iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 6 **Issue:** II **Month of publication:** February 2018

DOI: http://doi.org/10.22214/ijraset.2018.2012

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 6 Issue II February 2018- Available at www.ijraset.com

Green Chemistry in Daily Life

Rummi Devi Saini[1]
[1]Department of chemistry, S.M.D.R.S.D. College, Pathankot, India

Abstract: Green chemistry is one of the most explored topics these days. Major research on green chemistry aims to reduce or eradicate the production of harmful bi-products and maximizing the desired product in an eco friendly way. The three main developments in green chemistry include use of super critical carbon dioxide, water as green solvent, aqueous hydrogen peroxide as an oxidizing agent and use of hydrogen in asymmetric synthesis. In order to reduce carbon footprint the customary methods of heating are increasingly replaced by microwave heating. It also saves a lot of time. Even food with low carbon footprints is greatly encouraged these days. This paper mainly highlight on applying green chemistry to day to day life so that each individual could be made aware it.
Keywords: Volatile organic compounds (VOC's), Activators, Carcinogens, Biodegradable, Green chemistry, Environment, Sustainability.

I. INTRODUCTION

The U.S environmental law "The Pollution Prevention ACT of 1990" stated that the first choice for preventing pollution is to design industrial processes that do not lead to waste production . This made the approach for green chemistry.[1]The environmental protection agency (EPA) defines green chemistry, as the design of chemical products and processes that reduce or eradicate the use or generation of hazardous substances. This involves reduced waste products, nontoxic components and improved efficiency. Environmental chemistry is the chemistry of natural environment and of pollutant chemicals in nature, whereas green chemistry specifically tends to reduce and prevent pollution at source. Paul Anast as known as the father of green chemistry has given the term green chemistry in 1991. Main emphasis of green chemistry scientists is design of safer chemicals and chemical processes to replace the use of hazardous substances. [2]-[7]

A. Basic Principals of Green Chemistry

1) *Prevention*; It is better to prevent the production of 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 i.e. Reduce waste at the molecular level.
3) *Less Hazardous chemical synthesis;* Wherever practicable, synthetic methods should be designed to use and generate substance that possesses little or no toxicity to human health and environment.
4) *Designing Safer Chemicals;* Chemical products should be designed to affect their desired function while minimizing their toxicity and environmental destiny throughout the design of the process.
5) *Solvents and auxiliaries;* Chose the safest solvents available for any given step and avoid whenever possible.
6) *Design for energy efficiency;* Choose the least energy demanding chemical route. Ambient temperature and pressure are optimal.
7) *Use of renewable feed stocks;* Use chemicals which are made from renewable (i.e. Plant based) resources rather than chemicals originating from depleting resources.
8) *Reduce derivatives;* Minimize the use of temporary derivation such as blocking group, protecting groups.
9) *Catalysis;* Use catalytic reagents (as selective as possible) rather than stoichiometric reagents in reactions
10) *Design for degradation;* Design chemicals that degrade and break down into harmless products which do not persist in environment at the end of their function.
11) *Real time pollution prevention;* Monitor chemical reaction in real time, in process and control prior to the formation of hazardous substance
12) *Safer chemistry for accident protection;* Choose and develop chemical procedures and substances that are safer and minimize the potential for chemical accidents, explosions and fires. Here are some of the fields involved in everyday life where green chemistry has been applied to some extent.

II. APPLICATIONS OF GREEN CHEMISTRY IN DAILY LIFE

A. Green Dry Cleaning of Clothes

Percholoroethylene (perc) is the solvent most commonly used in dry cleaning clothes. Perc ($Cl_2C = CCl_2$) is suspected to be carcinogenic and it contaminates ground water on its disposal. A new technology known as micell technology is developed by Joseph De Simons, Timothy Remark and James Mc clain in which liquid carbon dioxide can be used as a safer solvent along with a surfactant to dry clean clothes.[8] This method is now being used commercially by some dry cleaners. Dry cleaning machines have been modified for using this technology so carcinogen PERC is replaced by green solvent.[9]

B. Green Bleaching Agents

Conventionally during manufacturing of good quality white paper, lignin from wood used for it, is removed by placing small pieces of wood into a bath of sodium hydroxide and sodium sulphide followed by its reaction with chlorine. Chlorine during the process also reacts with aromatic rings of the lignin to form chlorinated dioxins and chlorinated furans. These compounds being carcinogens, cause health problems. Terrence Collins of cambegie mellon university developed a green bleaching agent which involves use of H_2O_2 as a bleaching agent in the presence of some activators such as TAML which catalysis the fast conversion of H_2O_2into hydroxyl radicals that cause bleaching.[10] This bleaching agent breaks down lignin in a shorter time and at much lower temperature .It can be used in laundry and results in lesser use of water.[11]

C. Eco Friendly Paint

Oil based 'alkyd 'paints give off large amount of volatile organic compounds (VOCs) as it dries and cures. These VOC's have many environmental effects. Procter & Gamble and Cork composites & polymers established a mixture of soya oil and sugar to be used in place of petroleum petrochemicals derived paints resins and solvents which reduced the hazardous volatiles by 50%.Chermpol MPS, paint formulation use these bio basedsepose oils to replace petroleum based solvents and create paint which is safer to use.Sherwin William established water based acrylic alkyd paints from recycled soda bottle plastic (PET), acrylics and soya bean oil. These paints give performance benefits of alkyds and low VOC content of acrylics. In alone 2010 enough quantity of these paints were manufactured to eliminate 362,874Kg of VOC's.

D. Putting Out Fires The Green Way

The conventionally used chemical firefighting foams used worldwide discharge toxic substances into environment contaminating water and deleting ozone layer. A new foam called pyro cool has now been invented to put out fires effectively without producing toxic substances as in other firefighting materials. [12]

E. Turning Turbid Water Clear In Green Way

Conventionally, municipality and industrial waste water is made clear by the use of Alum. Alum is found to increase toxic ions in treated water which causes Alzheimer's disease. The tamarind seed kernel powder which is discarded as agriculture waste has been found as effective and economic agent to make municipal and industrial waste water clear as with alum. Also tamarind kernel powder is nonpoisonous, biodegradable and economic. In a study, four flocculants tamarind seed kernel powder, mixture of the powder and starch, starch and alum were taken. Flocculants with slurries were obtained by mixing measured amount of clay and water. The aggregation of the powder and suspended particles were found to be quite porous which permitted the water to pass through it. It also became compact more easily and thus larger volume of clear water was obtained. Starch flocks being light weight and less porous didn't allow water to pass through it easily. The study established that the powder has potential as a cost-effective flocculent having performance like more established flocculants such as potash alum.

F. Biodegradable Plastics

large dumps of non biodegradable waste plastic.[13] Many companies have been working in this direction. For example Nature Works of Minnetonka, Minnesota, is making food containers from polylactic acid branded as Ingeo. A method has been discovered by the scientists at Nature Works in which microorganisms convert cornstarch into a resin just as strong as the petroleum-based plastic presently used for making containers, water bottles etc.[14] The company is trying to use the raw material from agricultural waste. In another example BASF developed a biodegradable polyester film called as Eco flex.[20] This film is used along with cassava starch and calcium carbonate to make fully biodegradable bags called as Ecovio. The bags are certified by the Biodegradable Products Institute as completely biodegradable into water, CO_2, and biomass in industrial composting systems. These bags are also found to be tear-resistant, puncture-resistant, waterproof, printable and elastic so can be used in the place of conventional plastic bags. They will quickly degrade in municipal composting systems along with kitchen and yard waste.[15]

G. Computer Chips

Many chemicals, huge amounts of water, and energy are required to manufacture computer chips. At the Los Alamos National Laboratory scientists have developed a method where supercritical carbon dioxide is used in one of the steps of chip preparation which appreciably decreases the amounts of chemicals, energy and water required to manufacture chips. At the University of Delaware, Richard Wool, former director of the Affordable Composites from Renewable Sources (ACRES) program established a method to make use of chicken feathers to manufacture computer chips.[16] The protein, keratin of the feathers was worn to make a fiber form that is light but tough enough to withstand mechanical and thermal stresses.[17]

H. Medicine

The pharmaceutical industry is working to develop medicines with less harmful side-effects, by methods which produce less deadly waste.[19]Merck and Codexis developed a second-generation green synthesis of sitagliptin that is an active ingredient in Januvia, a treatment used for type 2 diabetes.[23] This resulted in an enzymatic process that eliminates the need for a metal catalyst, reduces waste, enhances yield and safety.[20] The drug, Simvastatin, sold under the brand name Zocor, is used on large scale for treating high cholesterol. The traditional method to make this medication employed a large number of steps, used large quantity of harmful reagents and formed a large amount of toxic waste in the process. Professor Yi Tang, of the University of California used an engineered enzyme and a low-cost feedstock to synthesize it. A biocatalysis company, Codexis, optimized both the enzyme and the chemical process which reduces hazard and waste to a great extent, is lucrative, and meets the requirements of the consumers.[21],[22]

I. Solar Cell

The solar cell is most important example of green technology. It directly converts the light energy into electrical energy by the process of photovoltaics. Solar photovoltaic technology has been found to be one of the few renewable, low-carbon producers with both the scalability and the technological development to congregate the ever-growing global demand for electricity. [24]The use of solar photovoltaics has been rising at an average of 43% per year since 2000. Generation of electricity from solar energy results in less consumption of fossil fuels, reduction of pollution and greenhouse gas emissions.

J. Building with Green Technology

Green buildings make use of a variety of environmentally friendly techniques in order to reduce their impact on the environment.[25] Use of domesticated materials, reflexive solar design, natural ventilation and green roofing technology may allow builders to construct a building with a significantly smaller carbon footprint than normal construction.[26] These techniques are beneficial for the environment as well as they can produce cost-effective buildings which are healthier for the occupants too. Green ventilation techniques reduce the need for traditional air conditioning by allowing natural airflow.

III. CONCLUSION

Though many exciting green chemical processes are being developed but there are far greater number of challenges lie ahead. A lot of efforts are being undertaken to design nonpolluting starting materials and to get safer products without side products. The greatest challenge is too incorporate the green chemistry in day to day life. Many successful efforts have been made but still a lot has to be done. This can be achieved by training and educating new generation of chemists. Green chemistry has to be introduced in the syllabus of the students at all levels, so that each individual is made aware to choose greener path in his or her everyday life.

REFERENCES

[1] P.T. Anastas, J.C. Warner, Green Chem Theory and Practice, Oxford Univ. Press, New York (1998).
[2] P.T. Anastas, I.T. Hovarsth, Innovations and Green Chemistry, Chem.Rev.107, 2169 (2007).
[3] S. Ravichandran, Int. J. ChemTech Res., 2(4)2191 (2010).
[4] B. M. Trost, Atom economy-A challenge for organic synthesis: Homogeneous catalysis leads the way. Angew Chem Int ., Ed., 34, 259 (1995).
[5] R.A. Sheldon, Green solvents for sustainable organic synthesis: State of the art. Green Chem., 7, 267 (2005).
[6] V.B. Bharati, Resonance, 1041 (2008).
[7] V.K. Ahluwalia and M. Kidwai, New Trends in Green Chemistry, Anamaya Publisher, New Delhi (2004).
[8] Micell Technology, Website: www.micell.com, accessed Dec. 1999

[9] McCoy, M. “Cleaning Product Makers Bask In New Solvents.” Chemical & Engineering News 2015, 93 (3), 16-19
[10] J.A. Hall, L.D. Vuocolo, I.D. Suckling, C.P. Horwitz, R.M.Allison, L.J. Wright, and T. Collins; Proceeding of 53rd APPITA Annual Conference, Rotorua, New Zealand. April 19-22, 1999.
[11] P. Tundo and P.T. Anastas, Green Chemistry: Challenging Perspectives, Oxford University Press, Oxford. (1998)
[12] P.T Anastas and T.C.Williamson, Green Chemistry: Frontiers in Benign chemical Synthesis and Processes. Oxford University Press, Oxford. (1998).
[13] Bastioli, editor, Catia (2005). Handbook of biodegradable polymers.Shawbury, Shrewsbury, Shropshire, U.K.: Rapra Technology. ISBN 9781847350442.
[14] Vroman, Isabelle; Tighzert, Lan (1 April 2009). "Biodegradable Polymers". Materials. **2** (2): 307–344. doi:10.3390/ma2020307
[15] A.Ashwin; K., Karthick (2011). "Properties of Biodegradable Polymers and Degradation for Sustainable Development". International Journal of Chemical Engineering and Applications: 164–167. doi:
[16] Crede KL. Environmental effects of the computer age. IEEE Trans Prof Commun. 1995;38(1):33–4
[17] Wallenberger FT, Weston N, Chawla K, Ford R, Wool RP. eds. 2002. Advanced Fibers, Plastics, Laminates and Composites
[18] Ritter, S.K. “EPA Analysis Suggests Green Success.” Chemical & Engineering News 2015, 93 (5) 32-33
[19] Ritter, S.K. “Seeing the Green Side of Innovation.” Chemical & Engineering News 2014, 92 (26) 24-28
[20] U.S. Environmental Protection Agency. “Presidential Green Chemistry Challenge Awards: 1997 Greener Synthetic Pathways Award.” http://www2.epa.gov/green-chemistry/1997- greener-synthetic-pathways-award (accessed June 30, 2015).
[21] U.S. Environmental Protection Agency. “Presidential Green Chemistry Challenge Awards: 2012 Greener Synthetic Pathways Award.” http://www2.epa.gov/green-chemistry/2012- greener-synthetic-pathways-award (accessed June 30, 2015).
[22] American Chemical Society. “Examples of Green Chemistry.” http://www.acs.org/content/ acs/en/greenchemistry/what-is-green-chemistry/examples.html (accessed June 30, 2015).
[23] U.S. Environmental Protection Agency. “Presidential Green Chemistry Challenge Awards: 2010 Greener Reaction Conditions Award.” http://www2.epa.gov/green-chemistry/2010- greener-reaction-conditions-award (accessed June 30, 2015)
[24] Jean, J., Brown, R.B., Jaffe, R.L., Buonassisi, T. and Bulović, V. “Perspective: Pathways for solar photovoltaics.” Energy Environ. Sci. 2015, 8, 1200-1219
[25] Background Booklet, International Conference on Green Buildings, Oct 2011, CII and IGBC
[26] Lead India: “What is the Market Size and Growth Rate?” (http://www.green-buildings.com)