fluids not be placed in safety cans.
- If at all practicable, halogenated and non-halogenated solvents should be packaged in separate containers. The University is required to pay a fee in order to properly dispose of halogenated solvents (e.g., chloroform, carbon tetrachloride).
- Do not place solid chemical waste that has been disposed of in biohazard bags, since doing so will inaccurately signal the presence of a threat that is not actually there.
- The laboratory workers will be able to empty their containers into drums specifically designed for contaminated glass and plastic that will be located in buildings housing Central Waste Storage. (for an example, view the image that follows)

Labelling

In addition to the general labelling requirements outlined in Section 4, these specific requirements for chemical waste must be followed:

Label the garbage container as Chemical Waste immediately after it has been acquired. Labels for chemical waste can be obtained totally free of charge from the EHS team. It is necessary to supply all of the information that is asked on the Chemical Waste Label. There is a requirement to provide the chemical substances' generic names. There is to be no usage of abbreviations, acronyms, or names of registered trademarks. It is unacceptable to use imprecise classifications such as "solvent waste." Please refer to Figure 1 for a finished example of a label for chemical waste.

Figure 1: Example of Properly Completed Waste Label

Chemical Compatibility

It is the obligation of the generator of the chemical waste to ensure that incompatible chemicals are not stored together in the same container while the trash is being prepared for disposal. Containers for waste should be stored according to the chemical reactivities that are compatible with one another. A few instances of them are as follows:

- Compounds that are acid-reactive, such as cyanides and sulphides, and that produce gaseous byproducts when acidified should not be combined with any inorganic acid, according to this rule (e.g., sulphuric or hydrochloric acid).
- Keep inorganic and organic acids in separate containers (for example, glacial acetic acid and regular acetic acid). Inorganic acids are often oxidising agents, but organic acids may be either reducing agents or flammable, depending on the specific acid.
- Materials that are water reactive, such as sodium, should be stored in an area that is not near any source of water.
- Oxidizers (i.e., any inorganic compound that assists fire such as hydrogen peroxide, lead nitrate) should never be mixed with organic materials (e.g., organic bases such as pyridine, aniline, amines, flammable solvents such as toluene, acetone), and reducing agents. • Oxidizers (i.e., any inorganic compound that assists fire such as hydrogen peroxide, lead n (e.g., water-reactive chemicals such as sodium).
- Take note that perchloric acid, despite the fact that it is an inorganic acid, is a potent oxidising agent, and that it should be regarded a potent oxidant when it is in its concentrated state.
- If you have any wastes that need to be handled in a particular way, such as explosives, organic peroxides, or PCBs (polychlorinated biphenyls), contact with the manager of the environmental protection department.

Special Cases

The method that came before this one dealt with the chemical wastes that are often produced by the university as a result of teaching and research. On occasion, chemical wastes are produced that, as will be demonstrated in the next section, call for extra or specialised management.

Asbestos

Materials that contain asbestos, such as bunsen burner pads, gloves, and other items, are disposed of by workers from the Facilities and Services Trades department who have been educated in the correct handling of these materials. Make contact with the property management of your building.

Batteries

Containers designed specifically for the recycling of household batteries have been strategically positioned across the campus. Facilities and Services is in charge of providing drop-off containers, and this page contains a list of the locations of those containers. Before bringing in any lithium batteries, PLEASE double check that tape has been applied to the terminals of all of the batteries. Get in touch with the Recycling Coordinator at this number for any more information: 416.946.5711. The EHS staff will personally collect any and all other types of batteries, including those with a voltage of 12 volts or above.

Empty Drums

Drums with capacities ranging from 20 to 205 litres will be emptied out by the EHS team. Bromides of Ethidium. It is imperative that any and all ethidium bromide-tainted materials, including solids such as gloves, be placed in a leak-proof container, labelled appropriately, and disposed of as hazardous waste. Gels that have been tainted with ethidium bromide should be sealed in plastic containers that cannot leak (rather than being placed in rubbish bags), and then disposed of as hazardous waste.

Explosives

Do not touch any materials that might explode. Materials such as trinitrated compounds (such as TNT), dry picric acid (with a water content of less than twenty percent by weight), fulminated mercury, and heavy metal azides are all examples of types of explosives (e.g., lead azide). The proper disposal of these items calls for specialised treatment. Regular inspections for degradation and symptoms of old age are required to be carried out on these materials. The "sweating" of a container, swelling, crystal formation around the top,

and other similar phenomena are all examples of these indications. Explosive substances that have been allowed to deteriorate provide a greater risk of injury when handled compared to newly manufactured explosives. Notify EHS as soon as possible.

Gas Cylinders

Each and every gas cylinder need to be regarded as a significant source of energy. Make use of the least size that will yet allow you to complete the task. Check with the provider to ensure that empty cylinders may be sent back to them directly before making the purchase of the cylinder. It would be very difficult and very expensive to dispose of these things in any other location. For further information, please get in touch with the EHS Office.

Mercury thermometers

Thermometers containing mercury that are to be discarded should be regarded as hazardous waste. Thermometers that have been broken should be considered contaminated, and any free liquid mercury should be collected and packaged in a container that will not leak. This should be done in conjunction with the packaging of any contaminated solids, such as glassware and gloves that were used during the cleanup. Cans of Paint Expired or used paint cans are often discarded in the same manner as other types of chemical waste.

Peroxidizable Compounds

Ordering these products in tiny amounts (an amount sufficient for less than six months' supply) and dating them after the container has been opened is recommended. Within six months of being exposed to air, the creation of organic peroxide can start to take place even if the producer has included a commercial inhibitor to the product. By placing orders for fewer units and decreasing the amount of space taken up by these materials in storage, one may increase the rate at which inventory is turned through and decrease the possibility that peroxide will be formed. Organic peroxides are explosive.

The following materials are potential organic peroxide formers:

- acetal
- decahydronapthalene
- dicyclopentadiene
- diethylene glycol
- dioxane
- ether isopropyl ether
- Polychlorinated Biphenyls (PCBs)

The management of waste items that are contaminated with PCBs calls for additional care during the phases of handling, storage, and disposal. In the province of Ontario, a waste item is regarded to be PCB-contaminated if it has a concentration of PCBs that is more than 50 parts per million. The usage of transformers bearing the trade name Aroclor (or the fluid with the generic name askarel) as a source of PCBs was popular in North America. These transformers also included the fluid with the generic name askarel. Nearly every capacitor that was produced between the years 1930 and 1980 was found to contain liquid PCBs. In addition, PCBs were utilised in a number of applications, such as hydraulic equipment, electromagnets, heat transfer equipment, and vapour diffusion pumps, amongst others.

The EHS team is able to conduct tests on samples to identify whether or not they contain PCBs. The Office of Environmental Health and Safety is responsible for coordinating any special disposal arrangements that are necessary.

How to Dispose of Chemical Waste

Through the Resource Conservation and Recovery Act, the Environmental Protection Agency (EPA) is responsible for enforcing regulations regarding chemical waste (RCRA). It is not possible to throw it out in

the ordinary garbage or flush it down the toilet. The EHS Hazardous Waste Program is required to be used for the disposal of the vast majority of chemical wastes. Follow these steps in order to get garbage that might be harmful removed from your laboratory:

If compatibility is not a concern, plastic bottles are preferable to glass jars for storing hazardous waste in plastic bottles are preferable for storing hazardous waste in plastic bottles. When sorting waste chemicals, compatibility should take precedence over alphabetical order.

Chemical waste containers must be labeled with the following information:

Full chemical name and quantity of the waste. For mixtures, each chemical must be listed. Abbreviations, acronyms and ditto marks ("") to replace words are not allowed, as this does not comply with The Hazard Communication Standard;

- Date of waste generation;
- Place of origin (department, room number);
- PI's name and telephone number;
- Bottle number assigned on corresponding waste sheet; and
- The tag or label must have the words: "Hazardous Waste."

The EHS office requires receiving a Hazardous Waste Information Form that has been completely filled out (Instructions are on the back of the form). On this form, we ask that you include the following:

The whole name of the chemical and the amount of trash. In the case of mixes, each component chemical and the amount or weight of that component must be given. Because doing so does not meet the requirements of The Hazard Communication Standard, the use of abbreviations, acronyms, and ditto marks ("") to replace words is prohibited;

- Date of waste generation;
- Place of origin (department, room number);
- PI's name and telephone number;
- A contact name is required to answer any questions or open the door;
- Bottle number (in numerical order) assigned on bottle; and
- A speedtype or account number.

Send the completed form to the Environmental Health and Safety Office, Service Building, 1st floor, Location Code 7227. The form must be received by EHS by Tuesday at noon. Chemical waste removal will then happen on Thursday of that week. Each container must be listed separately, tagged and sealed. Leaking or open containers will not be removed.

- The disposal of chemicals by sanitary sewer is only possible with written permission from EHS. Contact the Director or Chemical Waste Manager for more information.
- Submit a complete list of all chemicals to be disposed of to EHS.
- EHS will review and provide written approval on a case by case basis.
- Any change in formulation (volume of chemical, new chemical), will require a fresh review by EHS.
- Disposal of any chemical into the solid waste disposal system is not allowed.

CONCLUSION

The waste stream analysis result shows that the quantity of the solid waste was influenced by cultural activities of the town. Physical and chemical characteristics of the waste show slight variations among different seasons. From the waste stream analysis it was observed that biodegradable , combustible,

recyclable, inert , hazardous and infectious waste were found from primary collection to final level of disposal, this may due to improper segregation at source level, so the partially segregated waste was sent for windrow composting, which deteriorate the quality of the compost. Air emissions and leachate generation are the main disadvantages of windrow composting. Also the percentage of nutrient in the compost such as nitrogen, phosphorous, potassium and sodium were decreased.

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