Importance of Green Chemistry in Pollution Control

Dr. Mallikarjun Kote

Department of Chemistry B.V.Bhoomaraddi College of Arts, science & Commerce,
Bidar-585403

Abstract

Green chemistry generally refers to the replacement of hazardous chemicals with more environmentally friendly materials in product manufacturing, use and disposal. By introducing more environmentally benign chemicals into the design and manufacturing processes, green chemistry strives to reduce pollution and the environmental impacts associated with industrial wastes and product disposal. SRC (Selective Catalytic Reduction) is a proven leader in this field, especially in the area of identifying and assessing safer substitutes. Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry applies across the life cycle of a chemical product, including its design, manufacture, use, and ultimate disposal. Green chemistry is also known as sustainable chemistry. Due to increasing human activities pressure on natural resources is increasing day by day and something has to be done to reduce it, because if it continues at this rate life on earth would become unsustainable. Many environmentalist and scientist are working to make certain strategies to reduce environmental pollution. In addition to solid waste which we see in our household garbage bins, there are medical, industrial, agricultural and mining wastes. Environment is polluted mostly by improper disposal of waste. Therefore there is a need to keep a check over waste disposal.

Keywords: SRC-Selective Catalytic Reduction, hazardous chemicals, environmental pollution.

Introduction:

Basic Principals of Green Chemistry

1. Prevention, Prevention of waste.
2. Atom economy.
3. Less hazardous chemical syntheses.
4. Designing safer chemicals.
5. Safer solvents and auxiliaries.
6. Design for energy efficiency.
7. Use of renewable feedstock.
8. Reduce derivatives.
9. Catalysis, Catalytic reagents that can be used in small quantities.
10. Design for degradation, that they do not pollute the environment.
12. Inherently safer chemistry for accident prevention, to minimize risks such as explosions, fires, and accidental releases.

Objectives:
Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances. Green chemistry applies across the life cycle of a chemical product, including its design, manufacture, use, and ultimate disposal. Green chemistry is also known as sustainable chemistry. Green chemistry reduces pollution at its source by minimizing or eliminating the hazards of chemical feed stocks, reagents, solvents, and products [1].

- Human impact on the environment
- Environmental sustainability and development
- Air, water pollution & treatment
- Industrial pollution
- Waste management & treatment
- Pollution control technologies & devices
- Effects of mutagens

Management of Waste:
The production and improper disposal of domestic and industrial wastes are responsible for Environment Pollution. The domestic waste includes sewage and municipal waste while industrial wastes include inorganic and organic suspended particles and inorganic and organic soluble matter. One of the best methods to manage wastes especially domestic waste is by collecting them in bins. Government of India is promoting the usage of bins, under the Clean India Campaign that is, Swachh Bharat Abhiyan. It is advisable to collect biodegradable and non-biodegradable wastes into separate bins so that the municipal workers do not have to do extra work for separating them. This household waste is transferred to community bins from where they are collected by municipal workers which take the waste to the dumping sites. Municipal workers separate the waste into biodegradable and non-biodegradable waste at these sites. Biodegradable waste consist of households waste like vegetables, left over food etc. while non-biodegradable includes metal scraps, paper, plastic etc[2].

Recycling:
This is a simplest method of treating the waste. Recycling of materials saves much of the raw materials cost as well as reduces the cost of disposal. Some common examples of recycling by industries are:
- Recycling of Glass
- Using scrap metal to manufacture steel
- Recovering energy by burning down of wastes which are combustible in nature
- The use of waste paper,

In other words, recycling converts waste into wealth.

3 R for Sustainable development: Reuse-Reduce-Recycle.

Sewage Treatment:

The sewage treatment involves the following three types of stages

- The first stage known as Primary Treatment involves the removal of large solid particles. This is done by mechanical process consisting of screening and sedimentation. For this, the waste is filtered through different types of screens. In the next step solid waste are separated and then dumped in landfill sites. It is then allowed to flow into sedimentation tanks. This process allows removal solid that settles out (sludge). This process also allows removal of grease which floats to the surface and can be skimmed off.

- The second stage known as secondary treatment involves the biological oxidation of organic content of waste materials by micro-organisms followed by filtration.

- In the third step which is also called as final treatment which includes various specialized physical and chemical processes which help in reducing the quantities of specific pollutants which remains in the sewage even after primary and secondary treatments. Quality of waste water is improved after this process. The common method used in this treatment involves reverse osmosis, disinfection by chlorine, treatment with activated charcoal, coagulation, filtration, chemical removal of phosphate etc[3].

During these operations sludge is produced which also poses a problem for safe disposal. The sludge is dried and then damped or digested or may be incinerated, as explained below.

Types of Sewage Treatment Processes

Incineration

This converts organic materials into CO₂ and Water. This is used for biological waste (e.g. from hospitals), chemical waste, household waste etc. Most of such treatment occurs under aerobic conditions, where plentiful of oxygen is supplied and at very high temperature (above 1273 K). The exhaust gases are filtered. This process reduces the volume of the waste and inorganic ash is left behind which is disposed of as land fill [4].

Process of Incineration

\[
\text{Organic Waste} + \text{O}_2 \quad \xrightarrow{\text{Aerobic conditions}} \quad \text{CO}_2 + \text{H}_2\text{O}
\]

Using this method we can easily dispose relatively inert PCBs (polychlorobenzenes) and as this method involves endothermic reactions, the high temperature generated allows the breaking of C-Cl bonds in organochlorine compounds. The main disadvantage of this process is that it causes air pollution. Moreover, the ash particles which come out from the municipal incinerators are of very minute size and easily inhaled by the human lungs. Incomplete combustion of PCBs can cause formation of highly toxic chlorine compounds such as polychlorodibenzo-p-dioxins (PCDDs) and polychlorodibenzofurans (PCDFs).
Digestion:

In the process of digestion the microorganisms degrade wastes in the absence of oxygen and this happens when sewage undergoes anaerobic digestion. By using this process, a wide variety of toxic organic wastes can be degraded. The products of digestion are carbon dioxide and methane, which may be used as a fuel [5].

\[ \text{Organic waste} \rightarrow \text{CO}_2 (g) + \text{CH}_4 (g) \]

Dumping:

This is widely used practice of dumping the sewage sludge in the nearby seas. It is known as ocean dumping. However, the application of sludge to the land is increasing. The sludge contains nitrogen and phosphorus which may be useful as a fertilizer. Illegal Dumping consisting of unseparated toxic waste Most of the sludge produced by urban areas consist of toxic substances, so such toxic sludge must be dumped carefully and in a controlled manner.

Green Organic Analysis:

In conventional organic analysis, organic compound is fused with sodium metal which is very hazardous as may cause fire if come in contact with moisture or water. Sometimes it violently explodes and even strikes the eyes of the students causing damage. A safe and non-hazardous procedure, which can be alternatively performed, has been proposed to use zinc dust and sodium bicarbonate instead of metallic sodium [6].

Use of Nonpetroleum fuels:

1. Power Alcohol: When ethyl alcohol is used in an internal combustion engines, it is called “power alcohol”. It is mixed with Gasoline in the ratio of 4:1 in order to increase its octane number. As in India ethyl alcohol is prepared from molasses, a dark brown mother liquor residue left after the crystallization of sugar thus an enormous amount of residue is consumed and hence reduces the pollution.

2. Benzol: It is obtained as side product during coal carbonization. It is also obtained from the fractional distillation of light oil. It is a mixture of benzene (70%), Toluene (18%) and Xylene (6%) with some other hydrocarbons. It can be used as a component of motor fuels due to its high anti knocking value and hence it reduces the fuels consumption as well as generation of toxic pollutants [7, 8].

CONCLUSION:

Though many exciting green chemical processes are being developed but there is far greater number of challenges lies ahead. A lot of efforts are being undertaken to design non-polluting starting materials and to get safer products without side products. Development of better machines and fuels which produce lesser amount of polluting exhaust gases such as CO, CO2, SO2, nitrogen oxides etc. leading to air pollution and ultimately ocean acidification, has been proposed. Use of good fuel and modified green processes will also reduce the addition of heavy toxic metals and other toxic substances to the environment. Solvent free chemical processes or replacement of organic solvents by water reduces...
the addition of volatile organic compounds (VOC) in the environment. Use of microwave for chemical processes has reduced reaction time as well as amount of heat energy. Reduce, reuse and recycling, the principles of green chemistry will result in decrease of marine debris also in addition to pollution in surrounding environment. The greatest challenge is too incorporate the green chemistry in industrial, laboratory and day to day processes in order to control environmental pollution and hence ocean pollution at source. Many successful efforts have been made but still a lot has to be done. This can be achieved by training and educating new generation of chemists.

REFERENCES:


