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To Study the Current Status, and Future Challenges of Green Chemistry

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ABSTRACT

Green chemistry emerged from 1990s, in the increasing attention to problems of chemical pollution and resource depletion. The development of green chemistry was linked to a shift in environmental problem-solving strategies i.e. a movement from command and control regulation and mandated reduction of industrial emissions by the active prevention of pollution through the innovative design of production technologies themselves. The concepts now recognized as green chemistry and "sustainable" chemistry. Attempts are being made not only to quantify the greenness of a chemical process but also to factor in other variables such as chemical yield, the price of reaction components, safety in handling chemicals, hardware demands, energy profile and ease of product workup and purification. Green chemistry is increasingly seen as a powerful tool that researchers must use to evaluate the environmental impact of nanotechnology. As nanomaterials are developed, the environmental and human health impacts of both the products themselves and the processes to make them to ensure their long-term economic viability. Green solvents are generally derived from renewable resources and biodegrade often a naturally occurring product. Green technology (greentech) is the application of one or more of environmental science, green chemistry, environmental monitoring and electronic devices to monitor, model and conserve the natural environment and resources, and to curb the negative impacts of human involvement. Bioengineering is also seen as a promising technique for achieving green chemistry goals. A number of important process chemicals can be synthesized in engineered organisms. Over the course of the past decade, green chemistry has demonstrated how fundamental scientific methodologies can protect human health and the environment in an economically beneficial manner.

Keywords: CFC(chlorofluorocarbon), PLA (poly lactic acids)

I. INTRODUCTION

Green Chemistry is defined as the “design of chemical products and processes to reduce or eliminate the use and generation of hazardous substances.”

Principles

In 1998, Paul Anastas and John C. Warner published a set of twelve principles to guide the practice of green chemistry which help to reduce the environmental and health impacts of chemical production, and create the opportunities in the development of green chemistry technologies.

The principles cover such concepts as:

1) The design of processes to maximize the amount of raw material that ends up in the product.
2) The use of renewable material feedstocks and

energy sources

3) The use of safe, environmentally benign substances, including solvents, whenever possible
4) The design of energy efficient processes
5) Avoiding the production of waste, which is viewed as the ideal form of waste management.
6) Prevention:Preventing waste is better than treating or cleaning up waste after it is created.
7) Atom economy: Synthetic methods should try to maximize the incorporation of all materials used in the process into the final product.
8) Less hazardous chemical syntheses:Synthetic methods should avoid using or generating substances toxic to humans and/or the environment.
9) Designing safer chemicals: Chemical products should be designed to achieve their desired function while being as non-toxic as possible.
10) Safer solvents and auxiliaries:Auxiliary substances should be avoided wherever possible, and as non-hazardous as possible when they must be used.
11) Design for energy efficiency:Energy requirements should be minimized, and processes should be conducted at ambient temperature and pressure whenever possible.
12) Use of renewable feedstock:Whenever it is practical to do so, renewable feedstocks are preferable to non-renewable ones.

- ✓ Design for degradation-Chemical products should be designed so that they do not pollute the environment; when their function is complete, they should break down into innocuous products.
- ✓ Real-time analysis for pollution prevention-Analytical methodologies need to be further developed to permit real-time, in-process monitoring and control before hazardous substances form.
- ✓ Inherently safer chemistry for accident prevention-Whenever possible, the substances in a process, and the forms of those substances, should be chosen to minimize risks such as explosions, fires, and accidental releases.

Synthetic techniques

Novel techniques can often provide improved environmental performance of green chemistry. A 2005 review identified three key developments in green chemistry in the field of organic synthesis.

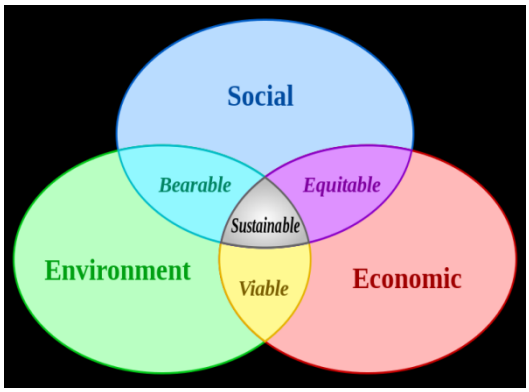
- ✓ Use of supercritical carbon dioxide as green solvent,
- ✓ Use of aqueous hydrogen peroxide for clean oxidations
- ✓ the use of hydrogen in asymmetric synthesis.

The concept of 'green pharmacy' has recently been articulated based on goals of green chemistry.

- ✓ **Carbon dioxide as blowing agent-**In 1996, Dow Chemical won the 1996 Greener Reaction Conditions award for their 100% carbon dioxide blowing agent for polystyrene foam production which is a common material used in packing and food transportation. Traditionally, CFC and other ozone-depleting chemicals were used in the production process of the foam sheets, presenting a serious environmental hazard. Flammable, explosive.Dow Chemical discovered that supercritical carbon dioxide works equally as well as a blowing agent, without the need for hazardous substances, allowing the polystyrene to be more easily recycled. The CO_2 used in the process is reused from other industries, so the net carbon released from the process is zero.
- ✓ **Hydrazine-** The Peroxide Process for producing hydrazine without cogenerating salt.It is traditionally produced by the Olin Raschig process.The net reaction produces one equivalent of sodium chloride for every equivalent of the targeted product hydrazine.
  - $NaOCl + 2\ NH_3 \rightarrow H_2N\text{-}NH_2 + NaCl + H_2O$
- ✓ In the greener Peroxide process hydrogen peroxide is employed as the oxidant, the side

product is water.

- ✓ **1,3-Propanediol**-It is a green route to 1,3-propanediol, which is traditionally generated from petrochemical precursors. It can be produced from renewable precursors via the bioseparation of 1,3-propanediol using a genetically modified strain of E. coli. This diol is used to make new polyesters for the manufacture of carpets.
- ✓ The Nature Works PLA process substitutes renewable materials for petroleum feed stocks, does not require the use of hazardous organic solvents typical in other PLA processes, and results in a high-quality polymer that is recyclable and compostable.
- ✓ **Carpet tile backings**:Research indicated that separation of the fiber and backing through elutriation, grinding, and air separation proved to be the best way to recover the face and backing components, but an infrastructure for returning post consumer has to the elutriation process was necessary. The post consumer carpet tile had a positive economic value at the end of its useful life.
- ✓ **Bio-succinic acid:**In 2011, the Green Chemistry by a Small Business Award went to BioAmber Inc. for integrated production and downstream applications of bio-based succinic acid. Succinic acid is a platform chemical of everyday products. It is produced from petroleum-based feedstocks. BioAmber has developed process and technology that produces succinic acid from the fermentation of renewable feedstocks at a lower cost and energy expenditure than petroleum equivalent while sequestering CO_2 rather than emitting it.
- ✓ The green technology, which is focusing on green chemistry will cooperative for the use of energy and resource sustainably and uplipment to avoid biodegradation of energy resources as social ,environmental and economic.
- ✓ **Energy resources as Social ,Environmental and Economic.**



Sustainable engineering:

It is the process of designing or operating systems such that they use energy and resources sustainably.

Energy Conservation: The green building is energy conservation. By implementing passive design, structural insulated panels (SIPs), efficient lighting, and renewable energy like solar energy and geothermal energy, a home can benefit from reduced energy consumption.

Indoor Environmental Quality: A much healthier environment can be created through avoiding hazardous materials found in paint, carpet, and other finishes. It is also important to have proper ventilation and ample day lighting.

The toxic material: The heavy metals like nickel, lead, cadmium, and mercury from batteries, and organic compounds found in pesticides and consumer products, such as air freshener sprays, nail polish, cleaners, and other products When burned or buried, toxic materials also pose a serious threat to public health and the environment. A good garbage prevention strategy would require that everything brought into a facility be recycled for reuse or back into the environment through biodegradation.

Green building refers to a structure and the application of processes that are environmentally responsible and resource-efficient throughout a

building's life cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. A 2009 report by the U.S. General Services Administration found 12 sustainably-designed buildings that cost less to operate and have excellent energy performance.

The next beneficial goal of green chemistry is renewable energy resources:

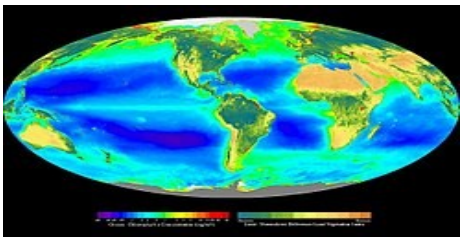
Renewable energy is generally defined as energy that comes from resources, which are naturally replenished, on a human timescale such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy replaces conventional fuels in four distinct areas: electricity generation, hot water/space heating, motor fuels, and rural (off-grid) energy services.

Solar cookers use sunlight as energy source for outdoor cooking.

It exist wide geographical areas. In international public opinion surveys, there is strong support for promoting renewable sources such as solar power and wind power. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20 percent of energy supply. The Intergovernmental Panel on Climate Change has said that there are few fundamental technological limits to integrating a portfolio of renewable energy technologies to meet most of total global energy demand. Mark Z. Jacobson says producing all new energy with wind power, solar power, and hydropower by 2030 is feasible and existing energy supply arrangements could be replaced by 2050.

Wind mill as an energy resource

Significant progress of methodological green chemistry is being made in several key research areas, such as catalysis, the design of safer chemicals and environmentally benign solvents, and the development of renewable feedstocks. Current and future chemists are being trained to design products and processes with an increased awareness for environmental impact. Outreach activities within the green chemistry community highlight the potential for chemistry to solve many of the global environmental challenges we now face.



Global environmental challenges

The origin and basis of green chemistry designing for achieving environmental and economic prosperity inherent in a sustainable world as mechanics ,statics, hydrology and fluid dynamics. Sustainable engineering is the process of operating system to use the renewable energy and resources.

Green Chemistry is a relatively new emerging field that strives to work at the molecular level to achieve sustainability. The field has received widespread interest in the past decade due to its ability to harness chemical innovation to meet environmental and economic goals simultaneously.

Framework of Green Chemistry:

The three main points about the Green Chemistry framework can be summarized as:

1. Green Chemistry designs across all stages of the chemical life-cycle.
2. Green Chemistry seeks to design the inherent nature of the chemical products and processes to reduce their intrinsic hazard.
3. Green Chemistry works as a cohesive system of principles or design criteria.

Education:

A masters level course in Green Technology, has been introduced by the Institute of Chemical Technology, India. There are also websites focusing on green chemistry, such as the Michigan Green Chemistry Clearinghouse at www.migreenchemistry.org.

II. CONCLUSION

For generations, molecular scientists have invented the molecules, materials, and manufacturing processes that have allowed economic and societal development. Green Chemistry is ensuring that all of that creative ability that is the long tradition of the field of chemistry is practiced in a way that builds in impact on people and the planet as a design criterion. Green Chemistry has shown that through innovation companies can be economically more profitable and more environmental at the same time. The Green Chemistry work hard around the world and the achievements of the past by comparison to the power and potential of the field such as advanced mathematics, thermodynamics,computer modeling etc.