Journal of Pharmacology and Biomedicine ISSN 2456-8244

REVIEW ARTICLE

Green Chemistry, the emerging field in pharmaceutical R&D: Boosting the economy

Deepak Basedia*, Balkrishna Dubey, Lavakesh Omray, Suresh Dhakar

Technocrats Institute of Technology Pharmacy Education and Research, Bhopal, Madhya Pradesh, India.

* Corresponding Author

Email: deepakbasediatit@gmail.com

ABSTRACT

Green chemistry is the sustainable practice of chemical science and manufacturing within a framework of industrial ecology in a manner that is sustainable, safe and non-polluting, consuming chemistry of the environment sustainable, consuming minimum amounts of energy and material resources while producing virtually no wastes. The invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of substances hazardous to human health and the environment Fundamental and innovative chemical methods that accomplish pollution prevention through source reduction chemistry of the environment accomplish pollution prevention through source reduction. Green chemistry also called environmental chemistry focused on the designing of products and processes that minimize the use of materials and generation of non toxic substances. It is better to prevent waste than to treat or clean up waste after it is formed.

Keywords: Green chemistry, Renewable energy, Eco-friendly technology

Introduction

Green chemistry also called sustainable chemistry is an area of chemistry and Green chemistry focused on the designing of products, processes that minimize the use and generation of hazardous substances whereas environmental chemistry focuses on the effects of polluting chemicals on nature, green chemistry focuses on technological approaches to preventing pollution and reducing consumption of nonrenewable resources.

Green chemistry also called environmental chemistry focused on the designing of products and processes that minimize the use of materials and generation of non toxic substances. Green chemistry overlaps with all sub disciplines of chemistry but with a particular focus on chemical synthesis, process chemistry, and chemical engineering, in industrial applications. To a lesser extent, the principles of green chemistry also affect laboratory practices. The overarching goals of green chemistry namely, more resource-efficient and inherently safer design of molecules, materials, products, and processes can be pursued in a wide range of contexts.

Today the environment is racing towards the tipping point at which we would have done permanent irreversible damage to the planet earth. Our current actions are pulling the world towards an ecological landslide which if happens would make destruction simply inevitable. Green technologies are an approach towards saving earth. Thus both its positives and negatives need to be investigated. Green technology uses renewable natural resources that never depletes. Green technology uses new and innovative energy generation techniques. Green nanotechnology that uses green engineering and green chemistry is one of the latest in green technologies. One of the important factors for environmental pollution is the disposal of waste. Green technology has answers to that as well. It can effectively change waste pattern and production in a way that it does not harm the planet and we can go green. Among the possible areas where these creations and growth are expected to come from include green energy, organic agriculture, eco-friendly textiles, green building constructions, and manufacturing of related products and materials to support green business. Because this is but new to the industry, it is also expected to attract new customers who will see the many advantages of using green technologies in their homes and others. Besides other forms of green technology in field of generation of energy are done by solar power and fossil fuel. These have no adverse effect on the planet and it won't replenish. So future generation can also benefit from them without harming the planet.

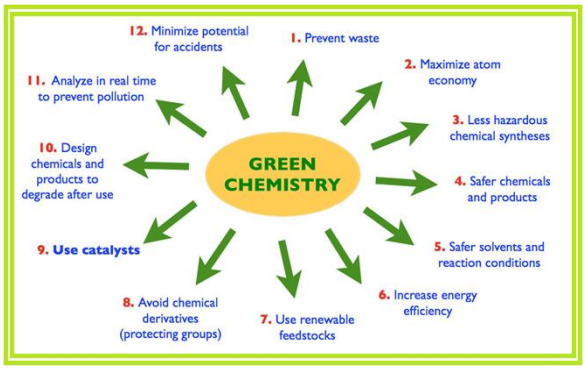
Pharmaceuticals Industries are using toxic chemicals and extra difficult process which produces comparatively a large amount harmful substance. These harmful substances cause bad impact on surroundings and nature. The approach of Green chemistry in Pharmaceutical science provides environmentally friendly way to replace harmful solvents and technologies, so prevent pollution. The new approach introduces in green chemistry synthesis, dealing out and relevance of chemical material in such a way as to minimize the risk to environment and health of human.

This advanced access is as well called:

1. Eco-friendly chemistry
2. Clean chemistry
3. Atom wealth
4. Benign design chemistry

Principles of Green Chemistry

1. Pollution Prevention
2. Atom Economy
3. Less Hazardous Chemical Synthesis
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstocks
8. Reduce Derivatives
9. Catalysis
10. Design for Degradation
11. Real-time analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention



1. **Pollution Prevention:** It is better to prevent waste than to treat or clean up waste after it is formed.
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 Synthesis:** Wherever practicable, synthetic methodologies 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 preserve efficacy of function while reducing 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 should be recognized for their environmental and economic impacts and should be minimized. 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 wherever technically and economically practicable.
8. **Reduce derivatives:** Unnecessary derivatization (blocking group, protection/ deprotection, temporary modification) should be avoided whenever possible.
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 do not persist in the environment and break down into innocuous degradation products.
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 potential for chemical accidents, including releases, explosions and fires.

APPLICATIONS OF GREEN CHEMISTRY TECHNOLOGY

Solar array

One of the best known examples of green technology would be the solar cell. A solar cell directly converts the energy in light into electrical energy through the process of photovoltaics. Generating electricity from solar energy means less consumption of fossil fuels, reducing pollution and greenhouse gas emissions.

Reusable water bottle

Another simple invention that can be considered green is the reusable water bottle. Drinking lots of water is healthy. Reducing plastic waste is great

for the environment. Hence, trendy reusable water bottles that you can refill yourself are health-promoting, eco-friendly, and green.

Solar water heater

Installing a solar water heater can be a great way to cut down on energy costs at a much lower initial expense. The costs associated with the installation of a solar water heater are actually recouped much faster than the costs associated with photovoltaic technology for power generation. This is due to the increased efficiency of solar water heating systems as well as their reduced expense when compared to the large solar array required for powering a home.

Wind generator

The costs of a home wind generator vary greatly. Some have built their own wind generators with off-the-shelf parts from their local hardware stores. Others have purchased kits or paid for professional installation to supplement the power purchased from their local electrical grid. The power production capability of a home wind generator varies about as much as the initial expense. Many kit based generators will produce only enough power to offset 10-15% of your home energy costs.

Rainwater harvesting system

Rain collector systems are extremely simple mechanical systems that connect to a gutter system or other rooftop water collection network and store rain water in a barrel or cistern for later non-potable use (like watering plants, flushing toilets and irrigation). These systems are extremely inexpensive.

Insulate our house: Based on EPA estimates 10% of household energy usage a year is due to energy loss from poor insulation. We will get an excellent return on investment from sealing our home to prevent energy escape.

Building with green technology

Green buildings use a variety of environmentally friendly techniques to reduce their impact on the environment. Reclaimed materials, passive solar design, natural ventilation and green roofing technology can allow builders to produce a structure with a considerably smaller carbon footprint than normal construction. These techniques not only benefit the environment but they can produce economically attractive buildings that are healthier for the occupants as well. The chief benefit of building green is reducing a building is impact on the environment. Using green building techniques can also reduce the costs associated with construction and operation of a building. Green ventilation techniques involve open spaces and natural airflow, reducing the need for traditional air conditioning and preventing many of these problems.

National benefits for energy generation

Power generation is another sector where green technology might create wonders. Distributed

generation technologies e.g. solar PV, biogas production, wind power etc. have practically proven that they can provide more employment opportunities to people and can be applied to provide energy solutions to communities in remote areas successfully. Live examples exist in India where people have used alternative green power generation technologies and have not only fulfilled their own energy needs but have also sold their energy to the grid thereby making significant income. Same is in countries like Germany, where people sell the electricity generated by their household Photovoltaic panels to the national grid and in rare cases may end up charging money from the utility instead of paying. In this way a person not only helps himself or herself but also helps the nation by actually contributing to the national power generation and thus proves to be an asset rather than a liability to the society.

Benefits to the rural areas

Green technologies have had great impact on communities of the areas where they have been implemented. Provision of bio-gas plants to rural households has empowered communities and has increased their productivity. Same has been the case with distribution of solar lanterns through certain programs. It is clear that people have benefited from it by not only using the outputs personally but also by trading it. Initiatives such as the barefoot college in Rajasthan empower villagers by teaching them how to use eco-friendly technologies like solar cookers, mud refrigerators, and sustainable farming practices. Villagers have built their own water storage and rainwater harvesting techniques and are not dependent on outside help. This has raised the standard of living in the participating villages.

Benefit to the urban areas

Cities which actively pursued their environmental concerns in the last ten years are showing a marked improvement in their environment quality parameters. For example Delhi launched CNG fuelled public transport in a phased manner. This was done as measures to improve air quality of Delhi where the toxic gas levels were off the charts, sometimes exceeding 5-12 times the normal values. Since then Delhi has shown steady improvement in the air quality.

Eco-friendly dry clean-up of clothes

Perchloroethylene (PERC) used for dry cleaning pollutes water resource and cancer-causing agent. To solve this problem Joseph De Simons, Timothy Romark, and James synthesized Micell which is made up of liquid CO_2 and a surfactant for cleaning garments. Cleaning machines have now been produced utilizing this procedure. Micell Technology has likewise developed a metal cleaning framework that utilizations CO_2 and a surfactant accordingly dispensing with the need of halogenated solvents

Solution to turn turbid water clear

Tamarind seed kernel powder, discarded as agriculture waste, is a good agent to create municipal and industrial waste water clear. the current follow is to use Al-salt to treat such water. It is been found that alum will increase poisonous ions in treated water and will cause diseases like Alzheimer's. On the opposite hand kernel powder is not- poisonous and is perishable and price effective. For the study, four flocculants specifically tamarind seed kernel powder, mixture of the powder and starch, starch ad alum were used. Flocculants with slurries were ready by combining measured quantity of clay and water. The result showed aggregation of the powder and suspended particles were a lot of porous and become compact a lot of simply and shaped larger volume of clear water. Starch flocks on the opposite hand were found to be light-weight weight and fewer porous and thus did not enable water to taste it simply. The study establishes the powder is potential as associate degree economic flocculants with performance shut more matured flocculants like potash alum.

Biometric multifunctional reagents

Whereas artificial contact action and reagents for the foremost half have targeted on concluding one distinct transformation. The manipulations could embrace activation, conformational changes, and one or many actual transformations and derivatizations.

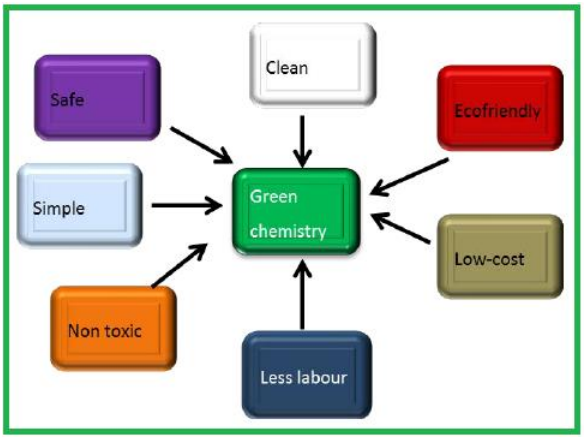
Combinatorial inexperienced chemistry

The chemistry of having the ability to create massive numbers of chemical compounds chop-chop on a little scale exploitation reaction matrices. The instance is lead that incorporates a massive no of derivatives. This chemistry has enabled massive no of gear to be created and their properties assessed while not the magnitude of the consequences of waste disposal.

Energy focus

The environmental impact of energy usage square measure profound however have not been as visible and as direct as a number of the hazards that haven't been expose by materials employed in manufacture, use and disposal of chemicals. The advantage of contact action is dramatic in chemical science. There is a requirement to style substances and materials that square measure effective, economical and cheap at the capture, storage and transportation.

Supramolecular chemistry Analysis is presently current within the space of supramolecular chemistry to generate reactions which may proceed in the solid phase without use of solvents. The cyclic addition of trans-1,2- bis(4-pyridyl)ethylene is directed by phenol within the solid state. This solid-state reaction take within the presence of ultraviolet light in 100 percent yield.



CONCLUSION

Implementation of Green chemistry approaches to design and develop systematic methodologies which give maximize the incorporation of all materials used in the process into the final product. Wherever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment. Chemical products should be designed to preserve efficacy of function while reducing toxicity. Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure. A raw material or feedstock should be renewable rather than depleting wherever technically and economically practicable.

Green chemistry is new approach that through 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.

Green chemistry is new approach for design of processes for maximize the amount of raw material use that ends up in the product by the use of renewable material, safe environmentally benign substances and design of energy efficient processes by avoiding the production of waste which is viewed as the ideal form of waste management and boost economy.

Consumer demand for green technology products is on the rise. Government customers are increasingly mandated to purchase green where available and the spectrum of products covered by such provisions is growing. As for business customers, if they demonstrate a return on investment in green products, then demand will materialize. Here, the greatest opportunities are in products that reduce energy consumption. Even so, a growing number of business buyers can be expected to be motivated by nothing more than

the desire to be perceived as supporting environmental sustainability. So change is coming. The green in technology products is being installed in the R&D phase.

References

1. P.T. Anastas, I.T. Hovarsth, Innovations and Green Chemistry, Chem. Rev, vol. 107, pp. 2169, 2007.
2. V.K. Ahluwalia and M. Kidwai, New Trends in Green Chemistry, Anamaya Publisher, New Delhi, pp. 435, 2004.
3. P.T. Anastas and J.C. Warner, Green Chemistry: Theory and Practice, Oxford University Press: New York, pp.30, 1998.
4. P.T Anastas and T.C. Williamson, Green Chemistry: Frontiers in Benign chemical Synthesis and Processes. Oxford University Press, Oxford., 1998.
5. P. Tundo and P.T. Anastas, Green Chemistry: Challenging Perspectives, Oxford University Press, Oxford. 1998.
6. Green Chemistry, United States Environmental Protection Agency. 06,28, 2006.
7. M. Poliakoff, P. Licence, Sustainable technology: Green chemistry, Nature. 450, 810–812. 2007
8. E. J Woodhouse, S. Breyman, Green chemistry as social movement. Science, Technology, & Human Values. 30 (2), 199–222. 2005
9. D. Acemoglu, P. Aghion, and D. Hemous, The environment and directed technical change , American Economic Review 102, 131-166, 2012.
10. G. D. Soni, Social Issues and Environmental Problems, Vol.3,9, 2015