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Chemistry and Sustainable Development

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I. INTRODUCTION

One cannot ignore the part that chemistry plays in sustainable development because of how enormous this contribution is. The role chemistry towards this end comprises but not limited to:

- Boosting eco-friendly green chemical manufacturing and use;
- Limiting the use of non-renewable resources and utilizing renewable resources;
- Limiting the use of hazardous materials;
- Devising and making available eco-friendly and economical techniques for employment invarious industries.

One could define sustainable development as an undertaking that influences development to occur across all areas to seek new chemicals and new ways to create these chemicals in order to serve the larger purpose of developing and maintaining a sustainable society and environment. According to the former Director-General of UNESCO, green chemistry is imperative in order to fix the damage caused by climate change, to eliminate poverty, and to improve health. Since chemistry is such a huge and ever-growing subject of study that covers entire molecular structures, it is obvious that such a subject would play a massive role in sustainable development. Sustainable chemistry or green chemistry is something that is being embraced and promoted by a number of countries and it is something that is proving to be a significant part of a host of research initiatives, networks, etc. Sustainable development is conservation and management of resources in environment friendly manner.

Bio plastics, bio fuels, bio energy, green catalysts, green solvents, green and renewable products all are environmentally benign products, contribute toward the sustainable future of society. Few environment friendly tools are discussed in the present paper.

II. AIM OF THE STUDY

Objective of present paper is to create awareness among society for the social progress and equality, environmental protection, conservation of natural resources and stable economic growth.

2.1 Biocatalysts

If looked at from a "green chemistry" point of view, one could categorize bio catalysis as both a sustainable and a green technique. This has been made possible only due to the massive leaps in biotechnology in the last twenty years. New bio catalytic reactions that used to be unimaginable now seem possible because of protein engineering. Enzymatic changes to fit predefined boundaries now seem doable which in turn bring about a system that is completely sustainable. Various examples can be found of this method being applied like in the pharmaceutical industry. Not just protein synthesis but all elements of bio catalysis can contribute to sustainable development. Elements like substrate and reactor engineering can prove to be extremely economical and efficient in turn contributing to the part of chemistry in sustainable development. Additionally, enzymes can made to be used more than once if they are immobilized. This would help make them more stable and improve performance. As mentioned before, these methods are being applied all over the world in various industries including the pharmaceutical industry and other commodities. Keeping sustainable development in mind, the use of bio catalysis would only increase with better technological improvements being made every year.

2.2 Gas Hydrates

Gas hydrates are ice-like strong compounds that naturally form in specific conditions of pressure and temperature within a water or gas mixture where hydrogen and water molecules bond together turning into a crystalline lattice

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becoming known as hydrates. When it comes to sustainable chemistry, gas hydrates are what form its core. This is because of their creative applications in a wide variety of settings like permanently storing CO2 present in flue gases by forming gas hydrates under oceans. When the research around gas hydrates began, it was mostly about limiting the hydrocarbon/gas pipeline blockage. Today the research surrounding gas hydrates has expanded exponentially encompassing water desalination, gas separation, gas storage and transport, energy recovery, etc. Methane is released from hydrate-bearing sediments, and more methane in the atmosphere has serious greenhouse warming implications.
One can imagine the importance of gas hydrates given that they even impact the earth's natural cycles, and their properties in different states of pressure and temperature have countless real-world applications. The release of methane from hydrate-bearing sediments is one of the major contributors in global warming and adverse climate change. Various industrial processes benefit from being able to manipulate the properties of hydrates since it helps with being efficient and economical. The hydrates that form during hydrocarbon production causes oil industries to incur massive amounts of financial loss. If technological advancements regarding gas hydrates are to be made then a core comprehension of their properties is imperative.

2.3 Zeolites

Renewable resources and renewable energy are the primary focus of sustainable development and countless endeavours have been and are being made to serve this primary focus because of the rapid rate at which the population is increasing and the industry is advancing. Zeolites are a group of crystalline materials with orderly distributed micropores in molecular dimensions. They are not only utilized in petrochemical industries, but are also used in other aspects of the world. This can be attributed to their distinct properties including their ion-exchange capability, their unique shape selectivity, their low production costs, etc.

2.4 Lignin

Lignin can fill in as a green source of aromatics. It has a robust and irregular polymeric design and is a significant part of lignocellulose. Barta and co-workers looked into the arising strategies for the depolymerization of lignin to well-defined products.

2.5 Green Solvents

Solvents are imperative in order to give one or more liquid stages for chemical reactions. The vast majority of solvents are synthetic, even though a lot of natural solvents exist. Solvents used to only be utilized to serve the purposes of the chemists. They however turned into selection tools in light of the big worldwide environmental and health issues. It is imperative that solvents used be sustainable, both for research and for industry. Chemical processes could gain a lot by using water as the solvent considering that it would permit milder reactions along with giving unexpected selectivity and reactivity. The production of catalysts compatible with water has thrived ever since the "Watershed" in organic synthesis. Separating a homogenouswater-soluble catalyst from the product soluble in organic solvents is easy since product organic compounds cannot be dissolved in water. Out of the organic solvents that are used, the most important ones are ionic liquids, supercritical fluids, liquid polymers, etc.

2.6 Bioplastics

Ordinarily used non-degradable fossil-based plastic is being replaced with biodegradable plastic. This type of plastic can be both synthetic, which is made up of bio-based polymers, as well as natural, which is made up of biopolymers.

III. Conclusion

Waste management has been granted a new vision due to the process of recycling. Being used in agriculture, packaging of food, as well as in shopping bags, biodegradable plastic has proven to be enormously useful in contributing to a sustainable environment. There needs to be a correspondence between markets and the society regarding sustainability in order to figure out other ways in which biodegradable plastics can be utilized.

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