

GREEN CHEMISTRY

WHAT IS Green Chemistry?

Green chemistry is the design, development, and implementation of chemical products and processes that reduce or eliminate the use of hazardous substances and the generation of waste.

It is a branch of chemistry that aims to design products and processes that are safe for the environment and human health. It focuses on the prevention of waste, the use of renewable resources, and the design of safer chemicals and processes.

ORIGIN

The term 'green chemistry' was first used by Paul Anastas and John Warner in their book 'Green Chemistry: Principles and Practice' in 1998. The book was a landmark publication in the field of green chemistry and helped to establish it as a distinct branch of chemistry.

ACHIEVEMENTS

- Development of safer solvents and auxiliaries
- Design for energy efficiency
- Use of renewable feedstocks
- Design for degradation
- Waste prevention
- Catalysis
- Atom economy
- Less hazardous chemical synthesis
- Designing safer chemicals

12 PRINCIPLES OF GREEN CHEMISTRY

- 1. REAL TIME POLLUTION PREVENTION
- 2. DESIGN FOR DEGRADATION
- 3. WASTE PREVENTION
- 4. CATALYSIS
- 5. SAFER SOLVENTS AND AUXILIARIES
- 6. SAFER CHEMISTRY FOR ACCIDENT PREVENTION
- 7. DESIGN FOR ENERGY EFFICIENCY
- 8. REDUCE DERIVATIVES
- 9. ATOM ECONOMY
- 10. USE OF RENEWABLE FEEDSTOCKS
- 11. LESS HAZARDOUS CHEMICAL SYNTHESIS
- 12. DESIGNING SAFER CHEMICALS

TERMS USED IN GREEN CHEMISTRY

GREEN ENERGY

Green energy is energy which is obtained from natural resources and does not harm the environment through pollution and its release from fossil fuels. It is important to environment as they release far less greenhouse gases than fossil fuels and the toxic by-products.

Examples of green energy are:

- Wind and solar energy
- Use of sustainable biomass and renewable electricity in transportation using electric vehicles

GREEN ENGINEERING

It is the design and use of processes and products in a way that minimizes pollution and risk to human health and the environment. It promotes safety, efficiency, and economy.

Example: In design and application of new materials, which have long lifespan and are easy to recycle.

ECONOMY IN CHEMISTRY

The economy in chemistry refers to the efficient use of resources and the reduction of waste. It involves the design of processes and products that are cost-effective and environmentally friendly.

What are solid acids?
Solid acids are those acids which don't dissociate in the reaction medium. They are green alternatives of mineral acids.



WHAT IS Green Chemistry?



Green Chemistry is the design, development & implementation of chemical processes for reduction of substances hazardous to human health & environment.

Transformation to green chemistry techniques aims to eliminate hazards by preventing contamination of large numbers of synthetic industrial chemicals, many of which are known to be toxic and carcinogenic. As these processes are more efficient, companies would consume less raw materials and energy. Throughout the design, production, use/reuse and disposal processes we can prevent chemically contaminated food, air, water and dust. This results in safer workplaces for industry workers, greatly reduced risks to vulnerable communities and safer products for consumers.

ORIGIN

The idea of green chemistry was initially developed as a response to the pollution prevention act, declared that U.S. national policy should eliminate pollution by improved design instead of treatment and disposal. Paul Anastas is known widely as the "father of green chemistry" for his groundbreaking research on the design, manufacture and use of environmentally toxic, etc. friendly chemicals.

TERMS USED IN GREEN CHEMISTRY

— Luna A. Ahmed
1st semester

GREEN ENERGY

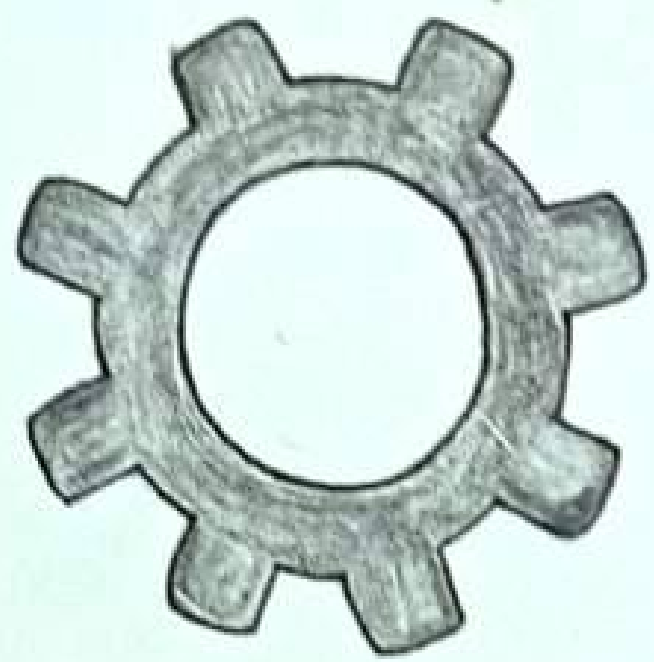
Green energy is energy which is collected from natural resources and don't harm the environment through factors such as releasing green house gases. It is important to environment as they release far less green house gases than fossil fuels and low levels of air pollutants.

Examples of green energy in individual use :-

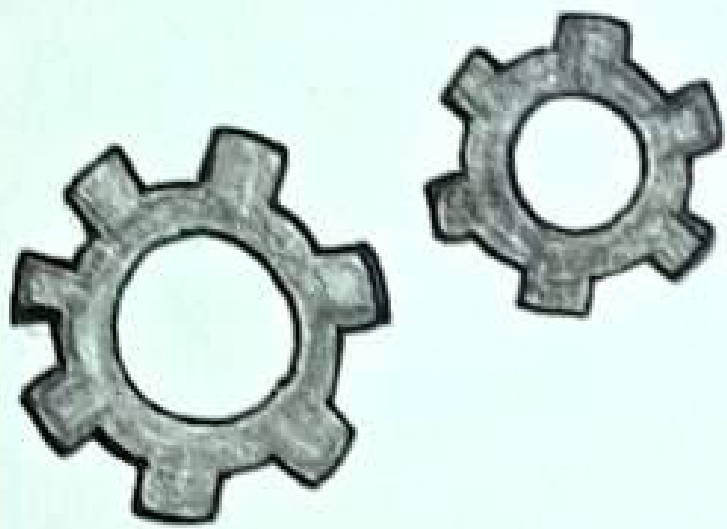
- Heating and cooling buildings.
- Use of sustainable biofuels and renewable electricity in transportation across multiple industry sector.



GREEN ENGINEERING

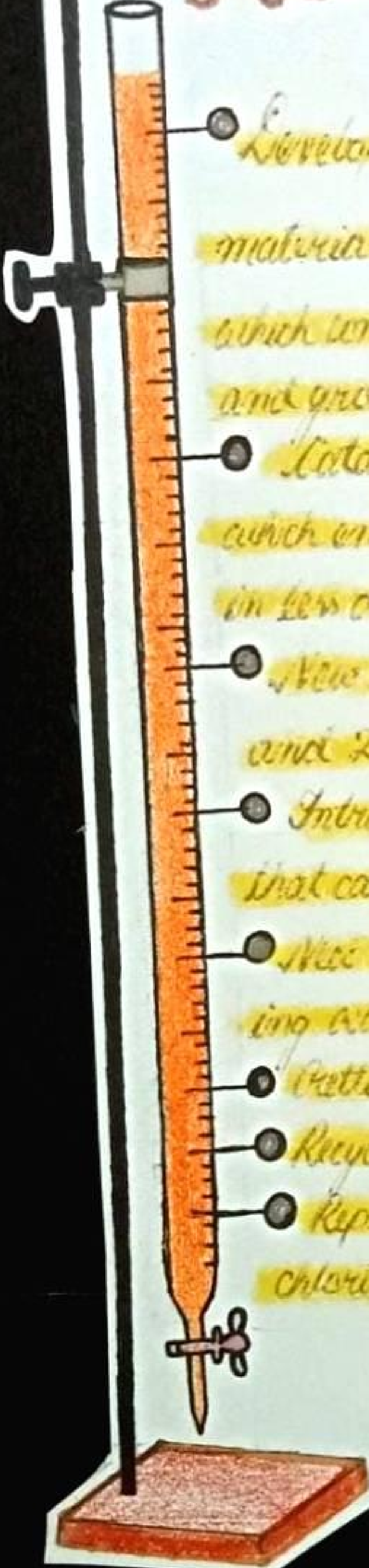


It is the design and use of processes and products in a way that minimizes pollution and risk of human health and the environment. It promotes sustainability without sacrificing economic viability and efficiency.



Example :- It develops and applies engineering solutions while being cognizant of local geography, aspirants and culture.

ACHIEVEMENTS



- Development of polystyrene foam sheet packaging material. This technology allows elimination of CFCs which contribute to ozone depletion, global warming and ground level smog.

- Catalytic hydrogenation of ethionamide, in which environmental friendly herbicide is produced in less dangerous ways.

- New synthesis of antibiotics such as Ibuprofen and Zoloft.

- Introduction of eco-friendly grain pesticides that cause less harm to habitats and the ecosystem.

- New oxidants for bleaching powder and disinfecting water.

- Getting lead out of automobile paints.

- Recyclable carpeting.

- Replacing volatile organic compounds and chlorinated solvents.

WASTE

PREVENTION

Green

Chemistry discusses the engineering concept of pollution prevention and zero waste both at laboratory and industrial scales. It encourages the use of economical and eco compatible techniques that not only improve the yield, but also bring down the cost of disposal of wastes at the end of a chemical process. Even pollution & wastage prevention was the main cause in originating the idea of green chemistry.

Dominic Smith, a Process Development Engineer, found a way to reduce energy consumption through green chemistry making medicines using enzymes. These enzymes are found in plants and soil, replace chemical synthesis steps to cut energy consumption during processing and reduce hazardous waste. However, the use of enzymes in green chemistry is still in its infancy and getting enzymes that are fast enough, stable enough, and produce the right yield is difficult.

ECONOMY IN

Without economic stabilisation neither a country nor an individual can survive in present. All chemist also works with economic calculation of atom or molecule termed as atom economy. The atom economy of a reaction is a measure of the amount of starting materials that end up as useful products. It means that all atoms and molecules have to be used to form the product. Maintenance of atom economy in a reaction is one of the important principle of green chemistry. Good atom economy means that most of the atoms of the reactant are incorporated in the desired products. Moreover poor atom economy is common in fine chemicals or pharmaceuticals synthesis and especially in the research.

— Dev Chowdhury
1st semester

CHEMISTRY

What are solid acids?

Solid acids are those acids which don't dissolve in the reaction medium. They are green alternatives of mineral acids.

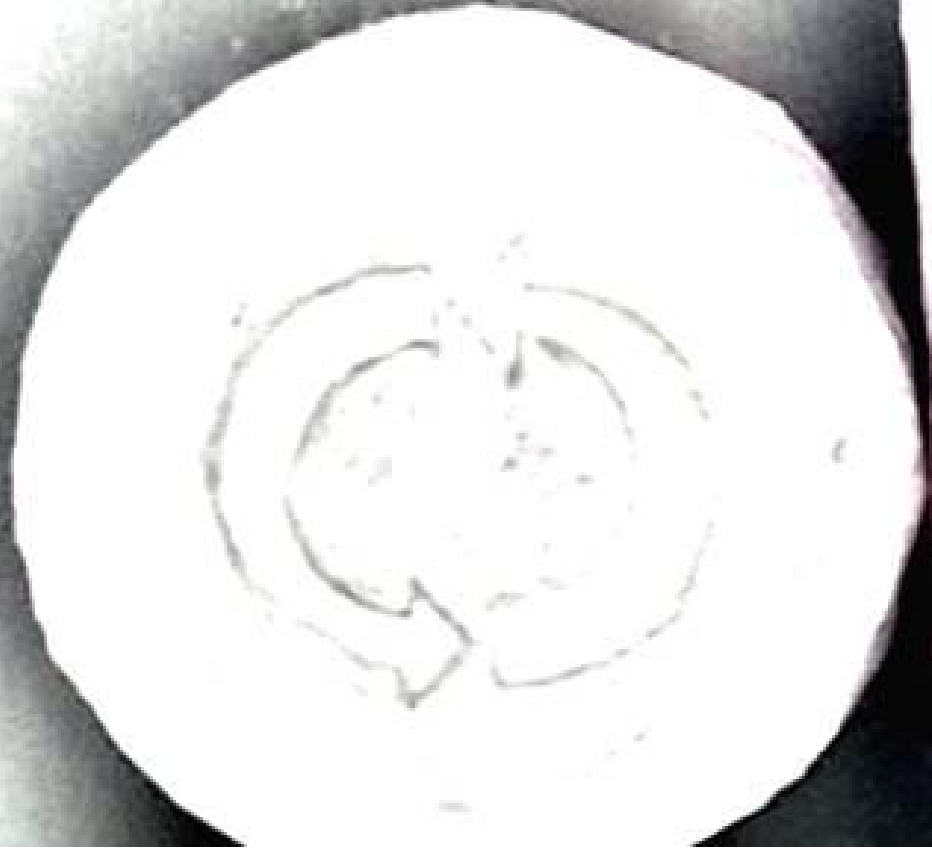
12 PRINCIPLES OF
GREEN CHEMISTRY

REAL TIME POLLUTION
PREVENTION





LESS HAZARDOUS
CHEMICAL SYNTHESIS



USE OF RENEWABLE
FEEDSTOCKS



ATOM ECONOMY



REDUCE DERIVATIVES



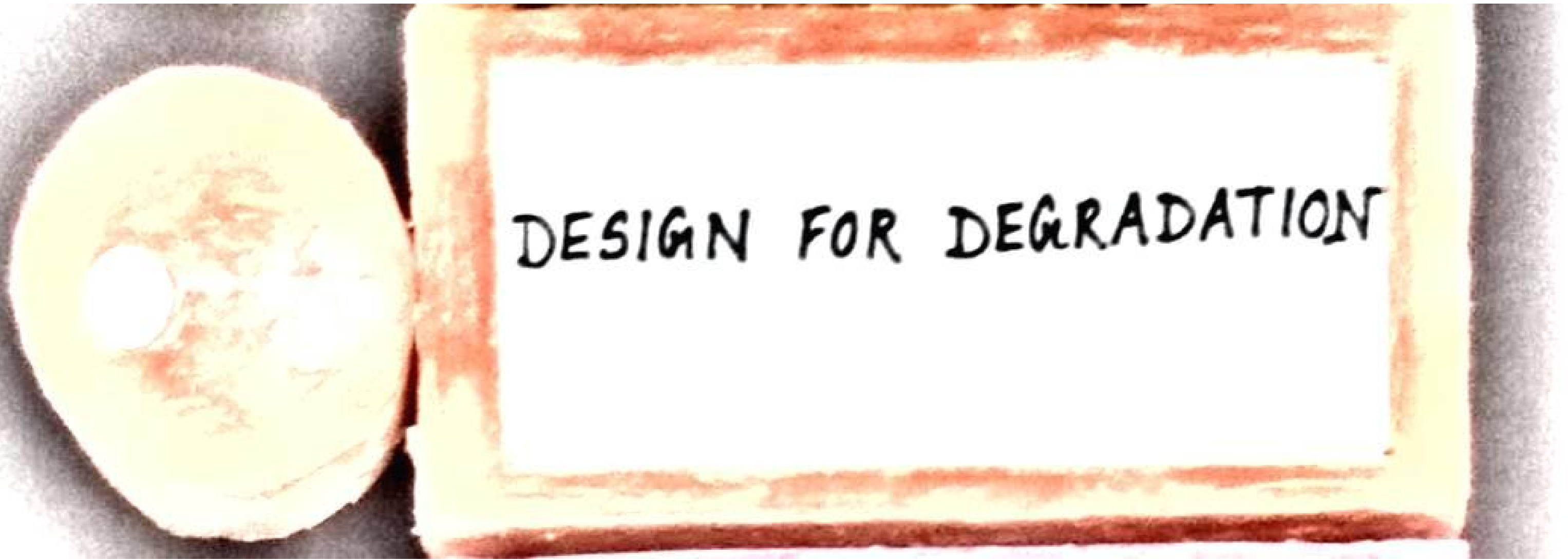
DESIGN FOR ENERGY
EFFICIENCY



SAFER CHEMISTRY FOR
ACCIDENT PREVENTION



SAFER SOLVENTS AND
AUXILIARIES





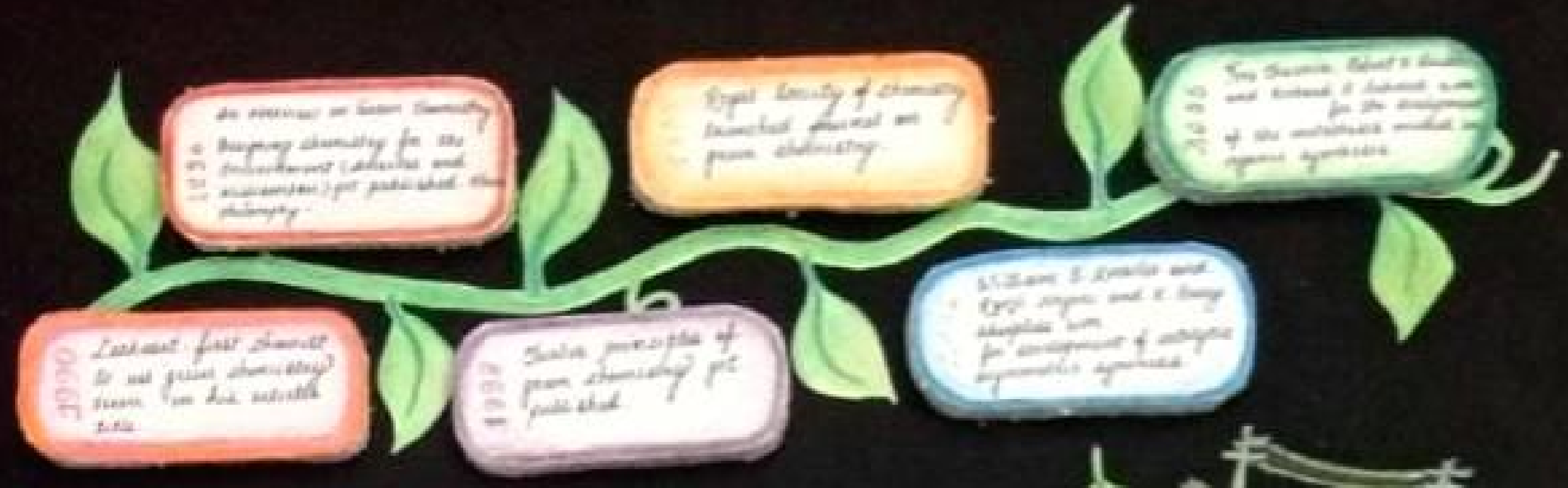
DESIGNING SAFER
CHEMICALS



WASTE PREVENTION



CATALYSIS



GREEN MEDICINE

Green medicine is a branch of chemistry that focuses on the development of drugs and pharmaceuticals in a sustainable and eco-friendly manner. It aims to reduce the environmental impact of the pharmaceutical industry by using green solvents, renewable feedstocks, and energy-efficient processes. Green medicine also emphasizes the use of natural products and the development of biodegradable drugs.

Key principles of green medicine include:

- Using renewable feedstocks
- Using green solvents
- Using energy-efficient processes
- Using natural products
- Developing biodegradable drugs

Chemical structure: CC1=CC=C(C=C1)C2=CC=CC=C2

GREEN CHEMISTRY

Green chemistry is a branch of chemistry that focuses on the development of chemical products and processes that are sustainable and eco-friendly. It aims to reduce the environmental impact of the chemical industry by using green solvents, renewable feedstocks, and energy-efficient processes. Green chemistry also emphasizes the use of natural products and the development of biodegradable products.

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- Using renewable feedstocks
- Using green solvents
- Using energy-efficient processes
- Using natural products
- Developing biodegradable products

NOBEL PRIZE 2021

William E. Bachmann and Eugene J. Corey

For their work on the development of catalytic asymmetric synthesis.

Chemical Reaction:

R2C=CR2 + R'2C=CR'2 + [Catalyst] -> [Transition State] -> R2C(R')C(R'')C(R''')R'' + R2C(R'')C(R''')C(R''')R''

Industrial Catalysis

Catalysis is a process that increases the rate of a chemical reaction without being consumed in the process. It is a key component of many industrial processes, including the production of chemicals, pharmaceuticals, and fuels. Catalysis is essential for the production of many of the products we use in our daily lives.

Key types of catalysis include:

- Homogeneous catalysis
- Heterogeneous catalysis
- Enzymatic catalysis

EDITORIAL

Everything seems to be in a state of flux at the moment. An article, similarly, a green future is just a motivation and it has a lot of good changes that that show the daily needs which protect the change being accounted by scientists supports the necessity of chemists behind their production as well than to delay in spite of some say their hands are not chemists & their products must be replaced gradually by safe alternatives & this is where Green Chemistry fits into the picture. With a vision for not just production from for the sake of making money but the use of sustainable materials as eco-friendly environment without disrupting the quality of their life, we are pursuing the vision of 21st Century Chemistry.

GREEN SOLVENTS

Green solvents are solvents that are derived from renewable resources and are biodegradable, non-toxic, and have a low environmental impact. They are used in a variety of chemical processes, including the synthesis of pharmaceuticals, polymers, and fine chemicals. Green solvents are essential for the development of sustainable chemical processes.

Key types of green solvents include:

- Water
- Supercritical CO₂
- Ionic liquids
- Deep eutectic solvents

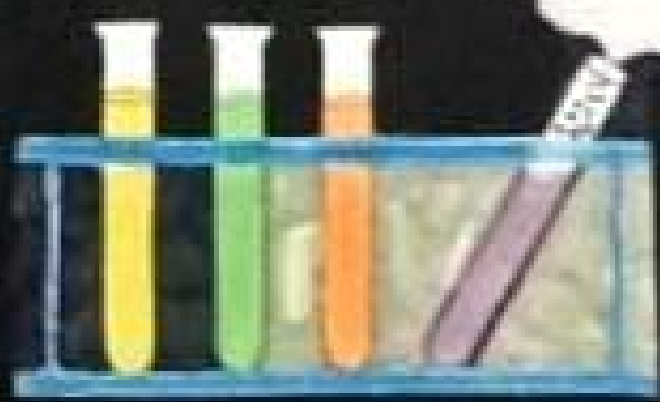
Green Chemistry

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কাৰ্বন ফুটপ্ৰিন্ট আৰু অপবাদিত দীপাবলী

প্ৰদূষণমুক্ত মেৰ্জীয়া দীপাবলী আন্নিও কান্ননা কৰোঁ। প্ৰদূষণ কৰল দীপাবলীত ফুটোৱা আতচবাজিৰ পৰাই হয় তেনে নহয়। মাটিৰ চাকি কেইটা জ্বলালেও কিছু পৰিমাণে কাৰ্বন নিৰ্গত হয়। কয়লা জ্বলাই উৎপাদন কৰা তাপবিদ্যুৎৰে চিকান্দিয়া বিজুলী বাতি লম্বায় মেৰ্জীয়া দীপাবলী আপদেই ফেচবুক, ইনষ্টাগ্ৰাম আদিত দিওঁতেও কিন্তু কাৰ্বন ফুটপ্ৰিন্ট কোনোবা এক দুৰপ্ৰাপ্তত সৃষ্টি হৈয়ে আছে। কাৰ্বন ফুটপ্ৰিন্ট হৈছে কাৰ্বন ডাই অক্সাইড সন্মতুল্য হিচাপে প্ৰকাশ কৰা ব্যক্তি, ঘৰনা, ভ্ৰমণচল, সেৱা স্থান বা সান্নপ্ৰীৰ দ্বাৰা হোৱা মুঠ মেৰ্জীপুহ গৈছে নিৰ্গমন।

সমগ্ৰ পৃথিৱীৰ লোকে আৱাইলৰ জৰিয়তে একবছৰত প্ৰেৰণ কৰা বৈদ্যুতিক বাতা সন্মুহে মুঠ ৩২০০০ টন CO_2 পৰিৱেশলৈ বৰঙনি সোপায়। ঘাইয়েল মিডিয়া বা ইন্টাৰনেট চাৰ্ভাৰ সন্মুহৰ মুঠ ১০ টা চেৰ্ভাৰ সন্মুহৰ কাৰ্বন ফুটপ্ৰিন্টৰ হিচাপে চালে চকু কপালত উঠিব। গতিকে, কেৱল দীপাবলীৰ আতচবাজি বা চাকিপটি দোষ দি চ'ছিয়েল মিডিয়াত পোষ্ট দিলেই কাৰ্বন ফুটপ্ৰিন্ট কান্নি নাযায়। এই সকলো কথাবোৰ বিজ্ঞানসন্ম ভাৱে উপলব্ধি কৰি কিছু প্ৰয়োজনীয় পদক্ষেপ ললেহে পৃথিৱীৰ ভৱিষ্যত আন্নি সুৰক্ষিত কৰিব পাৰিছ। নহ'লে আন্নি বা আপোনলোকৰ কাৰনেই প্ৰতি বছৰে 'দীপাবলী' বদনাম হৈয়ে থাকিব।

~ উৎস :- ফেচবুক

2021

Many Inorganic

NOBEL PRIZE 2021

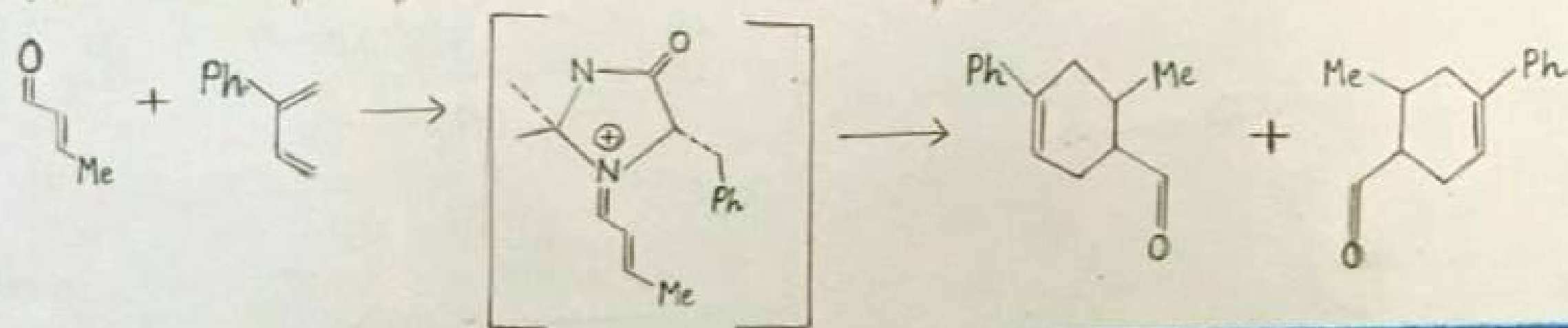
Development of catalyst for a reaction is one of the most important part of green chemistry. Many important catalyst have been developed, before starting the practice of green chemistry. for example Ziegler-Natta catalyst for making of plastic. However, green chemistry intrigued a widespread interest in development of catalyst with better performance which is also sustainable to the environment.

The 2021 Nobel prize in chemistry has been awarded to German Scientist Benjamin List of the Max Planck Institute and Scotland-born Scientist David W.C. Macmillan of Princeton University "for the development of asymmetric organocatalysis."

Prof. List worked on Aldol condensation & observed that the reaction proceeds throughout the human body in presence of Aldolase - A protein as catalyst and found that the catalyst can be replaced by L-proline.



Prof. Macmillan found an organic molecule Imidazolidinone, in place of the precious Co-based catalyst which was less efficient relatively costly and less environment friendly for Aldolase-reaction.



An overview in Green Chemistry:

Designing chemistry for the environment (Anastas and Williamson) got published. Their philosophy -

0665
1990

Lathcart - first chemist
to use green chemistry
term in his article's
title.

Twelve principles of
green chemistry got
published.

Royal Society of Chemistry
launched journal on
green chemistry.

William S. Knowles and
Ryoji Noyori and K. Barry
Sharpless won
for development of catalytic
asymmetric synthesis.

2005

Ives Chauvin, Robert H. Grubbs
and Richard R. Schrock won
for the development
of the metathesis method in
organic synthesis.

Industrial Catalysis

Catalysis is one of the 12 principles of Green Chemistry. It is the process of increasing the rate of a chemical reaction by introduction of a catalyst. A catalyst, in turn, is a substance that is not consumed by the chemical reaction, but acts to lower its activation energy. It is the fundamental support of many chemical based industrial processes.

The industrial reaction can be made more environmentally benign through the use of carefully selected catalysts.

For instance, the traditional peroxide process of producing hydrazine needs sodium hypochlorite and ammonia but in the greener peroxide process, hydrogen peroxide acts as oxidant and the byproduct is water. Likewise, zeolites (inorganic polymers) are key materials used in the manufacturing environment-friendly detergents. Alkylation of butene with HF and H_2SO_4 as catalyst can be improved with the use of solid acid catalysts like zeolite.

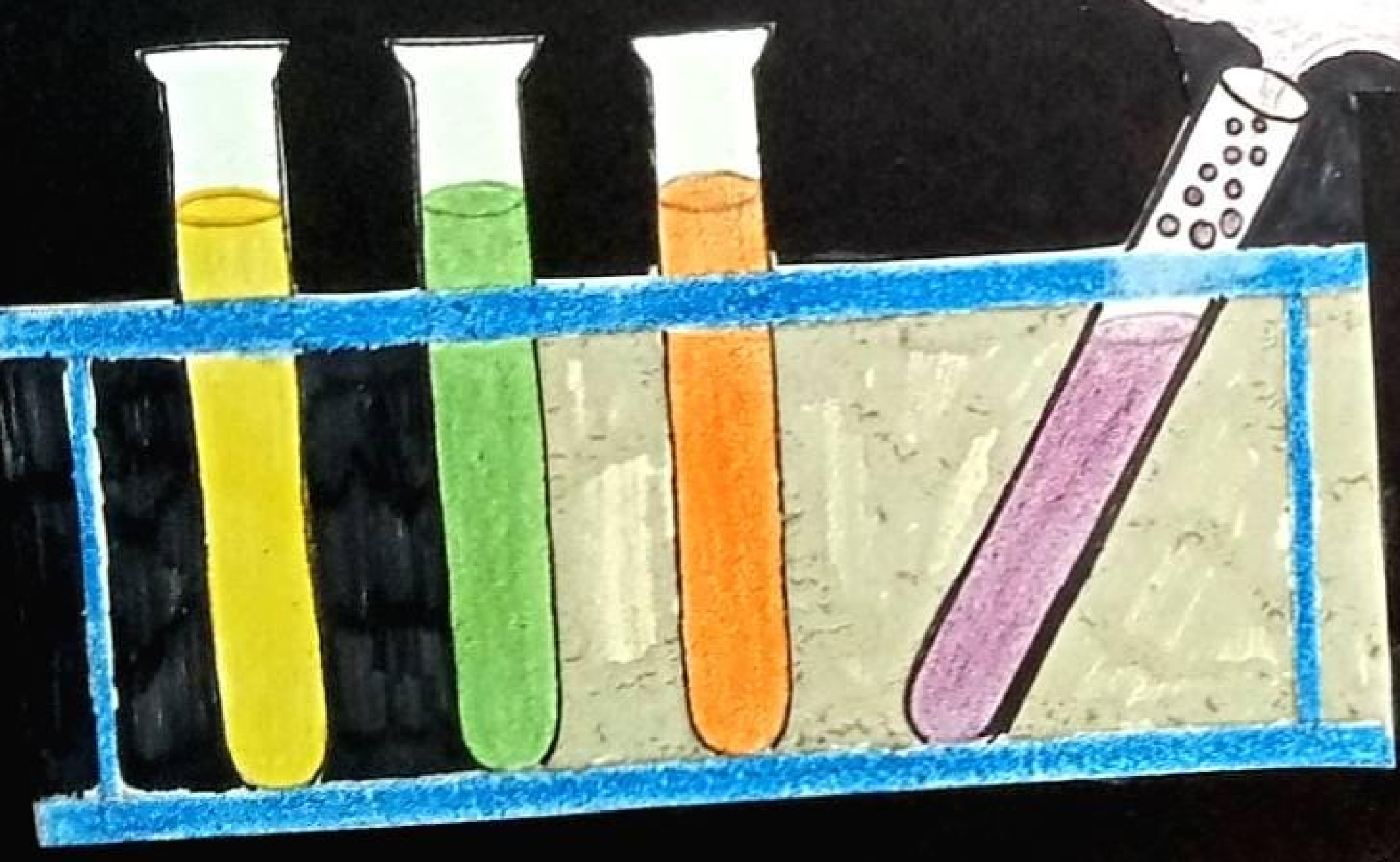
— Hydrogen peroxide

— Zeolites

and derived from agricultural
solvents. They are also
supercritical fluids, aqueous
liquids are the examples
accepted green solvent is
stability & no friendliness.
as they are biodegradable.

Excellent Class

It is really
amazing
work



GREEN SOLVENTS

Solvents define a major part in the performance of processes in the chemical industry and also have an impact on cost, safety and health issues. The idea of "green solvents" addresses the goal to minimize the environmental impact resulting from the solvents used in chemical production. Solvents which are environment friendly and derived from agricultural sources, are generally known as green solvents. They are alternative to petrochemical solvents. Supercritical fluids, aqueous solvents, polymerized solvents, ionic liquids are the examples of green solvents. Most widely accepted green solvent is water due to its low cost, easy availability & eco-friendliness. Biodegradable solvents are also green solvents as they are biodegradable, non-toxic & more efficient.

— Ankit Das, 1st Sem

EDITORIAL

Everything seems to be a stimulus until it turns into an action. Similarly, a greener future is just a motivation until it has a part of bold changes. But there come the daily needs which obstruct the changes. Being surrounded by materials suggests the necessity of chemicals behind their production. We need them so badly in spite of knowing their hazards. The toxic chemicals & their products must be replaced gradually by safer alternatives & this is where Green Chemistry dives into the picture, with a vision for reduced pollution. Hence, for the sake of awaring everyone about the need of conversion towards an eco-friendly environment without disrupting the equilibrium of daily life, we are presenting the theme of PSI as - Green Chemistry

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