REVIEW ON GREEN CHEMISTRY

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Abstract: Green or Sustainable Chemistry is a term that refers to the creation of chemical products and processes that reduce or eliminate the use and production of harmful substances. They are used exclusively chemicals and chemical processes that do not have negative consequences for the environment. It is based on twelve principles that can be used to initially create or recreate molecules, materials, reactions and processes that are safer for human health and the environment. The processes of the Green Chemistry that have been developed to date include almost all areas of chemistry, including organic, inorganic, biochemistry, polymer, toxicology, environmental, physical, technological, etc. Through the several prevailing trends of the green program such as catalysis, biocatalysis and the use of alternative: renewable feedstock (biomass), reaction media (water, ionic liquids and supercritical fluids), reaction conditions (microwave irradiation) and new synthetic pathways (photocatalytic reaction), the dual goals – environmental protection and economic benefit can be achieved.

Keywords:
Green chemistry, Invention, Performance criterion, Development.

INTRODUCTION

Green chemistry can be defined as the invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances for workers and consumer. The definition of Green Chemistry starts with the concept of invention and design. This means we must take into account from the start what we are looking for, what kind of product, how we are going to design its manufacture and its use. The impact of chemical products and chemical processes must be included as design criteria. Hazard considerations for initial materials and final products must also be included in the performance criteria.

From the beginning of the 1990s the ideas of Green Chemistry started to have a more international outlook. The purpose was to initiate alternative practices in the chemical industry and processes more benign to the environment. A committee of scientists and technological experts was convened from many industrial countries (Japan, USA, Germany, Sweden, Canada, etc) to propose the basic areas of research and development for Green Chemistry applications. The areas proposed for special focus under the green chemistry principles were the following.They were selected with emphasis on economic considerations and

1. **Alternative feedstocks**: There are already many new developments in this field, but the emphasis on renewable raw materials and a shift from fossil fuels is very desirable for sustainability. The starting materials for the chemical industry must be renewable and less toxic for workers and the environment.

2. Less hazardous reagents: There are now enough data for the toxicological and for the long term ecotoxicological properties of most of the high volume chemicals used for industry. Chemists and technologists must divert their efforts to use less dangerous raw materials and reagents for the synthetic routes of the production of chemical products. But if there are major obstacles they must choose less toxic substances and change their technologies accordingly, for example using catalysts and new synthetic techniques.

3. Use of natural processes, like biocatalytic techniques: New biosynthetic methods were developed in the last decades which are more selective, use less energy, lower temperatures, higher yields and demand raw materials which are less toxic. Green Chemistry research in the last decades replaced many old methods and introduced some innovative catalytic methods with high yields and less waste.

4. Use of alternative solvents. Many solvents, especially polychlorinated and aromatic solvents, were used for decades for extraction techniques in synthetic organic chemistry. Some of these solvents (e.g. carbon tetrachloride) were banned and some others are restricted. Chemists use now less toxic solvents and their waste can be recycled or

decomposed at high temperatures. The chemical industry invested, under the Green 30 Chemistry principles, in new solvents which are less toxic to workers and can disintegrate more easily under environmental conditions.

5. Design of safer chemicals and products. Many new developments in methodology and toxicological tests improved our understanding of the toxicity and their mechanisms of new chemicals and products. The methodology of Quantitative structure-activity relationships, QSARs can be used to speed up the estimation of toxicity, carcinogenicity or other toxicological property of a new substance. Thanks to Green Chemistry principles and applications most new chemical products have very low toxicity and are more benign to the environment. Industrial chemists have changed to a great extend the synthetic routes used for the production of chemical products. Renewable raw materials, lower temperature, energy savings, less waste, alternative solvents.

6. Developing alternative reaction conditions: In recent years there are many more alternative or "greener" reaction techniques improving substantially the product yield, saving energy and minimize waste. Photochemical reactions, microwave and ultrasound assisted organic synthetic techniques, reactions using water as solvent, catalytic reactions, etc are some of the new techniques in synthesizing chemicals.

7. Minimizing energy consumption: This is a very important goal considering the energy savings and the climatic change which has become a global environmental problem. The chemical industry has invested enough resources to reduce energy demands with innovations and changes in synthetic reactions (lower temperatures, reducing steps). Green Chemistry is very interested to contribute through research to minimize energy consumption in every step of the industrial process This was a very brief description of the most important changes in future industrial processes which are going to improve efficiency, save energy, minimize waste, and produce safer products and with less environmental impacts.

CONCLUSION

As we design new chemical synthese, decisions about whether hazardous substances will be used, whether toxic materials must be handled. Whether hazardous waste will require special disposal and the overall environmental issues associated with these processes must be seriously considered.

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