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Solvent and ionic liquids used for green synthesis

Mohini Pomne*, Mayuri Thorat
Department of Chemistry, Baramati College of Pharmacy Barhanpur, Maharastra, India

Abstract
Green chemistry is another name such as sustainable chemistry. Chemistry is design by benign pollution control in the molecular level. use of safer solvent is often times there are different solvents selection guides that have been studied with in the pharmaceuticals class or sector and are being used as a basis for guiding the choosing the safer solvents choice for the chemical reaction and extraction and separation here we study about the role of different types of solvents and ionic liquids used in green synthesis. Many ionic liquids and solvents choice for green synthesis. water, glycerol, vegetable oils etc. by using green chemistry concept we overcome the waste and cost and we search out the green protocol here we discuss the study strategies in ionic liquids and solvent . We hope this chapter give a brief consideration of importance of green chemistry.

Keywords: green chemistry, used for green synthesis, importance of green chemistry

Introduction

Green chemistry

Green chemistry is design of chemicals products and processes that reduce or eliminate the use or generation of hazardous substances.
Green chemistry used across the life cycle of a chemical products, including its designs, manufacture, used and ultimate disposal.
Green chemistry concept discovered by the scientist

Paul Anastas and John C. Warner

This chemistry is required to increase the economics of chemical manufacturing and to enhance the environmental protection .The green concept present an attractive technology to chemist, researchers, and industrialists for developed chemistry research and application.
Primarily, green chemistry is used to reduction of the environmental damage accompanied by the production of materials and respective minimization and proper disposal of wastes generated during different chemical processes.

Basic principles of green chemistry

Green chemistry is generally based on the 12 principles proposed by Anastas and Warner. Now-a-days, these 12 principles of green chemistry are considered the fundaments to contribute to sustainable development. The principles comprises instructions to enhances new chemical products, new synthesis and new processes.

1. Waste prevention
Prioritize the prevention of waste, rather than cleaning up and treating waste after it has been created. Plan ahead to minimize waste at every step.

2. Atom economy
Reduce waste at the molecular level by maximizing the number of atoms from all reagents that are incorporated into the final products. Use atom economy to evaluate reaction efficiency.

3. Less hazardous chemical synthesis
Design chemicals reactions and synthetic routes to be as safe as possible. Consider the hazards of all substances handled during the reaction, including waste.

4. Designing safer chemicals
Minimize toxicity directly by molecular design. Predict and evaluate aspects such as physical properties, toxicity and environmental fate throughout the design process.

5. Safer solvents and auxiliaries
Choose the safest solvents available for any given step. Minimize the total amount of solvents and auxiliary substances used, as these make up a large percentage of the total waste created.

6. Design for energy efficiency
Choose the least energy — intensive chemical route. Avoid heating and cooling, as well as pressurized and vacuum conditions (i.e. ambient temperature and pressure are optimal).

7. Use of renewable feedstocks
Use of chemicals which are made from renewable (i.e. plant-based) sources, rather than other equivalent chemicals originating from petrochemical sources.

8. Reduce derivatives
Minimize the use of temporary derivatives such as protecting groups. Avoid derivatives to reduce reaction step, resources required, and waste created.

9. Catalysts
Use catalytic instead of stoichiometric reagents in reactions. Choose catalysts to help increase selectivity, minimize waste, and reduce reaction times and energy demands.

10. Design for degradation
Design chemicals that degrade and can be discarded easily. Ensure that both chemicals and their degradation products are not toxic, bio-accumulative, or environmentally persistent.

11. Real-time pollution prevention
Monitor chemicals reactions in real-time as they occur to prevent the formation and release of any potentially hazardous and polluting substances.

12. Safer chemistry for accident prevention:-
Choose and develop chemical procedures that are safer and inherently minimize the risk of accidents. Know the possible risks and assess them beforehand.

Role of various types of solvents and ionic liquids used in green synthesis
In the 21st century our world faces the many problems related to environment, so green chemistry is useful in the pharmaceutical and the other chemical industries. It play the important role for our environment. US Environmental Protection Agency (EPA) give the suggestion for innovative techniques the reduce toxic, undesirable waste, and environmental impact. For green chemistry study have huge scientific area. After EPA 12 principles of green chemistry have been gotten more attention and these principles have been considered more seriously by pharmaceutical companies. Since 1998 solvents and stoichiometric reagents is the most useful and important parameter to greener strategies and this parameter are studied in detailed by many pharmaceutical companies. Green solvents are environmentally friendly solvents or bio-solvents which are derived from the processing of agriculture crops.
There are three types of green solvents:-
1. Oxygenated Solvents
2. Hydrocarbon Solvents
3. Halogenated Solvents

Here is Examples of green solvents developed as alternative to petrochemical solvents. Ethyl lactate is green solvents derived from processing corn. Ethyl lactate is ester of lactic acid.

Ionic liquids
Utilizing ionic liquids in green chemistry create a cleaner and more sustainable chemistry and are receiving, increasing interest as environmental friendly solvents for many synthetic and catalytic processes. Ionic liquids used in green chemistry because ease of reuse, non-volatility, thermal stability and ability to dissolve a variety of organic and organometallic compounds. Recently however a new class of solvents has emerged- ionic liquids these solvents fluid at the room temperature and consist entirely of ionic species. They have many properties which make them of fundamental interest to all chemists since both of thermodynamics and kinetics of reaction used out in ionic liquids are different to in conventional molecular solvents. The chemistry is unpredictable at our current state knowledge. However in adding to the scope for exciting new invention or discoveries with which they teach us.
Ionic liquids have no measurable vapour pressure, so it not emit volatile organic compounds (VOCs). They have attracted quite justifiably, enormous attention as media for green synthesis. Ionic liquids comes in two main categories, namely simple salty (made up of single anion and cation) and binary ionic liquids (salts where an equilibrium is involved) for example [Et NH3] [NO3] is a simple salt where as mixtures of aluminium (III) chloride and 1,3 dialkylimidazolium chlorides. (a binary ionic liquid system) have a several different ionic species and their melting point and properties depend upon the mole fractions of aluminium (III) chloride and 1,3 dialkylimidazolium chloride present.

Synthetic concept with green solvents

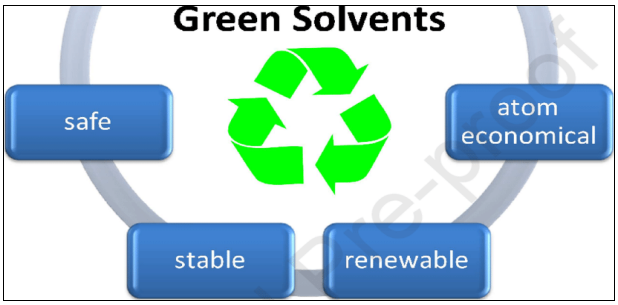
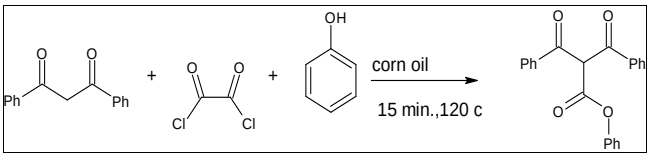


Fig 2

1. Vegetable oil is a green solvents
Vegetable oil used as green solvents. Vegetable oils are the oleo-chemicals which is extracted from the different plants and plant seeds. They are the renewable sources and have triglyceride structure. In which three hydroxyl groups of glyceride means glycerol are substituted with different fatty acids that is liquids or solids products is making. Vegetable oils are the important foods ingredient used in foods preparation. Unfortunately they have not considered as green solvents, so far except for a reaction which it was published by Nurettin Menges.
Vegetable oils utilized for bio-polymers and might be evaluated by scientists who are discovered for a new sources of green solvents. This reaction is the first example of vegetable oils and this idea should be concern with the more synthetic strategies due to the cost and efficacy of vegetable oil.

Acylation reaction in corn oil



(1) (2) (3) (4)

A mixture of di-benzoylmethane (1), Oxalyl chloride(2), Phenol(3) was heated in corn oil at 120c for 15 min. Authors have CH2 compound 1 was acylated very easily.

2. Glycerol as a green solvents
Glycerol (also called as Glycerine) is a polyalcohol and second part of oleo-chemical which are derived from the natural oils. Glycerol has been utilized in different fields such as pharmaceuticals and other foods industry, tobacco and cellulose films. Sustainability and low costs of glycerol make it a good green solvents with this respect. Pharmaceutical companies and chemists have gotten more attention for glycerol as a alternative to their organic solvents. Which are harmful, toxic, volatile compounds hazardous. Despite the fact that glycerol is a solvents and selected for many reactions. There are some obstacles which are chemists and medical scientists have to overcome:

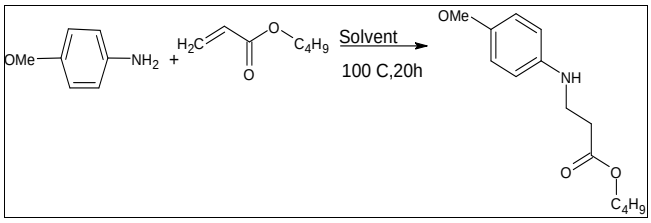
1. Glycerol viscosity it should be fluidified with a co-solvents. On the other hand, glycerol is much less viscous up to 60c and reactions can be processed at high temperature higher than 60c.
2. Glycerol might join the reaction as a reagent as it has three OH groups. Which can be mentioned as acidic sites.

Yield of reaction are high up to 93% and reactions give many different types of pyran derivatives. Further more, authors have tested the reaction in water and they have seen that yield of the reaction was decreased down to 70%. Cyclization reaction under atom economic and green solvent procedure is most important and this kind of reaction has prompted medicine scientists to reorganize the strategy for reaction design.

The reaction shows that crude glycerol gave yield of the reaction up to 81% and reuse of glycerol as third time for same reaction did gave the yield of the product perfectly.

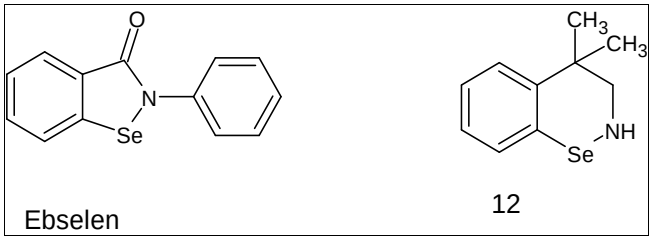
Nucleophilic attack to the alpha—beta-unsaturated carbonyl group in glycerol

With this respect Leonardo et.al.have described a green protocol without base a metal in glycerol for obtaining of organoselenium derivatives.



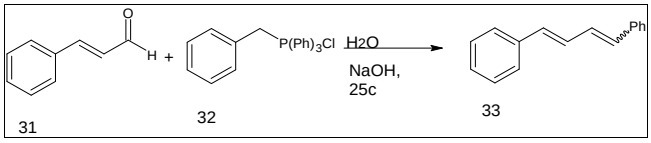
Solvent	*Yield*
Glycerol	82
No solvent	<5
Toluene	0
DMF	0
DMSO	0
Water	<5
1, 2-propandiole	30

Two examples of organochalcogens



3. Water as a green solvent

Basic reaction of organic chemistry are utilized in pharmaceutical chemistry to obtain medicines. One of these reactions is Witting reaction. This reaction is most important and gives a new C-C bond. Morsch et.al.have reported a green protocol for witting reaction, run in water at 25c.



Role of ionic liquid s in green chemistry

Ionic liquids are the organic salt which are liquid ambient temperatures. They are non-volatile, non-inflammable, thermally and chemically stable which make them as a better alternative for green chemistry than organic solvent. Due to their high polarity, it can be used in many chemical and bio-chemical reaction. Special properties, they show less solubility in water and are generally immiscible with many organic solvents such a hexane (s).They are more viscous than other organic solvent which might be due to more hydrogen bonds and van der waals interactions. The most important feature of ionic liquids is that they can be tuned by changing cation, anion and alkyl part, in which it is possible to obtain many manipulated green organic solvents. Some common cation and anion parts are presented.

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Conclusion

Green chemistry is getting extended in many industry areas and researches. The reason is that the resources of the world are limited and it is necessary to be consumed with caution. On the other hand, we have already witnessed that researchers and pharmaceutical companies searched out for green protocol when manufactured the pharmaceuticals. In this spirit, most pharmaceutical companies are making increasing efforts to limit waste and avoid air and water pollution. Green solvent and ionic liquids give many opportunities for greener methods in which impact on the environment and cost of the pharmaceuticals can be decreased. We hope that this chapter and others give a brief consideration of importance of green chemistry. With advantages of green chemistry, hopefully, industry we alter conventional methods with greener ones.

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