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VARIOUS AREAS OF GREEN CHEMISTRY AND SAFER ENVIRONMENT AN OVERVIEW

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ABSTRACT

Green chemistry is an implementation of sustainable development in chemistry and chemical technology by industry. Green chemistry paves the route to a new approach to the synthesis, processing and application of chemical substances in such a manner as to reduce threats to health and the environment. Green chemistry achievement will enables us to balance eco- development profitable for society, economy and the environment .Green chemistry covers twelve principles which are equally applicable to organic chemistry, inorganic chemistry, biochemistry, analytical chemistry and even physical chemistry. Green chemistry is increasingly seen as a powerful tool that researcher must use to evaluate the environmental impact of nanotechnology. Green chemistry involves an interdisciplinary effort guided by the principle benign by design. Nano-science and nanotechnology is another important contribution to green chemistry. Green analytical chemistry is the essential element of green chemistry. . Young chemists are currently acquainted with new methods of organic compound synthesis instead of traditional methods and with new analytical chemistry techniques allowing them to assess the state of environmental pollution in an increasing number of high schools. Bioengineering is also seen as a promising technique for achieving green chemistry goals. Present research article is an attempt to cover some major aspects of green chemistry to save our environment by every human activity that not only includes twelve principle of green chemistry but also other factors that plays an important role to save our environment.

KEYWORDS: Green Chemistry, Supercritical Fluids (SCFs), Nanoscience, Nanotechnology, Enzymes, Bioengineering

INTRODUCTION

*"**Prevention is better than cure**"*

The Green Chemistry believes in above proverb and it was developed by the US Environmental Protection Agency (EPA) with the goal of preventing or reducing pollution at its source, rather than having to clean it up afterwards. According to the chemists Paul Anatas and John Warner the most widely accepted definition for Green chemistry is a designing of chemical processes and products that reduces or eliminate the use and generation of hazardous and harmful substances. The term was coined in 1991 by Anatas. The first conference highlighting green chemistry was held in Washington in 1997. A master's level course in Green Technology has been introduced by the Institute of Chemical Technology India. Now UGC New Delhi has added one of the papers in P G syllabus entitled as a Green Chemistry. It is a rapidly developing and an important field in the chemical sciences. Chemistry played a pivotal role in daily human life and has provided an important material in the form of medicine, foods stuff, drugs, paints, agriculture, cosmetics, bimolecules, polymers, nanoparticles and many more.

CONCEPT OF GREEN CHEMISTRY

We're all in the same boat and we only have one boat ***-Paul Anastas***

Green chemistry works on well known twelve principles developed by Anatas and Warner .The basic idea of green chemistry comes from first principle of it- protecting the environment from pollution. The next eleven principles provide an idea on such issues that are eco- friendly for the environment. The twelve principle of green chemistry are as follows:

- Prevention
- Atom economy
- Less Hazardous Chemical Syntheses
- Designing Safer Chemicals
- Safer Solvents and Auxiliaries
- Design for Energy Efficiency
- Use of Renewable Feedstock's
- Reduce Derivatives
- Catalysis
- Design for Degradation.
- Real-time analysis for Pollution Prevention
- Inherently Safer Chemistry for Accident Preventio

Organic chemistry involves many synthesis using hazardous and volatile chemicals that are released into the environment by a volatilization process. Volatile organic compounds are more susceptible to leakage because in many syntheses their amounts exceed the amount of reagents. Several laboratory chemicals are controversial, and alternatives have been explored. The Massachusetts Institute of Technology has created the Green Alternatives Wizard to help identify alternatives. Ethidium bromide, xylene, mercury, and formalin have been identified as "worst offenders" which have alternatives .Pharmaceutical Industry], both GSK and Pfizer have published Solvent Selection Guides for their Drug Discovery chemists. The use of supercritical fluids (SCFs) in chemical processes is becoming more and more prevalent. Due to specific properties, the supercritical fluids show better solubility for many compounds with different polarity and molecular mass. In this direction, carbon dioxide as a super critical fluid is most frequently used as medium for reactions. In industry the phenomena of supercritical drying is commonly applied for processing aerogels.In pharmaceutical and nutraceutical manufacturing processes , the successful application of Thar process's supercritical fluid technology to remove residual solvent from tablets as well as from enriched phospholipids fraction eliminates the traditional solvent removal methods .Scientists at the Los Alamos National Laboratory have developed a process that uses supercritical

carbon dioxide in one of the steps in computer chip preparation, and it significantly reduces the quantities of chemical . Energy and water needed to produce chips

Analytical chemistry plays an important role in nearly all aspects of chemistry for examples clinical, agricultural, environmental, forensic, manufacturing, metallurgical and pharmaceutical concerns. It is concerned with the chemical characterization of matter and provides answer to both quality and quantity of the any analytes. Therefore, it becomes very necessary to evaluate the used analytical methods on the basis of their negative influence on the environment. A Life Cycle Assessment (LCA), a way of examining all of the impacts that a particular product has on the environment, may be a good tool for such evaluation. It can be stated that green analytical chemistry is the essential core of green chemistry. The role of direct analytical techniques (preparation step is not essential) have been applied as a more friendly for the environment The typical examples of procedures involves X-ray fluorescence ,solid phase extraction (SPE) ,solid phase microextaction (ASE) ,supercritical fluid extraction (SFE), vacuum distillation of volatile organic compounds, mass spectrometry with membrane interface (MIMS),accelerated solvent extraction (ASE), ultrasonic extraction etc. The extraction process of pesticide from soil samples of an analytical technique fulfilling the rules of green chemistry and has many advantages in comparison to classical extraction techniques applied for extraction of analytes from complex matrics .The chief government institutes in India like ,the Indian Agriculture Research Institute (IARI) and the Defense research and Development Organisation (DRDO) are working extensively for monitoring and analysis of heavy metals and pesticides.

Synthetic polymers or plastics are essential in fulfilling a broad range of national needs, present and prospective, in such categories as energy, transportation, construction, agriculture and food processing, medicine and national defense. More than 60 million pounds of polymers are produced in the United States each year. The feedstock that are used to produce these polymers are virtually all made from, a nonrenewable resource, i.e. petroleum.. In order to safe petroleum for future fuel, chemists have investigated methods for producing polymers from renewable resources such as biomass. Lactic acid is a fermentation product of corn and a biodegradable polymer of its i. e. polylactic acid (PLA) is synthesize from waste biomass .PLA can also be easily recycled by conversion back into LA and replaces many petroleum –based polymers in products such as carpets, bags. cups, and textiles fibers. A green application in the field of polymers is the transesterification of vinyl methacrylate by hydroxyl-terminated polyisobutylenes in the presence of *Candida antarctica* lipase B. Automobile paints used to colour automobiles like, cars ,that contain lead that is being extracted out of automobile but with the help of green chemistry automobile paints without lead can also be developed and used for colouring automobiles.

Due to the vast importance of peptides in biological processes, there is an escalating need for synthetic peptides to be used in a wide variety of applications. As a result of major advances in molecular biology and medicine, the importance of the peptides in biological processes has been attracting attention, and the need to accelerate the supply of peptide by chemical synthesis is rapidly increasing However, the consumption of organic solvent is extremely large in chemical peptide syntheses because of the multiple condensation steps in organic solvents. From the viewpoint of green sustainable chemistry, Mar. 7, 2009 — McGill University chemistry professor Chao-Jun (C.J.) Li is known as one of the world leading pioneers in green chemistry, an entirely new approach to the science which eschews the use of toxic, petrochemical-based solvents in favour of basic substances like water and new ways of making molecules. Li's new process, by contrast, allows researchers to construct a single, simple "skeleton" peptide which can be modified into any other peptide needed with the addition of a simple reagent. According to Li , the new method is considerably less expensive than traditional techniques,

and can readily be adopted by labs anywhere in the world, Hojo *et al*. (2011) focused on developing an organic solvent-free synthetic method using water, an environmentally friendly solvent.. Chemical peptide synthesis is classified into two types: solid-phase synthesis and solution-phase synthesis. Choosing the best amino acid derivatives is one of the most important, and sometimes difficult, aspects of peptide synthesis. Currently, Fmoc-amino acids are routinely used building blocks for solid-phase peptide synthesis In solution-phase synthesis, *tert*-butyloxycarbonyl (Boc)-protected amino acids are commonly used. Both Fmoc- and Boc-amino acids are highly soluble in ordinary organic solvents. Chemical peptide synthesis in water using water-dispersible amino acid nanoparticles method is superior to conventional methods in terms of cost effectiveness, resource conservation, and environment friendliness. Because, after a reaction, synthetic protected peptides precipitate and can be isolated easily by filtration. That is, the use of this method will simplify manufacturing processes.

Fats and oils (from plants and animals) as oleo chemical raw materials can become a new source of chemical feedstock's. Biodiesel oil is produced from cultivated plants oil and also can be obtained from wasted plants oils e.g. oils used in restaurants. The advantage of using biodiesel oil are obvious. It's fuel from renewable resources and contrary to normal diesel oil, the combustion of biodiesel does not generate sulfur compounds and also generally does not increase the amount of carbon dioxide in the atmosphere. A series of raw materials exist in the market with many applications in cosmetics, polymers, lubricating oils and other products.

Catalyst is one of the most important aspects of eco-friendly chemistry. Many of the reported catalyzed processes involve transition metals and their complexes. As an example, Ru complexes have been found to catalyze the hydrogenation of nitriles to primary amines with remarkable chemo selectivity. Another oxidation process leads from primary amines to amides in the presence of a supported ruthenium hydroxide catalyst [20] . Atul Kumar *et al.* (2011) has developed an efficient and green method for the synthesis tryptanthin of a biologically active natural product, employing a β-cyclodextrin, catalyst in aqueous media at room temperature from isatoic anhydride and istain in excellent yields [21] .

Green nanotechnology refers to both the use of nanotechnology to enhance the environmental sustainability of processes producing negative externalities and the use of the products of nanotechnology to enhance sustainability. It includes making green nano-products and using nano-products in support of sustainability. Scientists at the American Chemical Society (ACS) Symposium, said that next wave of green technologies is likely to draw heavily from nanotechnology in the 21st century. As Scott Rickert, CEO of Nanofilm, put it, "Nanotechnology holds the potential to unlock advances that will enable us to replace current environmentally harmful practices with new greener ones." By making the most of nanomaterials possesing unusual properties and by using advanced tools for manipulating matter at the nanoscale, researchers expect to gain greater performance and new capabilities in green technologies. Those advances should improve our ability to clean up air, water and soil, as well as to generate energy efficiently, reduce waste and recover resources.

The Government of Madhya Pradesh attempted a Guinness Word Record of planting 1 crore sapling in one day (12 hours) at multiple locations under the programme "Hariyali Mahotsav on 31 July 2014. Chandra Shekhar Azad Govt P.G. Nodal College, Sehore ,M.P. India also contributed in the programme by planting 500 saplings on the campus including the tree of various species.

In year 2012, virtual reservation message (VRM) are displayed on the Indian Railways Catering and Tourism Corporation IRCTC website, urging passengers to stop using A4 printouts. About three lakh A4 sheets are expected to be saved across the country every day through this initiative. Environmental activists are also happy with the decision. "It is a welcome move and is a good green model for others to follow to save our trees," said Exnora International founder B Nirmal. Online banking , online transaction, online admissions and examinations online booking for pilgrims accommodation ,donation *etc*. at various religious website like Tirupati Tirumala Devsthan (TTD), Shirdi sai baba sansthan (SSST), are another initiative towards environmental protection. Twelve green chemistry principles not only restricted the use of the safest chemicals in laboratories, researches *etc*. but also to protect our surrounding environment, living planet earth as a whole.

CONCLUSIONS

The key target of green or sustainable chemistry is making available to mankind useful compounds and materials, while causing no harm to the environment. This approach has acquired a central role in present day's chemistry. The research and development and the science and technology agencies that are responsible for the funding of scientific activities in the country must encourage and give preference to the development of greener science and technology In order to allow for the full potential of green chemistry to explore the scientific and economic advances the scientific community needs to provide educational opportunities to train chemists of the future and needs to design practical curriculum in order to follow greener chemistry view.

- Shop for eco gadget and appliances reusable shopping bags, recycled paper and stationary, eco –friendly shower heads , eco –friendly toys, BPA-free water bottles and lunch boxes, soy candles, eco–friendly wall paper, and eco – stickers, solar powered backpacks, bamboo kitchen ware , eco –friendly household cleaners and organic pet products.
- Use of natural colors for celebrations of color festivals like Holi.
- Immersion of god and goddess in rivers , water reservoirs *etc*, made by plaster of paris and painted with harmful chemical colors, at Ganesh chaturthi and Navratri festivals should not be used by people and use of small symbolic idol made of simple clay and natural colors should be encouraged by mankinds .
- P.G. practical exercises involving multistep organic preparations should not be throw after preparation but can be utilized for U.G. level practical for element detection and functional group detection etc.
- Our Honorable prime minister Narendra Modi’s Swach Bharat Abhiyan initiated on Gandhi Jayanti year 2014 for clean and Green Bharat is also a greater step towards environmental protection.

None of us can changes our yesterdays but all of us can change our tommorows. ***-Colin Powell***

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