AN OVERVIEW ON HETEROCYCLIC COMPOUNDS AND THEIR VERSATILE APPLICATIONS

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Abstract
One of the most imperative largest areas of research in organic chemistry is heterocyclic chemistry. Heterocycles form considerably the foremost of conventional organic divisions of organic chemistry and are of colossal importance biologically and industrially due to uniqueness in their structural Skelton parts. They are abundant in our surrounding and naturally found in nucleic acid, vitamins, antibiotics, hormones etc. Their contribution towards the development of society from a biological and industrial standpoint is of more interest. heterocycles also owe their importance in understanding the life processes and to the efforts to improve the quality of life. This paper tends to focus on the diverse applications of heterocycles in electronics, biology, optics, pharmacology, material sciences.

Index Terms: Agriculture, Antifungal, Biological, Heterocycles, Pharmaceutical.

I. INTRODUCTION

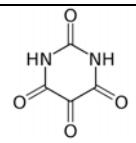
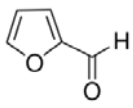
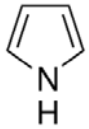
Heterocyclic chemistry is one of the most significant and important fundamental division of organic chemistry dealing with synthesis, properties, and applications of heterocycles. The name heterocyclic comes from the Greek word “heteros” which means “different.” Generally The Heterocyclic compounds are cyclic organic compounds that contain at least one hetero atom, the familiar hetero atoms are Nitrogen, oxygen and sulphur and other variety of atoms including Se, P, Si, B hetero atoms are also widely known[1,2]. Heterocyclic compounds are of enormous interest in our daily life. Amongst the approximately 20 million chemical compounds identified by the end of the second millennium, more than two-thirds are fully or partially aromatic and approximately half are heterocycles. Today, gigantic numbers of heterocyclic compounds are known and this number is increasing rapidly**.**

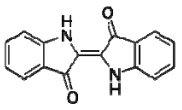
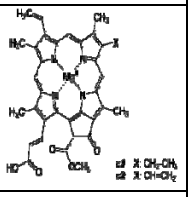
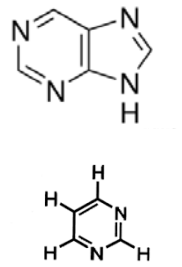
II. HISTORY OF HETEROCYCLIC CHEMISTRY

According to the exposure of Literature survey, the history of heterocyclic chemistry began in the 1800s [3], several notable development in heterocycles are,

In general, the physical and chemical properties of heterocyclic compounds are best understood by comparing them with ordinary organic compounds that do not contain heteroatoms.

Table:1.1 History of Heterocyclic compounds[3]

Year	Development	Scientist	Structure Of Compound
1818	Alloxan from uric acid	Brugnatelli	
1832	Furfural (a furan) on treating starch with sulfuric acid	Doberainer	
1834	Pyrrole ("fiery oil") by dry distillation of bones	Runge	

1906	Synthesis of indigo dye	Friedlander	 Indigo
1936	Chlorophyl derivatives from crude oil,	Treibs	
1951	The role of heterocyc-lic compounds (purines and pyrimidines) in the genetic code.	Chargaff's rules	

The heterocycles are of remarkable interest due to their widespread practical applications and clinical use in medicine, agriculture, photochemistry, biocidal formulation, polymer science, electronics, biology, optics, pharmacology, material sciences and so on is very well acknowledged.

The mainstream of pharmaceuticals and biologically active agrochemicals are heterocycles while numerous additives and modifiers used in industrial applications ranging from cosmetics reprography, information storage and plastics are heterocycles in nature.

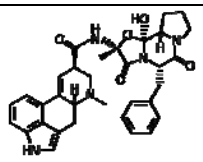
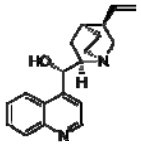
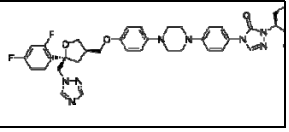
III. BIOLOGICAL SIGNIFICANCE OF HETEROCYCLIC COMPOUNDS

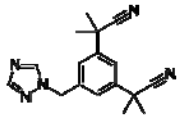
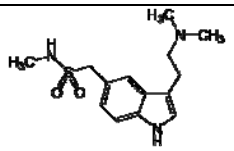
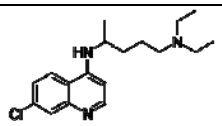
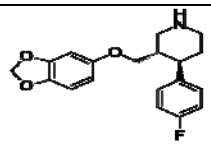
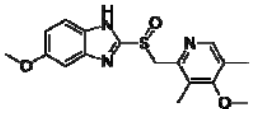
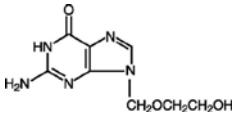
Heterocyclic compunds are extensively spread in nature, crucial to life and playing vital role in the metabolism of all living cells. Heterocyclic compounds are broadly and economically valuable as therapeutic agents with high degree of structural diversity. Biomolecules as DNA, RNA, various natural products, vitamins chlorophyll, haemoglobin and biologically active compounds having herbicidal, fungicidal, and insecticidal activity contains the heterocyclic ring in key skeleton. They often found as a key structural unit in synthetic pharmaceuticals and agrochemicals. They are used as vehicles in the synthesis of other organic compunds. Some of the natural products e.g. antibiotics such as penicillin's, cephalosporin; alkaloids such as vinblastine, morphine, reserpine etc. have heterocyclic moiety. Many heterocyclic compounds are found as key components in biological processes. Essential diet ingredients such as Thiamin (Vitamin B1), Riboflavin (Vitamin B2), Nicotinamide (Vitamin B3), Pyridoxal (Vitamin B6) and Ascorbic acid (Vitamin C) are heterocyclic compounds. Two of the essential amino acids tryptofan and histidine are also heterocycles [4].

IV. MEDICINAL SIGNIFICANCE OF HETEROCYCLIC COMPOUNDS

Medicinal chemistry plays an significant role in joining the chemistry and the medical life issues together . In the medicinal world, the chemistry of heterocycles with their intrinsic versatility and unique physicochemical properties has played a critical role in combating many deadly diseases. There are huge number of pharmacologically active heterocyclic compounds having application in many common diseases as antimicrobial, herbicides, urinary antiseptics and anti-inflammatory agents. Some heterocycles exhibits antitumor, antibiotic, anti-inflammatory, antidepressant, antimalarial, anti-HIV, antimicrobial, antibacterial, antifungal, antiviral, antidiabetic activity[3]. Table 1.2 shows the use of heterocyclic moiety containing drugs in various diseases [2].

Table 1.2. Heterocyclic compounds used in medical world

ACTIVITY	DRUG	CHEMICAL STRUCTURE
Antimigrai-n	Erogotamine	
Antimaleria-l	Cinchonin	
Antifungal	Posaconazol-e	

aromatase-inhibiting drug	Anastrozole	
Antimigrain	Sumatriptan	
Antimalerial	Chloro Quinine	
Antidepress-ant	Paroxetin	
Antiulcer	Omperazole	
Antiviral	Acyclovir	

V. OTHER VERSATILE APPLICATIONS OF HETEROCYCLIC COMPOUNDS

Some heterocyclic compounds exhibit a significant solvatochromic, photochromic, and biochemi-luminescence properties. The enormous applications of major heterocycles are in materials science as dyestuff, fluorescent sensor, brightening agents, information storage, plastics, and analytical reagents, supra molecular and specially in conjugated polymers. Furthermore they act as organic conductors, optical data carriers, organic light-emitting diodes (OLEDs), semiconductors, molecular wires, photovoltaic cells, light harvesting systems, liquid crystalline compounds and chemically controllable switches. Heterocycles are also of considerable interest because of their synthetic utility as synthetic intermediates, protecting groups, chiral auxiliaries, organ catalysts, and metal ligands in asymmetric catalysts inorganic synthesis. Therefore, substantial attention has been paid to develop efficient new methods to synthesize heterocycles. Nitrogen containing compound pyridine is used also as a solvent, a waterproofing agent, a rubber additive, an alcohol denaturant, and a dyeing adjunct.

Some of the heterocyclic compounds such as, 2-Phenyl-3-phenylimino-5-p-methoxyphenylimino-1,2,4-thiadiazolidine has been found to be relatively effectual in the lubrication of bearing balls of different compositions hence linking the heterocyclic chemistry with mechanical engineering[5].

VI. CONCLUSION

Almost all the compounds we know as drugs, vitamins, and many other natural products are heterocycles. As a result, a vast covenant of research carried out in chemistry is devoted to heterocyclic chemistry. It is vast and expanding area of chemistry because of obvious application of compounds derived from heterocyclic rings in pharmacy, medicine, agriculture, plastic, polymer and other fields. Heterocyclic compounds are widely distributed in nature. By virtue of their therapeutic properties, they could be employed in the treatment of infectious diseases. Many heterocyclic compounds synthesized in laboratories have been successfully used as clinical agents.

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