# ABSTRACT

Commencing from the very first days of 2020, this consumed nearly four years long to complete the exploration, investigation and entire study, embraced in this documentation, entitled **"SYNTHESIS AND CHARACTERIZATION OF ORGANIC FUNCTIONAL MATERIALS AND STUDIES ON THEIR APPLICATIONS"**. Actually completion of research work is just a myth. Completion of a productive five years and consequently the creation of such full – length Thesis or an intact documentation of five years, are nothing but an arrival into a new and fresh world of scientific aura. Such work is basically emphasized on uplifment of proficient and ecological pathways for synthesizing biologically convenient heterocyclic substituent. The overall work represented in this documentation has been distributed like the following manner.

A lubricant is a material that is applied to the surfaces that are in proximity with one another in order to minimize friction. This eventually minimizes the amount of heat produced whenever the surfaces circulate. In addition, it might be used for force transmission, the transportation of foreign objects, surface cooling wear resistance, and corrosion prevention.

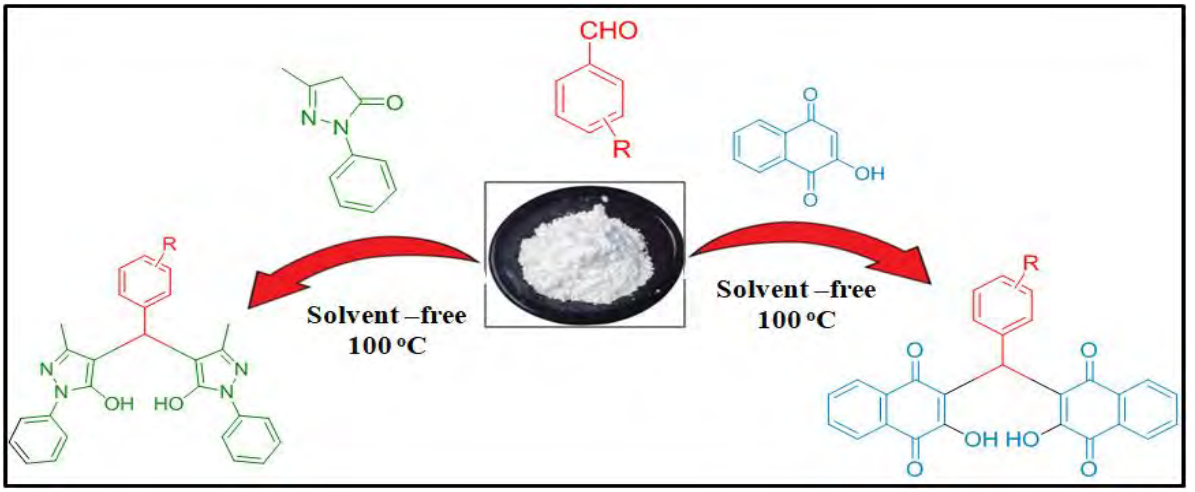
Base oil and additive packages are both present in the lubricant. The purpose of additives is to either add an innovative feature to the base fluid or improve one that already exists. The current work consists of the synthesis, characterization, and efficacy assessment of multifaceted lubricant additives.

**Chapter I (A concise explanation about the perspective towards some production of biologically significant compounds with heterocyclic moiety**) consists of total two sections.

**Section A** deals with the fact that Humic acid, a rarely used non virulent, easily accessible, inexpensive, environmentally benign, high molecular weight polymer, because of its extraordinary catalytic activity has been explored for the synthesis of functionalized 4*H*-benzo[4,5]thiazolo[3,2-*a*]pyrimidine-3-carboxylate and its derivatives along with functionalized benzo[*d*]thiazole. Environmental friendliness, low catalyst loading, outstanding yield, magnificent functional group forbearance and renewability up to fifth run without any noteworthy loss of its activity at the finishing point of reaction, are the cue significances of these methods.

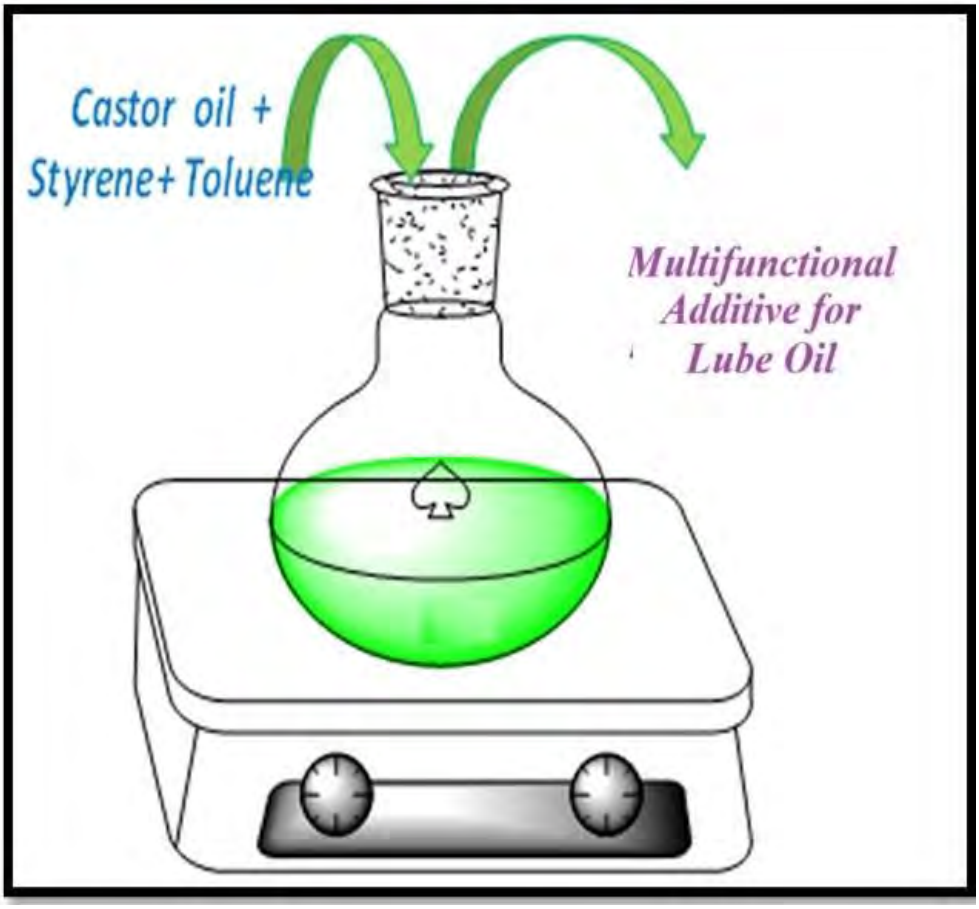



**Section B** deals with the fact that, a broad spectrum of extensively functionalized biologically convenient heterocyclic constituents such as, 3,3'–(phenylmethylene)bis(2-hydroxynaphthalene-1,4-dione) and 2-hydroxy-1,4-naphthoquinone can be synthesized in one pot under the maintenance of metal-free condition and using β-cyclodextrin, a common, water soluble and greener catalyst with supramolecularity. These procedures' primary goal is to investigate the fabrication of this organic supramolecule using a single pot and numerous substances. The main benefits of that study are its superior functional group forbearance, lack of harmful acid or metal catalyst, hard reaction circumstances, low cost, ecological, more sustainable and harmless methodology with respect to the environmental purpose. These procedures don't use any poisonous metal catalysts, dangerous solvents, or severe reaction pathways. The main benefits of these procedures are additionally low catalyst load, exceptional yield quantity, and outstanding functional group compatibility. Such technique is harmless for Mother Nature because it does not employ solvents and makes the utilization of a catalyst.



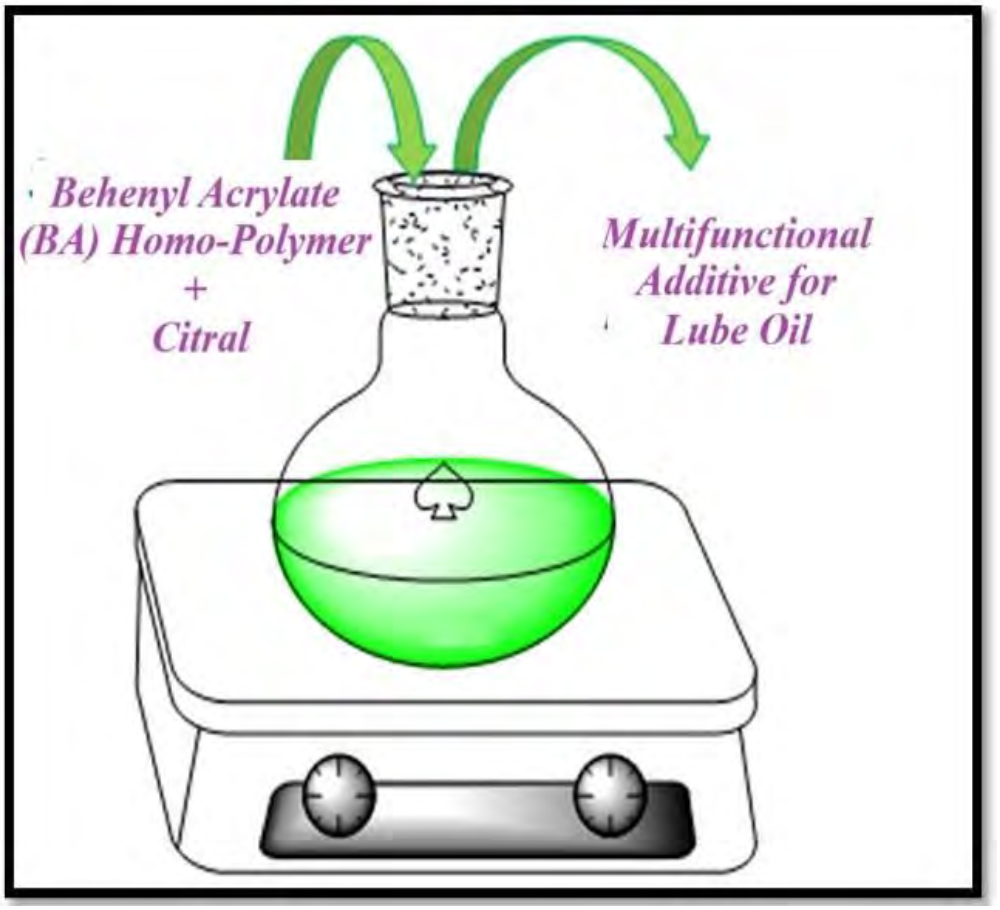

**Chapter II** (**Wide-ranging analysis of polymeric exploration, synthesis and evaluation),** consists of total three sections.

**Section A** deals with the fact that, the polymer and chemical industries are actively concentrating on the discovery and application of vegetable oils for polymer composites. In this work, castor oil homopolymers and their copolymers with styrene were made, and their assessment was done by spectroscopic methodology, thermo gravimetric analysis (TGA), and gel permeation chromatographic (GPC) strategy. The ASTM standard approach was employed to determine these polymers' efficiency in base oil. Photo micrographic imaging was utilized to assess the efficacy of additives as pour point depressants by examining their impact on the microstructure. The biodegradability experiment for polymers was conducted too and outcomes are quite promising. Their performance comparisons have also been assessed and reported.

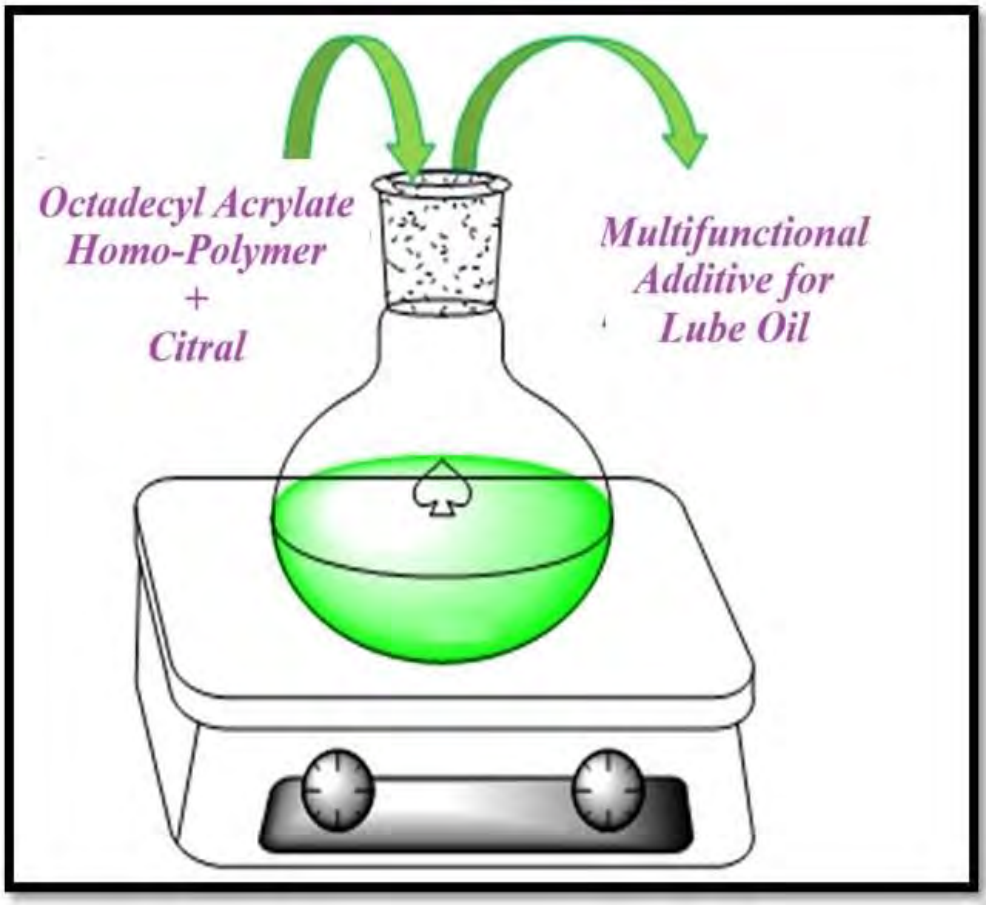



**Section B** deals with Behenyl Acrylate (BA) homo-polymer and its copolymers with citral were synthesized with varying percentage compositions (w/w) and subjected to thorough characterization through GPC (gel permeation chromatography) analysis and spectroscopic techniques (FT-IR, NMR). The polymers' capability was assessed through viscosity index improvers/viscosity modifiers (VII or VM), antiwear (AW) additives and pour point

depressants (PPD) for base oils (lubricating oil). The action mechanism of the PPD properties was investigated through photomicrographic analysis. Additionally, the polymers' thermal stability was measured using TGA or thermo gravimetric analysis. Biodegradability tests on copolymers were conducted using soil burial test (SBT) and the Disc Diffusion (DD) method. The copolymers exhibited exceptional PPD, VII, and AW performance when incorporated into lubricating oil.




**Section C** deals with Homopolymer of Octadecyl acrylate, and its different copolymers with varied percentages of Citral have been synthesised via free radical polymerisation. All the prepared polymers were characterised by FT–IR and NMR spectroscopy and their molecular weights were measured by GPC. Their performances as pour point depressant (PPD) and viscosity index improver (VII) in lube oil have been evaluated. Thermo Gravimetric Analysis (TGA) of these polymers accounted for their thermal stability as a polymeric additive. Also eco-friendly nature of the citral based polymers was established via biodegradability test.


Octadecyl Acrylate
Homo-Polymer
+
Citral
Multifunctional
Additive for
Lube Oil