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A REVOLUTION IN CHEMISTERY-GREEN CHEMISTRY

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ABSTRACT
The Green Chemistry revolution is providing an enormous number of challenges to those who practice chemistry in industry, education and research. With these challenges however, there are an equal number of opportunities to discover and apply new chemistry, to improve the economics of chemical manufacturing. Green chemistry is a philosophy and study of the design of products o substances that will not involve materials harmful to the environment. Chemistry that deals with the application of environmentally friendly chemical compounds in the various areas of our life such as industrial uses and many others. This area of chemistry had been developed by the need to avoid chemical hazards that organic and inorganic compounds had on the body of humans and animals. Chemistry plays a pivotal role in determining the quality of modern life. The chemicals industry and other related industries supply us with a huge variety of essential products, from plastics to pharmaceuticals. However, these industries have the potential to seriously damage our environment. Green chemistry therefore serves to promote the design environmentally benign chemicals and chemical processes. All these will be discussed in this present article.

INTRODUCTION

Green chemistry, also called sustainable chemistry, is a chemical philosophy encouraging the design of products and processes that reduce or eliminate the use and generation of hazardous substances. Whereas environmental chemistry is the chemistry of the natural environment, and of pollutant chemicals in nature, green chemistry seeks to reduce and prevent pollution at its source. One of the key challenges of the millennium is to combine the technological progress with the environmental safety. In the effort to move towards "Sustainable Development", chemistry now a days is at the forefront of the development of clean production processes and products. One factor that is greatly speeding the incorporation of pollution prevention into industrial manufacturing processes is the development of green chemistry curriculum materials. The chemical industry is discovering that when their chemist are knowledgeable about pollution –prevention concepts, they are able to identify, develop and implement techniques that reduce pollution and cost. Green Chemistry is the special contribution of chemists to the conditions for sustainable development. There is no doubt that the emerging area of green chemistry has identified scientific principles, approaches and methodologies that have demonstrated the most positive aspects of chemistry. Chemical industries have adopted new eco-friendly techniques to survive in the market. Since its introduction in the early 1990's, green chemistry has spread throughout all aspects of chemical enterprise internationally. Green Chemistry is a revolutionary area for science and technology that seeks to unite government, academic and industrial communities by placing more emphasis on tending to environmental impacts at the earliest stage of innovation and invention. This approach requires an open and interdisciplinary view of material design, applying the principle that is better not generate waste in the first place rather than disposing or treating it afterwards. In 2000, Daryl Busch former president of the American Chemical Society said 'Green Chemistry represent the pillars that hold up our sustainable future. It is imperative to teach the value of green chemistry to tomorrow's chemists."

Concept of Green Chemistry

The concept of green chemistry incorporates a new approach to the synthesis, processing and application of chemical substances in such manner as to reduce threats to health and environment. This new approach is also known as:

- Environmentally benign chemistry
- Clean chemistry
- Atom economy

- Benign-by-design chemistry

Green Chemistry or environmentally benign chemistry is the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances. Green chemistry was developed by virtue of the need to overcome this hazardous effect that toxic compounds exert on the body. This relatively new area of chemistry uses water as the medium of chemical reactions that are done in the laboratory. Chemical reactions are usually done in a medium that is called solvent. An exception is reactions that take place in the gas phase where there is no need for medium there. Sometimes chemical reactions are done in a neat fashion. Namely, the reacting compounds are mixed and reacted together with the need for a solvent. This is one of the methods that are used in green chemistry to avoid pollution and the hazardous effect of the volatile solvent. As a chemical philosophy, green chemistry applies to organic chemistry, inorganic chemistry, biochemistry, analytical chemistry and physical chemistry to minimize west, utilize renewable resources

The Tweleve Priciples of Green Chemistery

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Prevention

It is better to prevent waste than to treat or clean up waste after it is formed.

Atom economy

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

Less hazardous chemical syntheses

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

Safer Solvents and Auxiliaries

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

Designing safer chemicals

Chemical products should be designed to preserve efficacy of function while reducing toxicity.

Design for energy efficiency

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

Use of renewable feedstock

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.

Reduce derivatives

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

Catalysis

Reduce derivatives = Unnecessary derivatization (blocking group, protection/ de protection, temporary modification) should be avoided whenever possible. Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.

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. 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 and 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.

Progress in Green Chemistry

Over the past decade, green chemistry has convincingly demonstrated how fundamental scientific methodologies can be devised and applied to protect human health and the environment in an economically beneficial manner. Significant progress has been made in key research areas, suchas atom economy, alternative synthetic route for feed stocks and starting materials, bio-catalysis, green solvent, bio sorption, designing safer chemicals, energy and waste management.

Atom Economy (Synthesis of Ibuprofen)

Atom economy is one of the fundamental principles of green chemistry. Atom economy looks at the number of atoms in the reactants that end up in the final product and by- product or waste. % Atom economy = 100 x (FW of product /FW of reactants)

Alternative Synthetic Route for Feedstock & Starting Materials
Production of dimethyl carbonate (DMC) production DMC is a versatile and environmentally innocuous material for the chemical industry. Owing to its high oxygen content and blending properties, it is used as a component of fuel. Traditional method for the production of DMC This method involves the use of phosgene (COCl2) and methanol (CH3OH) as shown below:

COCl2 + 2CH3OH →CH3OCOOCH3 (DMC) + 2HCl

Alternative route for the production of DMC
This involves the use of copper chloride (Coclé), methanol (CH3OH), oxygen (O2) and carbon monoxide.
2CuCl + 2CH3OH + 1/2O2 → 2Cu(OCH3)Cl + H2O
2Cu(OCH3)Cl + CO → 2CuCl + CH3OCOOCH3

Bio-catalysis
Bioleaching is the extraction of specific metals from their ores through the use of microorganisms such as bacteria. This is much cleaner than the traditional heap leaching using cyanide in the case of gold extraction.

Extraction of gold
This can involve numerous ferrous and Sulphur oxidizing bacteria, such as Acidithiobacillus ferroxidase and Acidithiobacillusthiooxidans (also referred to as Thiobacillus). For example, bacteria catalyse the breakdown of the mineral arsenopyrite (FeAsS) by oxidizing the Sulphur and metal (in this case arsenic ions) to higher oxidation states whilst reducing dioxygen by H2 and Fe3+. This allows the soluble products to dissolve.

FeAsS(s) → Fe2+(aq) + As3+(aq) + S6+(aq)

This process occurs at the cell membrane of the bacteria. The electrons pass into the cells and are used in biochemical processes to produce energy for the bacteria to reduce oxygen molecules to water. In stage 2, bacteria oxidise Fe2+ to Fe3+ (whilst reducing O2).

Fe2+ → Fe3++ e-

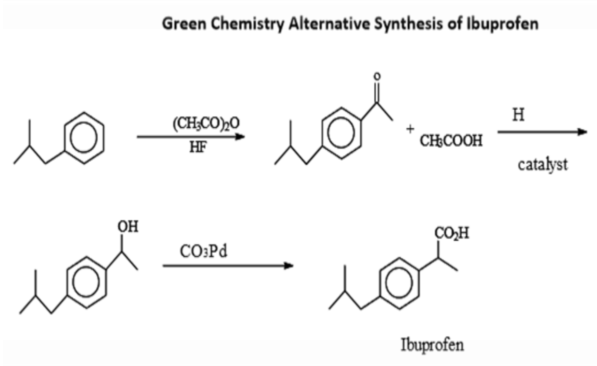
They then oxidise the metal to a higher positive oxidation state. With the electrons gained, they reduce Fe3+ to Fe2+ to continue the cycle. The gold is now separated from the ore and in solution.

Biosorption
Biosorption is one such important phenomenon, which is based on one of the twelve principles of Green Chemistry, i.e., "Use of renewable resources." It has gathered a great deal of attention in recent years due to a rise in environmental awareness and the consequent severity of legislation regarding the removal of toxic metal ions from wastewaters. In recent years, a number of agricultural materials such as the following have been used to remove toxic metals from wastewater.

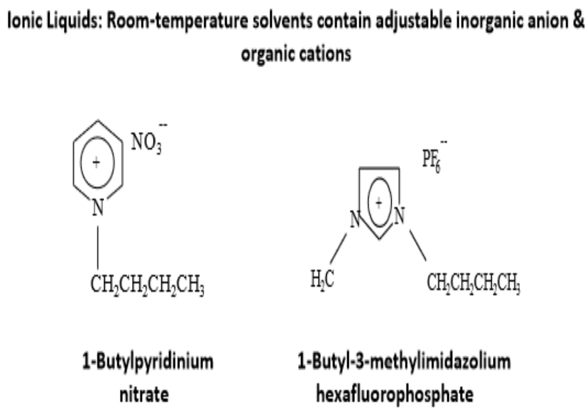
Energy
Fossil fuel is dogged with many environmental pollution problems. There is, therefore, a growing need for alternative energy sources to replace fossil fuels. Renewable energy resources that are currently receiving attention include, solar energy, wind energy, hydro energy (Anastas and Williamson, 1998). Environmentally benign petrol can be obtained by the removal of Pb from petrol; by addition of ethanol produced from biomaterials to the petrol pool; by addition of methyl tbutyl ether (MTBE) to the petrol pool. MTBE has high octane and by use of electric vehicles powered by fuel cells.

Green Route of Chemical Synthesis
Green Chemistry involves the design and redesign of chemical syntheses and chemical products to prevent pollution and thereby solve environmental problems. The research applications for the principle of green chemistry include:

Clean Synthesis (e.g. new routes to important chemical reactions).



Enhanced atom utilization (e.g. more efficient methods).
Replacement of stoichiometric reagents (e.g. Catalytic oxidation using air as the only consumable source of oxygen).
New solvents and reaction media (e.g. use of supercritical fluids and reactions in ionic liquids).



Water based processes and products (e.g. organic reaction in high-temperature Replacement for hazardous reagents (e.g. use of solid acids as replacement of traditional corrosive acids).

In order to be eco-friendly, or green, organic syntheses must meet at least some of the requirements: avoid waste, be atom efficient, avoid use and production of toxic and dangerous chemicals, produce compounds which perform better or equal to the existing ones and are biodegradable, reduce energy requirements, use renewable materials, use catalysts rather than stoichiometric reagents. The demand for solvents has declined over the past decade due to a combination ofenvironmental concern and stricter legislation, as well as weak European and Asian economies. The trend from chlorinated solvents towards oxygenated solvents continues. An alternative for the use of organic solvents is the utilization of water as solvent. Water, in fact is not a popular reaction medium for organic reactions due to the limited solubility of many substrates and also that a variety of functional groups are reactive towards water.Inspite of this, there has been a revival of interest in water as a solvent as it offers many advantages for a clean green chemistry. Addition of surfactants can strongly modify the attitude of water to make organic molecules soluble.

TECHNIQUES

Replacement of Toxic Solvents with Less Toxic Ones

The replacement of toxic or hazardous organic solvents in industrial processes and systems has been initiated long time ago. Examples, like replacement of benzene with toluene, cyclohexane instead of carbon tetrachloride, dichloromethane instead of chloroform etc. The scientific literature contains many examples and practices with replacement of the most toxic and hazardous solvents.

Microwaves in Organic Synthesis, without Solvents

We examined in the previous chapters the use of microwave furnaces for organic reactions. These techniques do not require solvents and are considered “greener” than the conventional methods. The wide range of applications of microwave chemistry has been extended recently to many aspects of organic synthesis. Catalysis under the Principles of Green Chemistry and Eco-friendly Synthesis are new innovative trends with substantial applications.

Sonochemistry in Organic Synthesis, without Solvents

Sonochemistry is also considered a methodology of organic reactions without solvents. Their use has been described before and it is obvious that their applications in organic chemistry will be extended further. High yields, low energy requirements, low waste, no use of solvents are some of the fundamental advantages of these sonochemical techniques.

Other “Greener” Techniques

In addition to the above methodologies which do not require solvents or use less solvents than the conventional methods, there are techniques of biocatalysts, self-thermo-regulated systems, soluble polymers, etc which are considered “green methodologies”. Green Chemistry covers all these aspects of eco-friendly methods and promotes their use in research laboratories and in industrial organic synthesis processes.

“Green solvents” from plants

Plants are considered a renewable sources of energy but also a resource for various materials. Plant oils or vegetable oils derive from plant sources. Unlike petroleum which is the main source of chemicals in the petrochemical industry they are renewable sources. There are three primary types of plant oil, differing both by the means of extraction and by the nature of the resulting oil: Vegetable oils can replace petroleum derived organic solvents, with better properties and more eco-friendly conditions as waste. Chemists have advanced recently techniques so that some vegetable oils to become solvents and replace hazardous organic solvents. As an example of plant-based oils we selected the research project by separately on soybean oils and their esters

Recent Developments and Examples

Creative and innovative skills of chemists have helped to develop new processes, synthetic methods, analytical tools, reaction conditions, catalysts, etc., under the green chemistry cover. Some of these are:

- In 2005, Archer Daniels Midland (ADM) and Novozymes N.A. Won the Greener Synthetic Pathways Award for their enzyme interesterification process. Novozymes and ADM worked together to develop a clean, enzymatic process for the interesterification of oils and fats by interchanging saturated and unsaturated fatty acids. The result is commercially viable products without trans-fats. In addition to the human health benefits of eliminating trans-fats, the process has reduced the use of toxic chemicals and water, prevents vast amounts of by products, and reduces the amount of fats and oils wasted.
- The demand for non-ionic surfactant is growing and a new example of this is alkyl glycoside, which is made from a saccharide. This product can be used as a replacement for alkyl aryl sulphonate anionic surfactant in shampoos. Sodium silicate can be used as a more environmentally benign replacement for phosphorus containing additives in washing powder.
- Feedstock recycling of plastic wastes into valuable chemicals useful as fuels or raw materials. The development of technologies that enables the conversion of biomass into value added chemicals is an essential step towards a more renewable chemical industry.

- The first bio-pesticide for sugarcane has been launched in Australia. The product is based on a naturally-occurring fungus that has been cultured on broken rice grains to provide a medium for distribution.
- Green Routes for Use of Organic Templates in Zeolite Synthesis.
- A novel and very effective wet chemical route for the preparation of metal dendritic nanostructures was developed by starting from VOSO4and Ag2SO4 (or K2PdCl4) in aqueous solution at room temperature.

Green chemistry in pharmaceutical industry

Pharmaceutical companies have the capacity to improve the environmental performance by using the knowledge related to green chemistry. Green chemistry is engaged in developing innovative drug deliverance methods which are less toxic and more useful, efficient and could help millions of patients, Examples:-

1. Phosphoramidite:solid-phase which is blend of antisense oligonucleotides has been altered to entrain the concepts of green chemistry by discarding the usage and formation of toxic or hazardous materials and recycling the important materials like protecting groups amides and solid support, thus upgrading the cost-efficiency and atom economy[54]
2. The formation of Naproxen with chiral metal catalyst containing 2,2'-bis[diphenylphosphino]-1,1'-binaphthyl ligand with fine quantity of product and this was described by Anastasetal.
3. The green chemistry used in the manufacturing of a key intermediate of atorvastatin and the processes take place in two steps :-

a) In first step, bio catalytic reduction of Ethyl-4-chloro-3-oxobutanoate occurs with combination of keto-reductase and glucose for regeneration of the useful substance which is essential for activity of enzyme forming a product [S]ethyl-4-chloro-3-hydroxybutyrate with high yield.
b) In next step, a halohydrindehalogenase is used to accelerate the substitution of the chloro with cyano group, and this reaction takes Place at neutral pH and atmospheric temperatures in presence of natural catalyst.
c) Few workers have invented clean, quick and inexpensive way for the preparation of amines with huge portion of drug molecules. Presently, industries manufacture amines in a two-step process at high cost and it results in grand amounts of by-products as a waste material. On the other hand, concepts of Green chemistry don’t produce any waste product, and reaction is also a quick one-step process in presence of little amount of catalyst. Steps for Aspirin synthesis with microwave irradiation using catalysts such as H2SO4, MgBr3.OEt2, AlCl3, CaCO3, NaOAc, Et3N and solvent-free approach have been designed.

Green Chemistry In India

India, second largest producer of pesticides and ranked 12th in pharmaceutical production, is fast emerging among the top 5 players in selected petrochemicals. These facts, in turn, have led to an increased stress on our delicate environmental balance, thus India needs to pursue green chemistry along with progressive chemistry more exhaustively and extensively. Due to large-scale production of pesticides, pharmaceuticals, petrochemicals, and other consumer durables, there is a great potential for green chemistry research in India to refine the existing technologies and also to find more environmentally benign alternatives. To increase the research in this field, we need to publicize the needs, effects, and practice of green chemistry. Currently, green chemistry research in India is confined mainly to areas of greener synthetic strategies, catalyst development, usage of biocatalysts, usage of nonconventional technologies, and analytical techniques.

In developing green synthetic strategies, Indian scientists are mainly concentrating on avoiding environmentally no compatible reagents, solid-phase syntheses, modification of synthetic routes to decrease the number of steps and increase overall yield, usage of newer catalysts and simplification of classical procedures of reaction. However, what is required is a combined approach for a greener synthesis. Catalyst and reagent chemistry is one of the most important aspects of eco-friendly chemistry. Reagent chemists in India are working toward development of more benign and selective reagents that require ambient conditions. The elimination of hazardous solvents is one of the prime concerns among them. Enzymes have emerged as biotechnological tools, which can offer solutions to the major problems of the chemical industry in India. Over the years, chemists in India are engaged in enhancement of an application base of enzymes to develop new alternative sweeteners such as high fructose corn syrup (HFCS), synthetic honey, and other food products such as polysaccharide gums, thickeners, and flavor enhancers. There is a great need to develop newer enzymes that can work at ambient conditions and to determine their optimum activity by in-depth study. An interdisciplinary approach and healthy partnership between research institutions and industry can very effectively evolve solutions to problems faced like the increase in the cost of chemical fertilizers and consequent risk of degradation of soil fertility by excessive use of chemical fertilizers, the role of bio fertilizers is becoming significant. India has been using rhizobium for leguminous crops and blue-green algae for rice cultivation, but the consumption levels have been low. Keeping in view the vast Indian biodiversity, there is need to explore the same without damaging the fragile ecological balance. In India, although there is growing awareness about the ill effects of pollution, promotion of continual introduction of environmentally friendly products and methodologies in the chemical industry needs to be furthered. Usage of nonconventional technologies is highly popular in India. First in this list is the usage of microwaves, which is also the field of my research work. Further, the microwave chemists are turning their attention toward microwave-assisted dry-media reactions in order to minimize solvent usage, an added advantage to already established microwave chemistry. In addition to microwave-assisted reactions, ultrasonic and photochemical reactions are also used as nonconventional reaction technology. Analytical chemistry has been at the center of the green chemistry movement. Advances in analytical chemistry are key to environmental protection. In India, the focus for analytical chemistry is mainly on extraction technologies such as solid phase, ultrasound and microwave, supercritical fluid extraction, and automated soxhlet extraction. Monitoring and analysis of heavy metals and pesticides is very important for an agro economy-based country like India, and chief governmental institutes like the Indian Agricultural Research Institute (IARI) and the Defense Research and Development Organization (DRDO) are working extensively in this field. Further removing of these elements from industrial and agrochemical usage is of prime importance for these institutes.

Future Trends In Green Chemistry

Chemists are using their innovative and creative skills from all over the world to build up new processes, reaction conditions, synthetic methods, Catalysts etc. Profitable applications of green chemistry have led to Intellectual research to find out different alternatives to the active artificial methods and some environmental laws: These laws are in general have become "command and control" laws. Risk occurring with toxic chemical is a function of Hazard and Exposure. With the passage of time, these laws have completed a great deal in improving pollution prevention in coming years.

Green Chemistry Applications

1. Chemicals from glucose: These are the chemical compounds are a set of chemicals which might be made on a completely massive scale to satisfy international markets. Glucose is alternative for product chemicals. Biotechnological strategies are used to control the production of fragrant compounds], compounds inclusive of catechol, hydroquinone, and adipic acid, every compounds of which be able to be vital, may be synthetic. Benzene is the initial material used for these materials, by means of changing benzene amid glucose can assist in lowering the usage of diverse reagents with certain toxic. Synthesis which takes region in water as a replacement for of natural solvents is more beneficial.

2. Polysaccharide Polymers: They are an essential group of compounds that include widespread packages. They have got their dangerous consequences. The big range of compounds can be exploited. Polysaccharide because the feedstock have to be used as beginning materials due to the fact that it's far extra environmentally feedstock. Those are organic and have the benefit of being renewable or viable, in place of petroleum feedstock. On the opposite side these don't have any chronic toxicity to environment and health of humans.

A few more reactions are:

a) Green chemical reactions

• Production of aromatic amines which are halide free: Conventional manufacturing of aromatic amines is done by treating benzene with chlorine with the help of nitrogen and then displacing chlorine with a brand new group (nucleophilic substitution). In this process nitrobenzene together with aniline is heated in the presence of tetra methyl ammonium hydroxides to formtetramethyl-ammonium salts. The technique avoids using halogenations intermediates.

b) As green reagents

• Liquid oxidation reactor: It allows safe oxidation of organic chemicals with pureoxygen.It can cause reaction to occur at low temperature and is quite useful. Due to this the amount of vent gas has been decreased.

• Complexes formed by green oxidative transmissions: various oxidation methods have bad ecological impacts. The contaminate (metal ion) can be decreased by the use of molecular oxygen as the number one oxidant. Many ligands have been advanced that are strong towards oxidative decomposition in oxidizing environments. Because of this it's miles viable to synthesize stable excessive oxidation kingdom transition metal complexes.

c) Reaction conditions for green solvents

Making solvents immobile: For solvents which have high quantity and vast applicability, the capacity for their poor impact on human health and the environment may be very high. Various solvents are comfortable and hard to handle.

d) Products of green chemicals

• Other methods for designing nitrites: Different structures of compound that can be toxic are studied and changes are done to reduce toxicity. The mechanism causing acute toxicity is thought to be due to removal of hydrogen cyanide from cyanohydrins, depending on the nature of the substitution at alpha carbon function may be decreased or improved.

• Polyaspartic acids (donlar's): By means of the usage of bio rational techniques the soybean cyst nematode can be managed: Soybean cyst nematode fungus is still an agricultural hassle. Being part of an inter disciplinary attempt to find a bio rational solution to the problem, various glycinoeclepinA analogues(a natural hatching stimulus of the nematode) have been developed and testing done. Number of the analogues were found to have inhibitory action on the hatching of soybean cyst nematode eggs. These eggs in the woman can last for eleven to twelve days in soil.

Green Chemistry In Routine Life

1. Green Dry Cleaning of Clothes: Per-chloroethylene is most common solvent used for dry maintenance. It is also suspected as a cause of cancer. Micell technology,

uses liquid CO_2 and a surfactant for dry cleaning clothes, in the place of PERC and CO_2 so that need of halogenated solvent get eliminated.

2. Bleaching Agents: The paper is produced from wood. The wood may consist of approximately seventy percent polysaccharides and about thirty percent lignin. The amount of lignin must be removed from the wood to get a good quality paper. For the removal of lignin various reagents used like, sodium hydroxide, sodium supplied and chlorine gas. But on the other hand it is also causing environmental pollution and various other problems. For the decomposition of lignin the reaction with Chlorine also result in many other hazardous products. Dioxins and furans are produced like chlorinated furans and 2, 3, 4-tetrachloropdioxin. They are by products of chemical reaction of Chlorine and aromatic rings of the lignin. These products cause different health problems and cancer. Later on, chlorine gas was replaced by chlorine dioxide. There are other agents like O_3, H_2O_2 or O_2also did not give this the desired products. Terrence Collins of Camogie Mellon University has developed a versatile agent. In this, use of hydrogen peroxide as bleaching agent takes place in the presence of different activators known as TAMLs [Tetra Aamido Macrocyclic Ligands] activators. The catalytic action of TAMLs activators grants H_2O_2 to break down more lignin at low temperature in less time.

3. To Change Turbid Water into Clear Green Solution: In present era the use of alum salt to treat municipal and industrial waste water clear is in practice. It has been raised that alum is not perfect for this purpose because it increasing the hazardous ions in discharged water and may cause Alzheimer's ailments. Therefore, agriculture waste that discharged such as kernel powder and tamarind seeds, acts as an efficient agent to compose municipal and industrial waste water clears. Powder of Kernel is harmless. It is also ecofriendly and cheaper than alum. Four different flocculants taken for the testing, that is kernel powder, seeds of tamarinds, mixture of the starch and alum, and powder and starch mixture Slurries prepared by the addition of weighed amount of clay, sand and water to the given flocculants.

CONCLUSION

The challenges in resource and environmental sustainability require more efficient and benign scientific technologies for chemical processes and manufacture of products. Green chemistry addresses such challenges by opening a wide and multifaceted research scope thus allowing the invention of novel reactions that can maximize the desired products and minimize the waste and byproducts, as well as the design of new synthetic schemes that are inherently, environmentally, and ecologically benign. Therefore, combining the principles of the sustainability concept as broadly promoted by the green chemistry principles with established cost and performance standards will be the continual endeavor for economies for the chemical industry. It is, therefore, essential to direct research and development efforts towards a goal that will constitute a powerful tool for fostering sustainable innovation. Green chemistry alone cannot solve the pressing environmental concerns and impacts to our modern era, but applying the twelve principles of green chemistry into practice will eventually help to pave the way to a world where the grass is greener.

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REFERENCES

1. Anastas, P. and J. C. Warner, Green Chemistry: Theory and Practice, Oxford Science Publications, Oxford, 1998.
2. Anastas, P.T and T.C. Williamson, Green Chemistry: Frontiers in Benign chemical Synthesis and Processes. Oxford University Press, Oxford, 1998
3. Chandrasekaran, S., B.C. Ranu, G.D. Yadav and S. Bhanumati, Monographs on Green Chemistry Experiments, GC Task Force, DST, 2009.
4. Clark, J. H. Catalysis of Organic Reactions by Supported Inorganic Reagents, VCH, New York, 1994.
5. Clark, J. H., Chapman and Hall, Chemistry of Waste Minimisation, Corporate Image of the Chemical ed London, 1995. Industry, CIA (UK), 1993. Pan European Image Survey, CEFIC, 1994.
6. James H. Clark, Green chemistry: Challenges and Opportunities, Green Chemistry February 1999 Ravichandran, S. Int. J. Chem Tech Res., 2010; 2(4): 2191, Sheldon, R.A. Green solvents for sustainable organic synthesis: State of the art.
7. Green Chem., 7, 267, 2005 Tanaka, K. and F. Toda, Chem. Rev., 100, 1045. 2000 Tundo, P. and P. T. Anastas, Green Chemistry: Challenging Perspectives, Oxford Science, Oxford, 1999.
8. Mono M Singh, Zvi Szafran and RM Pike. J Chem Educ, 1999; 76: 1684.
9. PT Anastas and TC Williamson {eds}, Green Chemistry: Frontiers in benign Chemical Synthesis

and processes, Oxford University Press, Oxford, 1998.
10. P Tundo and PT Anastas. Green Chemistry: Challenges Perspectives, Oxford University Press, Oxford, 1998.
11. R Noyori. Chem Rev, 1999; 99: 353.
12. WF Hoelderich. J Appl Catal A., 2000; 487: 194.
13. RA Sheldon. Chem Rev., 1999; 9: 10.
14. Ryoji Noyori. Chem Comm, 2005; 14: 1807.
15. S Johnston. Eur Chem News, 2002; 72: 32.
16. RA Sheldon et.al. Science, 2000; 287: 1636.
17. JX Haberman, GC Irvin, VT John and Li Chao-Jun. Green Chem., 1999; 1: 265.
18. GDYadav, AA Pujari and AV Joshi. Green Chem., 1999; 1: 269.
19. BM Choudary. Catal Today, 2000; 57: 17.