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Role of Chemistry in Environment: A Review

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ABSTRACT: Chemistry is important as everything in this universe is made up of chemicals. Chemistry explains everything around us. It has made our life comfortable by giving us lifesaving drugs, synthetic fibres, variety of cosmetics, various types of plastics, fertilizers, pesticides and beautiful paints etc. Chemistry can help us to understand, monitor, protect and improve the environment around us. Plastics play a very important role today in both industries and household appliances. Non-biodegradability of synthetic petroleum-based plastic leads to the accumulation of huge plastic waste which promotes the major environmental impacts like global warming, ozone depletion, eco-toxicity and eutrophication etc. In the present paper the pollution due to plastic waste has been discussed which is one of the biggest pollution challenges we are facing .

Keywords: Chemistry, environment, petroleum-based plastic and pollution.

INTRODUCTION: Chemistry is important as whatever we do in our daily life is chemistry. Each matter including our body in this universe is made up of chemicals. We all human beings are chemists. We make use of chemicals every day and perform many reactions without thinking much about them. Many changes which we observe in our daily life are caused by many chemical reactions. We find chemistry in air, water, soil, foods, our emotions, environment and literally in everything which we can see, touch or taste. With such vast range of topics, it is important to have basic knowledge of chemistry to know the world around us. Chemistry is the study of matter, its properties, why and how substances combine or separate to form other substances and how substances interact with energy[1]? It is related with the uses of natural substances and the synthesis of artificial ones by chemical or physical reactions [2].

Everything is the product of chemistry. In the morning we use a chemical product in the form of toothpaste. Chemistry explains how food changes when we cook it, how to preserve food , how it rots, how our body makes use of the food we consume and how different ingredients interact to make food. It explains what happens when we breathe, drink, eat or just we do work or take rest. It explains softness, hardness and the purity of water. It explains cleaning action of soaps and detergents. It explains which disinfectant and mosquito repellent is safe for use. We can use chemistry to decide which cleaner is best for dishes, laundry, ourself and our home. Knowing some chemistry can help us take day-to-day decisions that affect our life. It explains how use of supplements, vitamins and drugs can help or harm us. Part of the importance of chemistry lies in developing and testing new medical treatments and medicines.

Hand sanitizer generally used to decrease infectious agents on the hands is also a chemical product. During the covid-19 pandemic because of high demand and shortage of hand sanitizer World Health Organization produced a guide to make hand sanitizer but there are precautions against making them such as incorrect measurement or ingredient may result in an inadequate amount of alcohol to kill the coronavirus thus making the product ineffective or even poisonous[3]. Exposure to per- or poly-fluorinated substances (PFASs) can raise a person's likelihood of developing severe Covid-19[4]. Chemistry makes one chemical compound a nutrient and another compound a pollutant.

Chemistry has made our life comfortable by giving us life saving drugs, synthetic fibres, variety of cosmetics, various types of plastics, fertilizers, pesticides and beautiful paints etc. We can give plants the best nutrients to help them in their growth. In a nutshell, chemistry explains everything around us and the better we know chemistry, the better we know our world.

Environment: Environment means everything that surrounds us. It can be living or non living things that includes physical, chemical and other natural forces**.** Our environment is a huge complex system that includes the air, soil, water and the climate around us. Living things live in their environment. They continuously interact with it and adapt themselves to their environmental conditions. In the environment there are different interactions between animals, plants, air, water, other living and non-living things. Everything is part of the environment.

Healthy living of human beings depends on the environmental conditions. Environment provides air, food and other requirements and it is the only home that we have. Our whole life support system depends on the safety of all the environmental factors. In different fields of knowledge the word environment is used differently. In psychology and medicine, a person's environment is the people, physical things and places that the person lives with. Growth and development of the person are affected by the environment.

Chemistry is the central point of discussion about environmental problems. How can we keep our environment safe and clean? What chemical processes can synthesize the things, which we can use without disturbing the environment? Chemistry can help us to understand, monitor, protect and improve the environment around us. Knowing the basic concepts of chemistry we can observe and measure air, soil and water pollution. Environmental issues such as conservation, biodiversity, pollution and renewable energy etc. have become important issues in our daily life. Many people believe that chemistry as well as chemical industries are harmful to the environment. However, currently many new advances and scientific researches in the field of chemistry are developed to invent more environment friendly applications and objects. One such example of environment friendly chemistry is '**Green chemistry**'.

Green Chemistry: It deals with the design of chemical processes and products that reduce or eliminate the use or production of substances that are harmful to humans, animals and the environment. Toxic wastes can destroy natural resources and especially the means of livelihood for upcoming generations. In addition, many feedstocks for the production of chemicals are petroleum based which is not a renewable resource. The main question is about development and use of good alternatives. In addition, we must ensure that upcoming generations can also use these new alternatives. Sustainability is a concept that is used to distinguish methods and processes that can make sure the long-term productivity of the environment so that even our

upcoming generations can live on this planet. Sustainability has environmental, economic and social dimensions.

Principles of Green chemistry are :

1. Waste prevention instead of remediation
2. Atom economy or efficiency
3. Use of less hazardous and toxic chemicals
4. Safer products by design
5. safe solvents, minimum use of solvents which are toxic to environment.
6. Energy efficiency by design
7. Preferred use of renewable raw materials
8. Catalytic rather than stoichiometric reagents
9. Design products to undergo degradation in the environment
10. Analytical methodologies for pollution prevention
11. Inherently safer processes

The air we breathe, the water we drink, the land we live on, and the stock of material resources we use in our daily lives are at the heart of our economy, our society and our way of life. We can not take these granted for ever. As we strive towards a better world, we work to ensure chemistry's contributions are realised. In the present paper the pollution due to plastic waste has been discussed which is one of the biggest challenging problems we are facing .

Plastic: When it was first produced it was welcomed as a wonder product. Plastic is multitalented, light weight, durable, cost effective, easy to process, electrically and thermally insulative, impervious to water, resistant to microorganisms etc. Since the mid-20th century, this long-lasting and versatile low cost material has been manufactured in loads and disposed of in large quantities.

Plastics play a very important role today in both industries and household appliances. Plastics are extensively used for various applications such as hand baggage, toys, food packages, cold drink bottles, medical equipments ,components of electronic equipment, modules of vehicles, furniture, dress materials etc.[5] Plastics are synthetic or semi-synthetic materials made from polymers which are long molecules built around carbon atoms chains, usually with hydrogen, oxygen, sulfur, and nitrogen filling in the spaces. Plastics mostly are organic polymers.[6]

There are different varieties of plastics, even within one type, different grades exist (eg, low viscosity polypropylene (PP) for injection molding, high viscosity PP for extrusion, and mineral-filled grades). Plastics can be shaped into films, fibers, plates, and objects such as bottles or boxes etc. Some plastic products have short-term uses and many have long-term applications (eg, plastic pipes can be used for many years. Plastic is everywhere. It is in our clothes, shoes, in products on supermarket shelves, in vehicles and buildings etc. Many automobile parts are now made of plastics. Among the most used polymers are polystyrene polymers and copolymers, polypropylene, and polyvinyl chloride etc. All these plastics are made from non-

renewable resources like petroleum or natural gas. These materials have reduced the cost and the weight of the cars.

The production of petroleum-based synthetic plastics annually was found to be more than 300 million tons until 2015.[7] Plastics have replaced traditional materials such as wood, ceramics, glass, leather ,stone, horn, steel and concrete etc.

Plastic Pollution: Increase in the production and consumption of these plastics causes an increase of oil consumption and serious environmental pollution. Their production involves many chemicals, some of which have raised health concerns among consumers. During the manufacturing of plastic bags, the discharge of carbon and many other harmful gases causes environmental problems.[8] About 2.8 kg of CO_2 is evolved on burning 1 kg of plastic [9].

The percentage of plastics in municipal solid waste continues to increase rapidly. When plastic wastes are dumped in landfills, they form harmful chemicals on interaction with water and the drinking water may also be polluted.[7] Plastic waste usually does not decompose and can last for centuries in landfills, or else ends up littering the streets or polluting the natural environment. Non-biodegradability of synthetic petroleum-based plastic leads to the accumulation of huge plastic waste which promotes the major environmental impacts like global warming , ozone depletion, eco-toxicity and eutrophication etc.[10]

Plastics are also found where we don't want them – polluting our soils, rivers, oceans and harming the creatures that inhabit them. Plastics in the oceans have devastating effects on wildlife. Animals suffer when they eat plastics and habitats suffer when chemicals leach from plastics. During the covid-19 pandemic plastic waste is also polluting our environment. Single-use masks, gloves and bottles of sanitizer protecting us from the spread of COVID-19 are ending up on the streets, in the seas and among wildlife. Gloves, masks and other personal protective equipment (PPE) are important for those fighting the pandemic but are also widely used by the public. Because they are not always disposed of properly, environmentalists fear negative outcomes for wildlife and the fight against plastic pollution.

Accumulation of vast amount of plastic waste in environment encourages many industrial fields to produce biodegradable plastic.[12] Fossil resources and environmental pollution are the major problems caused by traditional plastics and these should be solved for sustainable development in future.[11] Thankfully, plastics technology has covered a long way. So efforts have been taken to reduce the use of synthetic plastics and to promote bioplastics to meet the growing demand for global plastic consumption.

Bioplastics: Bioplastics are plastic materials produced from renewable biomass sources such as vegetable fats and oils, corn starch, woodchips and recycled food waste etc[13]. They can be made from agricultural by-products and also from used plastics by using microorganisms. Bioplastics are usually derived from sugar derivatives including starch, cellulose and lactic acid.

Bioplastic is also often called bio-based plastic as it is made from plants or other biological materials instead of petroleum. Bioplastics are not just one single substance. These are a huge

family of different materials with different properties and applications . According to European Bioplastics, a plastic material is called a bioplastic if it is either biobased, biodegradable or contains both properties[14]. So Bioplastics are biobased, biodegradable or both.

Biodegradability is a chemical process in which microorganisms present in the environment break down materials into natural substances such as CO_2, water and compost without harming the environment. This process depends on the surrounding environmental conditions (e.g. temperature, water, oxygen) and chemical properties of the material etc. Biobased does not mean biodegradable. Biobased plastics may be non-biodegradable and fossil based plastics can also be biodegrade.

A bioplastic can also satisfy both criteria. Polylactic acid, thermoplastic starches (TPS), and polyhydroxyalkanoates (PHAs) are based on natural or renewable feedstock and exhibit biodegradation under various conditions. Products such as biobased polyamides and biopolyethylene are fabricated from bioderived feedstocks but are not degradable. On the other hand polybutylene terephthalate (PBT) and polybutylene succinate (PBS) are typically manufactured from petrochemical feedstocks but are biodegradable.

Sustainability is the motivation for bioplastics production. The principle for sustainability is simply explained. Whatever human needs for survival and well-being directly and indirectly comes from our natural environment. Sustainable action is one that fulfils conditions under which human and nature coexist harmoniously and where economic, social and environmental requirements of present and upcoming generations are fulfilled.

Advantages of bioplastics: To achieve the aim of sustainable production and consumption and in search of new material solutions, bioplastics have a number of benefits. They reduce carbon footprint and provide energy savings in production. They save non-renewable raw materials by using biomass which is regenerated annually. Their production decreases non-biodegradable waste that contaminates the environment. They do not contain additives like phthalates, bisphenol A or polybrominated diphenyl ethers which are harmful to human health. They do not change the taste or fragrance of the contained edible items.

Positive Effects of Human Activities: We must work to make sure that our developments in some areas do not adversely affect our environment and also ensuring that we compensate or minimize any damage that has occurred. One important step regarding reduction of pollution is to be aware of everything that causes pollution. We must use resources efficiently and reduce the amount of waste we create as a society. We should seek alternatives free of waste. Even by making simple changes in our daily life we can help to save the environment.

We interact with the world around us continuously and sometimes some of our actions adversely affect the environment. But our interactions with environment are always not negative. Whenever we recycle used paper, plastic or metal, or pick up a piece of waste from the sidewalk, we have a positive impact on the environment. Our priority should be to avoid

needless use of plastics. Sometimes the ways of using the plastic polymers cause harms to the environment.

CONCLUSION: Our policies set out how we will preserve our stock of material resources by minimising waste, promoting resource efficiency and moving towards a circular economy. Comprehensive and regular waste collection systems should be available to collect as much waste material as possible, promote householder and commercial participation and ensure that high levels of quality recyclable or compostable materials are available for reprocessing. This will preserve our stock of natural resources by ensuring as much used material as possible gets converted into new products again. Not all plastics can be recycled indefinitely. It is not always technically, environmentally and economically practicable to do so. Polymers can begin to degrade, meaning their quality becomes too poor to be used in new products. Still there is a strong requirement to design and improve biodegradable plastics that are not only biodegradable but also meet the market demand.

CONFLICT OF INTEREST: The author declares that I have no affiliation with or involvement in any organization or entity with any financial or nonfinancial interest in the subject matter or materials discussed in this manuscript.

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