
Preface

Nitrones are regarded as a 3 centered dipolar 4π electronic system. Nitrones usually undergoes 1,3-dipolar cycloaddition reactions with different dipolarophilic reagents. 1,3-dipolar cycloadditions have both electronic and steric effects. 1,3-dipolar cycloaddition reaction between a nitrone and an ethylinic double bond is one of the most efficient methods for the synthesis of isoxazolidine systems.

Fukui's *frontier molecular orbital theory* (FMO) which provides relative interaction energies of frontier orbitals between 1,3-dipole and dipolarophiles reflects reactivity and the role of substituents in 1,3-dipolar cycloaddition reactions and has been rationalized successfully. The dipole and dipolarophiles with electron attracting or electron releasing moiety influences the atomic orbital coefficients and has a significant influence on the regioselectivity of the cycloaddition reactions.

Moreover, the cycloadducts (furfuryl derived isoxazolidine, isoxazoline derivatives and dihydrofuran derived isoxazolidine, isoxazoline derivatives) synthesized from furfural and dihydrofuran respectively have found numerous applications in organic synthesis. These include *Sonogashira cross-coupling reaction* and formation of *inclusion complexes*. These features definitely find attraction in the applications of this chemistry. In addition, nitrones may be employed as a good oxidizing reagent in the synthesis of aldehydes and ketones with atom efficiency. Nitrone-olefin cycloaddition reaction features asymmetric induction and is achieved through the incorporation of chirality in both the dipole and the dipolarophiles. *Greener approaches* in the synthesis and cycloaddition reactions (*ball-milling and microwave induced reactions*) have made this chemistry much more attractive nowadays.

The present dissertation entitled "*Synthesis, Characterization and Inclusion Complexation of some Isoxazolidine and Isoxazoline derivatives for Advanced Applications Explored by Physicochemical Approach*" reports synthesis and 1,3-dipolar cycloaddition reactions of two different nitrones (*N-methyl-C-furfural nitrone* & *N-phenyl-4-hydroxy nitrone*) and their further applications including significant "anticancer activities" and "inclusion complexations". These cycloaddition reactions have been executed with these nitrones and a variety of olefins and alkynes leading to the development of stereo & regioselective cycloadducts.

The following chapters fulfilled these ideas:-

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- Chapter I** The chapter deals with the general theoretical approach and basic concepts of different kinds of 1,3-dipoles (revisiting works reported in this chemistry). The chapter also states general nature of intra and inter molecular 1,3-dipolar cycloaddition reactions of nitrones. Special explanation has been given to HOMO – LUMO approach in this regard. Attempts have been made in this chapter to cover a full comprehensive review on the literature and latest developments up to January 2021.
- Chapter II** The chapter focuses on the most important experimental section. In this section, the method of synthesis of two different nitrones (*N-methyl-C-furfural nitrone* derived from furfural and *N-phenyl-4-hydroxy nitrone*) has been discussed. 1,3-dipolar cycloaddition reactions of these nitrones with different alkene and alkynes have been studied using *green chemistry methodologies* like *solvent less solid phase reactions* (ball-milling and *microwave induced reactions*). Host-guest inclusion complexation using β -cyclodextrin and few newly synthesized isoxazolidine molecules have been studied. Some useful synthetic applications of the new cycloadducts have been also performed successfully for their conversion into the synthesis of cross-coupling products (Sonogashira reaction) and inclusion complexations. This chapter also describes how nitrones may be utilized as an oxidizing reagent in the synthesis of aldehydes and ketones (atom efficient reactions). The chapter also deals with significant *biological study (anticancer activity)* of the new cycloadducts.
- Chapter III** The chapter deals with results and discussion and the new achievements of the work presented. Spectral interpretation *viz.* ^1H NMR, ^{13}C NMR, MS, IR and elemental analysis have been discussed in detail for the confirmation of structures of the new cycloadducts. Inclusion complexation with few cycloadducts added extra flavour in this chemistry undoubtedly. The chapter also explains in detail how the stereoselectivity and regioselectivity of the new cycloadducts have been assigned.
- Chapter IV** The chapter is focused on the future perspectives of the work presented and also opens new routes of further research work in this chemistry.
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