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Heterocycles comprise the major classical divisions of organic chemistry. These are extremely important with broad spectrum of synthetic, industrial and pharmaceutical applications. Compounds containing five and six membered heterocyclic rings in their structures possess wide range of biological activities. Bearing in mind the high drug-like properties of these heterocycles, medicinal chemists and organic chemists synthesize a large number of chemotherapeutic agents.

In addition, most potent natural compounds, the alkaloids, are heterocycles. Heterocycles are the key components of biological molecules e.g. DNA and RNA. Nucleotides are the building blocks of our genes and these are the derivatives of pyrimidines (cytosine, thymine, uracil) and purine (adenine, guanine). Pyrimidine and purine derivatives are monocyclic with two nitrogen containing and bicyclic four nitrogen containing heterocycles and they directly participate in genetic information encoding. Chlorophyll and heme (oxygen carriers in plants and animals, respectively) are the derivatives of large porphyrin rings. Many essential amino acids (proline, histamine, tryptophan), hormones (kinetin, heteroauxins, cytokinins), neurotransmitter (serotonin, histamine) are also heterocycles. Vitamin B series (thiamine, folic acid, riboflavin, cyanocobalamin) are nitrogen containing heterocycles while vitamin C (ascorbic acid) and vitamin E (α-tocopherol) are oxygen containing heterocycles.

The presence of sulfur, nitrogen and oxygen containing heterocycles in many organic compounds in pharmacology, electronics, biology, cosmetics, optics, material sciences, electronics, etc is very familiar. Many natural drugs (e.g. theophylline, atropine, etc), some dyes (e.g. mauveine), pesticides (e.g. diazinon), lumineshores (e.g. acridine orange) are heterocyclic in nature. Large number of synthetic heterocyclic compounds with important applications such as herbicides, anticorrosive agents, photostabilizers, agrochemicals, dyestuff, copolymer, photographic developers, fluorescent whiteners, sensitizers, flavouring agent and antioxidant in rubber. They also possess broad spectrum of therapeutic uses such as analgesic, antiinflammatory, muscle relaxant, antimicrobial, antimycobacterial, trypanocidal, anti HIV activity, antitumoral, insecticidal, antimalarial, anticancer, anticonvulsant, lipid peroxidation inhibitor, hypnotics, antidepressant, antileishmanial agents, etc.
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In the human body, all these natural and synthetic heterocyclic compounds such as serotonin, ATP, nucleic acids, vitamins, enzymes, co-enzymes participate in principle life processes such as supply of energy, metabolism, hereditary information transfer and nerve impulses transmission. Heterocycles are able to get involved in an exceptionally wide range of reaction types. They may behave as acids or bases by forming anions or cations depending on the pH of the medium. Some heterocycles are amphoteric in nature; some interact readily with electrophilic reagents while some react easily with nucleophilic reagents. Some are easily reduced, but resist oxidation, while others readily oxidized but are stable toward the action of reducing agents. Electronic distributions are the main reason for such versatile reactivity in heterocyclic molecules.

Globally oils and fats are important raw materials for chemical industry. In several institutions and industries, oleochemistry has grown a major research and technology division. Huge variety of products which include specialties for polymer applications, biodiesel, emollients for home and personal care industries, pesticides and biodegradable mineral oil replacements for lubricants are based on oils and fats.

The dicarboxylic acids are industrially produced either by dimerization of oleic acid and linoleic acid or by ozonolysis of oleic acid to produce azelaic acid. Surfactants and emulsifiers are also derived from vegetable oil-based fatty alcohols and fatty acids. Surfactants show important applications in food sector, in mining and in crop protection.

Apart from this they also show important applications in washing and cleansing sector, textile treatment and in cosmetics. Fatty acid derivatives of proteins and amino acids found significant importance in the personal care market. These are mainly used in surfactant based face cleansers, mild shower and bath products, cold-wave preparations and fixatives, mild shampoos, body wash products and in emulsifiers for leave-on products. Besides food uses, oils and fats have found their way into agrochemicals and industrial products such as plastics, inks, adhesives, coatings, pharmaceuticals, etc.

In the field of lubricants, environmental and economic reasons lead to the utilization of plant oils and animal fats after proper chemical modification. Oleochemicals are more favorable than mineral oil because they are renewable.
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Biodegradable, non-flammable, readily available all around the world and cause fewer health problems and allergies to the end users. Products formed from plant oils and animal fats are often biodegradable because of their biobased nature. Biodegradable fatty acid esters found applications in chain saw oil, gearbox oil, hydraulic oil and lubricants for off-shore crude oil exploration. Oleic acids are highly desired components in vegetable oils (VOs) for lubricant application because of high thermal stability than polyunsaturated fats. For industrial, agriculture and farming applications, this biobased grease with high oxidative stability can be prepared by using epoxy VOs. In addition, this biobased grease have better properties than mineral oil-based grease such as effective lubrication, wear protection, corrosion resistance, friction reduction, heat removal, etc.

Literature survey reveals that long fatty acid chains substituted on heterocyclic rings are rare in nature. By doing the modification and derivatization of functional groups (i.e. terminal and internal double bond and carboxylic acid) present in the fatty acid chain, number of industrially useful and biologically active compounds can be synthesized which will be a valuable addition to the synthetic methodology available for the synthesis of hetero-fatty acid derivatives.

Bearing in mind the aforementioned facts and importance of heterocycles and fatty acids, number of heterocyclic fatty acid analogs (hetero-fatty acids) have been synthesized from saturated, unsaturated (terminal and internal) and hydroxy unsaturated fatty acids. Further, these compounds were screened for their in vitro antimicrobial activity and in vitro anticancer activity. From these studies, it is understandable that further derivatization and heterocyclization of these hetero-analogs of fatty acids can be served as new template for antimicrobial and anticancer drug discovery and could be probably leads to more potent agents in this area.

Whole work done of this research is divided into five chapters and these are as follows:

Chapter 1: Synthesis of pyrazolones and phthalazindiones
Chapter 2: Synthesis of isoxazole and dihydroisoxazoles
Chapter 3: Synthesis of oxadiazolthiones, triazolthiones and triazolothiadiazines
Chapter 4: Synthesis of hydrazono-isatin and N-methyl isatin derivatives
Chapter 5: Synthesis of oxazolines and thiazolines