

Green Chemistry: Recent Advancements and Future Perspectives

***Ram Lakhon Meena**

ABSTRACT

The several synthetically produced organic substances like fertilizer, herbicides, medications, and antibiotics has increased the quality of life for people, but also leave behind some harmful effects directly in the air, ground, and the agriculture and ultimately result in environmental pollution. Green chemistry was first recognized in the 19th century. The pharmaceutical and organic sectors are drawn to green chemistry and have adopted it. Green Chemistry was founded with the goals of reducing waste, consuming less energy, utilizing renewable resources, and creating biodegradable substances. It is non-polluting, repeatable, and safe for the environment. The various chemical related disasters caused by toxicity, physical hazards and global dangers, were studied in the green chemistry. The guiding concepts of green chemistry can be divided into two categories: "Reducing Risk" and "minimizing the Environmental Footprint." This specific review provides a concise summary of recent advancements and applications of green chemistry principles to everyday activities, chemical processes, economics, pharmacy practices and analytical chemistry to create novel medicine molecules.

KEYWORDS: Green Chemistry, Biodegradable, Hazardous, Environment, Nobel drug molecules.

INTRODUCTION:

Aim of 'Green Chemistry' to make prolonged molecular existence. Given this goal, it is hardly surprising that it has been used in a variety of business sectors. Green Chemistry is the part of environmental chemistry synthesis that have ecological approaches and it involve decreasing or eliminating the use of hazardous and toxic substance to make hazardous chemical compounds. Establishment of molecular sustainability in the man ambition of green chemistry method. It is hardly unexpected that it has been used in various industrial areas given this object from agriculture to the fields of aircraft, automobiles, cosmetic, electronic, energy, home goods, and pharmaceuticals.

As a result, green chemistry provides risk free production of variety of compounds. It is very difficult for industries and research to develop non-hazardous products under green chemistry. In novel approach to produce, process and using chemical called 'green chemistry' goal to decrease the chances to danger for both human health and ecosystem, such as:

- The environmentally benign chemistry

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- The clean chemistry
- The Atom economy

HISTORY AND ORIGIN OF GREEN CHEMISTRY:

In the year 1990 Pollution Prevention Act (PPA) was passed in US. The act give a path to the growth of new and inventive approach to handle with pollution and hazardous substance. The green chemistry Idea was made possible as a result. The two letter phrase 'Green Chemistry' and its 12 principle was created by Paul Anastas and Johan Warner.

Principle of green chemistry are:-

Waste Prevention(G-1): Try to develop such conditions in the process that produce very less waste generates.

Atom Economy (G-2): A synthetic approach used to designed to increase the formation of all input substance into finished output. Therefore, such synthetic techniques should be used to transform as many reactant atoms as possible into manufactured goods.

Safe Chemical Synthesis (G-3):

This synthetic approach should be planned to utilize and industrialized substance that have low toxicity impact to human being and animal as well as environment.

Designing Safer Chemicals (G-4):

It is necessary to develop chemical compounds that affect their essential functions while reducing and eliminating their toxicity.

Safer Solvent and Auxiliaries (G-5):

In process, auxiliary substance like solvents and partition agents should be avoided , however, if they are used, they should be non-toxic materials. In process, auxiliary substance like solvents and separation agents should be escape, however, if it is used, it should be nontoxic materials.

Design For Green Efficiency (G-6):

In light of the detrimental effects that chemical process have on the economy and the environment, their energy requirements should be reduced, The best place to carry out synthetic operations is at atmospheric temperature and pressure.

Use of Renewal Feed Stock (G-7):

When scientifically and financially achievable, a raw material for feedstock should be renewable rather than finite.

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Reduced Derivatives (G-8):

Use of blocking groups, protection and temporary modification of physical or chemical process are undesirable derivatives that should be minimized or avoided whenever possible because they call for additional reagents.

Catalysis (G-9):

Catalytic chemical should be of better quality to stoichiometric reagents.

Design for Degradation (G-10):

The chemical compounds should be produced in such a way that they decompose into harmless elements at the end of their use and do not remain in the environment for long.

Pollution Prevention Real-Time Analysis (G-11):

Analytical methodology must be further improved to allow real time while during production monitoring and control before to the production of potential dangerous chemicals.

Inherently Safer Chemistry for Accident Prevention (G-12):

To lessen the possibility of chemical related events such as explosions, releases and combustion, the substance and the form of a substance used in a chemical procedure must be identified.

APPLICATIONS OF GREEN CHEMISTRY:-

Below are some examples of different environmentally friendly chemical or green chemistry:-

1. In Everyday Life:

Tarbutj Water Clarity: Tamarind seed Kernel powder and A1 salt are used to clear turbid water in municipality and commercial operations waste water system.

Systems for Collecting Rainwater: To collect rainwater and store it in a tank or container for later use beyond drinking such as irrigation, flushing toilets and watering plants.

Textile Dry Cleaning: Dry washing used perchloroethylene (PERC) and the micelle technology.

Manufacturing of Adipic Acid: The production of adipic acid from benzene and glucose is carried out by enzymes made by bacteria.

Manufacturing of Biodiesel: It is sympathetic to eco. It synthesized from natural vegetation such as soybean oils. The plant oils embedded fat by removing glycerin.

2. IN PHARMACY:-

- **Neproxen:** A catalyst made of chiral metal the BINAP (2,2'-bis(biphenyl phosphine)-1,1'-binaphthyl) A ligand is used to manufacture neproxen with a decent yield and a manageable reaction process.

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- **Ibuprofen:** The BASF-introduced, more environment friendly technique of synthesizing Ibuprofen use half as many steps as the conventional method. The latest method atom effectiveness is almost two time then previous synthesis. In an attempt to develop sustainable method, BASF developed the BASILTM (Bi-phasic Acid Hunting Using Ionic Liquids) technology, which generates the common photo catalyst compound alkoxyphenylphosphene.

ADVANCEMENTS OF GREEN CHEMISTRY:

Green Chemistry makes major enhancements to the production of goods that improve living quality, human welfare and sustainable development for example:

Quinapril: It is a type of ACE inhibitor and is employed to treat cardiac heart failure and hypertension. CH_3Cl is used an explosive hydroxyl-benzotriazole, dicyclo hexylcarbodiimide [DCC] utilized as sensitizer, an adequate volume of toluene is added in the solvent exchange method to separate the acetic acid from the resulting mixture. Manufacturing of toxic material has been reduced and less chemicals and greener solvents have been used ⁽¹⁵⁾.

Celecoxib: It is an anti-inflammatory agent. When the unnecessary substance produced are 35% and less hydrazine is applied, yield rises from 63 to 84%. Cooling the product at 208 Celsius in place of 58 Celsius. Using CH_2Cl_2 and hexane, two unwelcome and undesired solvents when combined with other reduce the requirement for 5200 metric tons of solvent yearly ⁽¹⁶⁾.

Sildenafil Citrate: The primary medication used to tackle erectile dysfunction orally was sildenafil citrate. The first, invented at Pfizer's UK research facilities, had a straightforward 11-step synthesis process and yielded a 4.2% overall output of 2- pentanone. The chemistry procedure improves product yield. This raised production and decreased the waste of ecologic liquids like ethyl acetate, water, and butanol⁽¹⁷⁾.

- **Replacement with Coral skeletons of Human Backbone:** In non-load bearing, excavated skeletal areas, coral skeletons have replaced human bone. Interconnected pores and channels make up the combination. The skeletal systems of corals are reshaped into new calcified structures, and biomimetic techniques are used to restructure artificial corals. Aquaculture's role is in coral modification and the creation of artificial coral ⁽¹⁸⁾.
- **Synthesis of carotenoids from natural sources:** The plant kingdom is a common source for the production of diterpenoids of the atisane class. Tetracycline C_{20} was the main component and varied in structural complexity and pharmacological action. It's a trick to make a lot of atisane-type diterpenoids by converting their structural makeup in the middle. They also greatly help in the production of carotenoids ⁽¹⁹⁾.
- **Removal of Carotenoids from Microalgae and Seaweeds:** Large-scale manufacturing of carotenoids from an algal source happens in the pharmaceutical sectors. Many physiologically

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active compounds come from marine microalgae and seaweeds. Natural carotenoids including-carotene, zeaxanthin, violaxanthin, lutein, astaxanthin, and fucoxanthin are derived from them ⁽²⁰⁾.

- Using biphenyl carbonate instead of phosgene and methyl chloride to create polycarbonate.
- Wicker oxidation of the ethylene with oxygen and a sufficient catalyst produces the acetaldehyde. Use di methyl carbonate to remove the risk instead of the traditional methylation procedure.
- Pharmaceutical and medical chemistry both involve metal catalysis.
- Important and difficult heterocyclic and sterically encumbered substrates can be coupled with the help of platinum catalysts.
- Green solvents used in green synthesis include water, liquid polymers, ionic liquids, bio ethanol, supercritical fluids, and ethyl acetate.

FUTURE TRENDS IN GREEN CHEMISTRY:

Chemists from all over the world are developing novel procedures, reaction conditions, synthetic methods and catalysts etc. using their imaginative and creative applications of green chemistry to find a number of options to active artificial processes and some environmental laws. These rules have generally established into "command and control" laws. With toxic chemicals, risk depends on exposure and hazard. These laws have significantly improved pollution prevention over time and will continue to do so in the coming years skills. Academic research has been prompted by commercial ⁽²¹⁾.

CONCLUSION:

The usage of renewable energy sources, waste reduction techniques, some endangered resources, wastes that contaminate the environment, and life cycle analysis have all gained importance in light of the current circumstances. The cost of the product and the production of hazardous materials are decreased via green chemistry. By virtue of its ideas, it advances the pharmaceutical sector and drug corporations towards economic and environmental benefits. It had to do with biology, drugs, etc. By investigating novel processes that produce the Number of products and the fewest hazardous products, it overcomes such difficulties. It makes chemical reactions simpler. In the globalized world, a sustainable future can be built with the help of green science. It offers solutions to issues that people are currently confronting, including global warming, sustainable farming, energy requirements, harmful, and the consumption of organic materials. As an illustration, consider developing new chemicals and procedures for the production and usage of hazardous materials. It offers a unique arena for original study on the potential for other environmentally friendly and sustainable technologies. A field known as "green chemistry" seeks to advance the creation of chemicals and compounds that will protect the environment. The new reality's reaction offers economic advantages to be attained by lowering production costs and conserving energy. The globe

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should actively participate in the avoidance of pollution in our country and employ using green chemistry as a novel method; we can protect both human health and the environment.

***Assistant Professor
Department of Chemistry
Govt. College, Karuali (Raj.)**

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