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A REVIEW OF IMPORTANCE AND APPLICATIONS OF GREEN CHEMISTRY

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ABSTRACT

Green Chemistry is a division of design for environment applying innovative scientific solutions to product manufacturing that means processes reducing or eliminating hazardous substances. Last three decades, Green chemistry has now been making a real difference in our world. In future all division of chemistry fully depends on green chemistry due to decreasing the amount of chemical waste released to the air, water, and soil. 12 set of values of green chemistry is important which diminish or removes the use or creation of hazardous constituents. The principles of green chemistry can be reached using environmentally responsive, inoffensive, reproducible, innocuous solvents and catalysts during manufacture of medicine, and in investigates. The use of non-traditional technique like UV-energy, Microwave irradiation etc. is also significant way to achieve the goal of green chemistry.

KEYWORDS: Green chemistry, Environment and Chemicals.

INTRODUCTION

Green chemistry is the design of chemical products and processes that reduce or eliminate the use or generation of hazardous substances.[1] Green chemistry applies across the life cycle of a chemical product, including its design, manufacture, use, and ultimate disposal. Prevents pollution at the molecular level is a philosophy that applies to all areas of chemistry, not a single discipline of chemistry.[2] Applies innovative scientific solutions to real-world environmental problems. Results in source reduction because it prevents the generation of pollution.[3] Reduces the negative impacts of chemical products and processes on human health and the environment.[4] Lessens and sometimes eliminates hazard from existing products and processes. Designs chemical products and processes to reduce their intrinsic

hazards.[5] Green chemistry reduces pollution at its source by minimizing or eliminating the hazards of chemical feedstock's, reagents, solvents, and products.[6] This is unlike cleaning up pollution (also called remediation), which involves treating waste streams (end-of-the-pipe treatment) or cleanup of environmental spills and other releases.[7] Remediation may include separating hazardous chemicals from other materials, then treating them so they are no longer hazardous or concentrating them for safe disposal.[8] Most remediation activities do not involve green chemistry.[9-12]

Green chemistry's principles

These principles demonstrate the breadth of the concept of green chemistry.

1. Prevent waste: Design chemical syntheses to prevent waste. Leave no waste to treat or clean up.

2. Maximize atom economy: Design syntheses so that the final product contains the maximum proportion of the starting materials. Waste few or no atoms.

3. Design less hazardous chemical syntheses: Design syntheses to use and generate substances with little or no toxicity to either humans or the environment.

4. Design safer chemicals and products: Design chemical products that are fully effective yet have little or no toxicity.

5. Use safer solvents and reaction conditions: Avoid using solvents, separation agents, or other auxiliary chemicals. If you must use these chemicals, use safer ones.

6. Increase energy efficiency: Run chemical reactions at room temperature and pressure whenever possible.

7. Use renewable feedstock's: Use starting materials (also known as feedstock's) that are renewable rather than deplorable. The source of renewable feedstocks is often agricultural products or the wastes of other processes; the source of deplorable feedstocks is often fossil fuels (petroleum, natural gas, or coal) or mining operations.

8. Avoid chemical derivatives: Avoid using blocking or protecting groups or any temporary modifications if possible. Derivatives use additional reagents and generate waste.

9. Use catalysts, not stoichiometric reagents: Minimize waste by using catalytic reactions. Catalysts are effective in small amounts and can carry out a single reaction many times. They are preferable to stoichiometric reagents, which are used in excess and carry out a reaction only once.

10. Design chemicals and products to degrade after use: Design chemical products to break down to innocuous substances after use so that they do not accumulate in the environment.

11. Analyze in real time to prevent pollution: Include in-process, real-time monitoring and control during syntheses to minimize or eliminate the formation of byproducts.

12. Minimize the potential for accidents: Design chemicals and their physical forms (solid, liquid, or gas) to minimize the potential for chemical accidents including explosions, fires, and releases to the environment.

Importance of Green Chemistry: Green chemistry, also called sustainable chemistry, is **an approach to chemistry that attempts to prevent or reduce pollution**. It also tries to improve the efficiency of chemical products by changing how chemicals are designed, manufactured, and used.

Dr. MS Swaminathan

When India began adopting his methods, it imported 18,000 tons of HYV of wheat from Mexico, laying the foundations of the Green Revolution. The figure who brought this revolution to India's doorsteps was **Dr. MS Swaminathan**, the father of the Indian Green Revolution.

Green chemistry's roots in the Pollution Prevention Act of 1990

To stop creating pollution in the first place became America's official policy in 1990 with the Federal Pollution Prevention Act.

The law defines **source reduction** as any practice that.

- Reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal.
- Reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

The term "source reduction" includes:

- Modifications to equipment or technology
- Modifications to process or procedures
- Modifications, reformulation or redesign of products
- Substitution of raw materials

- Improvements in housekeeping, maintenance, training, or inventory control

Section 2 of the Pollution Prevention Act establishes a pollution prevention hierarchy, saying:

- The Congress hereby declares it to be the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible;
- Pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible;
- Pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; an
- Disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

Green chemistry aims to design and produce cost-competitive chemical products and processes that attain the highest level of the pollution-prevention hierarchy by reducing pollution at its source.

For those who are creating and using green chemistry, the hierarchy looks like this.

1. Source Reduction and Prevention of Chemical Hazards

- Designing chemical products to be less hazardous to human health and the environment*
- Making chemical products from feedstock's, reagents, and solvents that are less hazardous to human health and the environment*
- Designing syntheses and other processes with reduced or even no chemical waste
- Designing syntheses and other processes that use less energy or less water
- Using feedstock's derived from annually renewable resources or from abundant waste
- Designing chemical products for reuse or recycling

Reusing or recycling chemicals

2. Treating chemicals to render them less hazardous before disposal
3. Disposing of untreated chemicals safely and only if other options are not feasible

Chemicals that are less hazardous to human health and the environment are:

- Less toxic to organisms
- Less damaging to ecosystems
- Not persistent or bioaccumulative in organisms or the environment
- Inherently safer to handle and use because they are not flammable or explosive

Applications of Green Chemistry

Human Health

- Cleaner air: Less release of hazardous chemicals to air leading to less damage to lungs.
- Cleaner water: less release of hazardous chemical wastes to water leading to cleaner drinking and recreational water.
- Increased safety for workers in the chemical industry; less use of toxic materials; less personal protective equipment required; less potential for accidents (e.g., fires or explosions).
- Safer consumer products of all types: new, safer products will become available for purchase; some products (e.g., drugs) will be made with less waste; some products (i.e., pesticides, cleaning products) will be replacements for less safe products.
- Safer food: elimination of persistent toxic chemicals that can enter the food chain; safer pesticides that are toxic only to specific pests and degrade rapidly after use.
- Less exposure to such toxic chemicals as endocrine disruptors.

Environment

- Many chemicals end up in the environment by intentional release during use (e.g., pesticides), by unintended releases (including emissions during manufacturing), or by disposal. Green chemicals either degrade to innocuous products or are recovered for further use
- Plants and animals suffer less harm from toxic chemicals in the environment
- Lower potential for global warming, ozone depletion, and smog formation
- Less chemical disruption of ecosystems
- Less use of landfills, especially hazardous waste landfills

Economy and business

- Higher yields for chemical reactions, consuming smaller amounts of feedstock to obtain the same amount of product
- Fewer synthetic steps, often allowing faster manufacturing of products, increasing plant capacity, and saving energy and water
- Reduced waste, eliminating costly remediation, hazardous waste disposal, and end-of-the-pipe treatments
- Allow replacement of a purchased feedstock by a waste product
- Better performance so that less product is needed to achieve the same function

- Reduced use of petroleum products, slowing their depletion and avoiding their hazards and price fluctuations
- Reduced manufacturing plant size or footprint through increased throughput
- Increased consumer sales by earning and displaying a safer-product label (e.g., Safer Choice labeling)
- Improved competitiveness of chemical manufacturers and their customers

CONCLUSION

Green Chemistry is new philosophical approach. Application and extension of the principles of green chemistry can contribute to sustainable development. Presently it is easy to find in the literature many interesting examples of the use of green chemistry rules. Great efforts are still undertaken to design an ideal process that start from non-polluting materials. It is clear that the challenge for the future chemical industry is based on safer products and processes designed by utilizing new ideas in fundamental research. Furthermore, the success of green chemistry depends on the training and education of a new generation of chemists. Students at all levels have to be introduced to the philosophy and practice of green chemistry.

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