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RESEARCH ARTICLE

A study of why we need green chemistry?

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Abstract

Green chemistry is chemistry for the environment. It is really a philosophy and way of thinking that can help chemistry in research and production to develop more eco-friendly solutions. Green chemistry is considered an essential piece of a comprehensive program to protect human health and the environment. In its essence, green chemistry is a science-based non-regulatory and economically driven approach to achieving the goals of environmental protection and sustainable development. Combining the technological progress with environmental safety is one of the key challenges of the millennium.

Introduction

Green chemistry can be defined as the practice of chemical science and manufacturing in a manner that is sustainable, safe, and non-polluting and that consumes minimum amounts of materials and energy while producing little or no waste material. The practice of green chemistry begins with recognition that the production, processing, use, and eventual disposal of chemical products may cause harm when performed incorrectly. In accomplishing its objectives, green chemistry may modify or totally redesign chemical products and processes with the objective of minimizing wastes and the use or generation of particularly dangerous materials. Those who practice green chemistry recognize that they are responsible for any effects on the world that their chemicals or chemical processes may have. Far from being economically regressive and a drag on profits, green chemistry is about increasing profits and promoting innovation while protecting human health and the environment.

Why Green Chemistry?

Green chemistry represents a major paradigm shift that focuses on environmental protection at the design stage of product and manufacturing processes. It is an innovative way to deal with chemicals before they become hazards, with the goal of making chemicals and products "benign by design." Green chemistry is a preemptive strategy that reduces the use of toxic substances before they contaminate the environment and our bodies. It is a marked departure from the past where society managed industrial and municipal wastes by disposal or incineration. Green chemistry seeks to dramatically reduce the toxicity of chemicals in the first place, rather than merely manage their toxic waste after use and disposal. Green chemistry focuses on improving the building blocks of manufacturing the feed stocks and the catalysts used to make things so products can be engineered to be safer, easily reused and not persist in the environment. The use of fewer hazardous substances means healthier air quality, cleaner drinking water and a safer workplace. Green chemistry changes the design of products and industrial processes so they do not threaten human health or the environment.

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What Is Green Chemistry?

Green chemistry is essential to sustainable development because of the inherent focus on how we make things and what products we create as scientists. As a science, green chemistry has been clearly defined since the publication of the book Green Chemistry: Theory and Practicein 1998 by Paul Anastas and John Warner. The subject addresses the heart of the pollution problem and asks molecular designers to consider creating materials

and products that are sustainable from the very beginning (i.e., at the design stage). Through this approach, we can ensure that the building blocks that make up our economy are truly sustainable. If these building blocks are sustainable, then the end product will be much more likely to be sustainable as well.

Green Chemistry Definition

Green Chemistry is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products.

The 12 Principles of Green Chemistry

1. **Prevention**

It is better to prevent waste than to treat or clean up waste after it has been created.

2. **Atom Economy**

Synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.

3. **Less Hazardous Chemical Syntheses**

Wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.

4. **Designing Safer Chemicals**

Chemical products should be designed to affect their desired function while minimizing their toxicity.

5. **Safer Solvents and Auxiliaries**

The use of auxiliary substances (e.g., solvents, separation agents, etc.) should be made unnecessary wherever possible and innocuous when used.

6. **Design for Energy Efficiency**

Energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. If possible, synthetic methods should be conducted at ambient temperature and pressure.

7. **Use of Renewable Feedstocks**

A raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.

8. **Reduce Derivatives**

Unnecessary derivatization (use of blocking groups, protection/ deprotection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.

9. **Catalysis**

Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

10. **Design for Degradation**

Chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.

11. **Real-time analysis for Pollution Prevention**

Analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.

12. **Inherently Safer Chemistry for Accident Prevention**

Substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires

Green Chemistry Goals

• Ensure principles of green chemistry are widely used

• Decrease adverse impacts to human health and theenvironment via improved design of products and processes

• Promote innovation and economic development

• Improve competitiveness of goods on global market

The Benefits of Green Chemistry.

Green chemistry and green engineering offer many benefits to scientists, educators, businesses, policymakers, and the public. For scientists, it provides a platform for not only avoiding or eliminating hazards and waste, but also for creating new, innovative, and efficient methodologies. For educators, it can be a tool for inspiring students to pursue scientific careers, providing context to a subject that is often abstract. For businesses, it can help realize cost savings through reduced waste disposal costs and reduced worker liability costs, while offering competitive advantage in existing markets, offeringa greater value added to customers, and over all higher innovation potential that leads to the creation of new markets. For policymakers, it is projected to advance opportunities for environmental outcomes that go beyond what is now possible with existing regulatory policies and reduce social conflict around the trade-off between the environment and economic growth. And for the public, it means a cleaner, safer environment, as well as greater economic opportunities.

Conclusion

Consumers and business purchasing departments can promote green chemistry by demanding safer, non-toxic products from manufacturers. This will help give a competitive advantage to those companies who screen the chemicals used in their products and demand safer substitutes from their suppliers. Such demand will also help increase the number of green chemistry courses in universities, training the next generation of chemists to consider life cycle impacts of the chemicals they design. To what degree the chemical industry is actually adopting green chemistry principles is unknown because some of the most innovative examples are proprietary. Researchers are identifying the barriers within the chemical industry that pre vent or slow the adoption of green chemistry.

Green chemistry awards help publicizes the feasibility of green chemistry but much more needs to be done. Governments have a major role in adopting policies that promote green chemistry innovation and implementation in the commercial sector. At the same time the chemical industry has a duty to integrate the principles of green chemistry into their manufacturing processes while product manufacturers and retailers have a responsibility to demand chemicals from their suppliers that have been tested and shown to be inherently safe. Green economic innovation for the 21st Century will require green chemistry**.**

Great efforts are still undertaken to design an ideal process that starts from non-polluting initial materials, leads to no secondary products and requires no solvents to carry out the chemical conversion or to isolate and purify the product. However, more environmentally friendly technologies at the research stage do not guarantee that they will be implemented on an industrial scale. Adoption of environmentally benign methods may be facilitated by higher flexibility in regulations, new programs to facilitate technology transfer among academic institutions, government and industry and tax incentives for implementing cleaner technologies.

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