The term lubricating oils is generally used to include all those compounds having lubricating actions. The basic functions of a lubricant are to keep moving parts apart, reduce friction, protect against wear, transfer heat, prevent rust and corrosion, act as antioxidantetc.The lubricating base oil can't alone satisfy all the demand of machinery system, therefore suitable additive package are added to base oil which either impart new and useful properties to the lubricant or enhance properties already present.

Present work involves synthesis, characterization and performance study of multifunctional lube oil additives. Different acrylate based polymer were synthesized by varying the alcoholic part of the acrylate ester. In case of copolymers one unit was acrylate and the other unit were styrene, 1-decene and different vegetable oils. Blending ofacrylate polymer with ionic liquid also be used in this study. The polymers were synthesized thermally or by microwave method in presence of BZP or AIBN as initiator. Characterization of the polymers was carried out by spectral analysis (FT-IR, ^{1}H NMR and ^{13}C NMR), followed by molecular weight determination (Viscometric / GPC). Thermal stability of polymers was determined by Thermogravimetric analysis (TGA). Additive performance of the polymers as viscosity modifier (VM), pour point depressant (PPD) and in some cases as anti-wear (AW) were investigated in different base oils according to standard ASTM methods. The shear stability and oil thickening property of the polymers has also been studied.For the biodegradable polymeric additives, biodegradability test was done by disc diffusion method against different fungal pathogens and by soil burial degradation test. Since all the additives were multifunctional in nature, interest of research on this area gives a new perspective in the lubrication technology.

In this thesis at first general introduction about the research area was given. Then the complete research work has been divided into three parts: Part I, Part II and Part III. Part I"Acrylate polymers as multifunctional lubricating oil additives"is divided into four chapters (chapter I, chapter II and chapter III and chapter IV). Chapter I comprises the background study of part I. Chapter II is divided into section A and section B. Section A discussed about the homopolymer of dodecyl acrylate and its

copolymer with styrene and 1-decene.First the homo and copolymer are synthesized followed by characterisation of the prepared polymer by spectral method (FT-IR, ^{1}H NMR and ^{13}C NMR) and viscometric molecular weight determination. Then different performance as viscosity index improver (VII), also known as viscosity modifier (VM), Shear stability, Thickening (THK) of the prepared polymers in base oils were evaluated and was found that shear stability decreases with increasing the polymer concentration in base oil.Section B of part I comprises with synthesis of homopolymer of decyl acrylate and its copolymer with styrene and 1-decene followed by their characterisation by spectral method (FT-IR, ^{1}H NMR and ^{13}C NMR) and molecular weight determination (by GPC i.e. Gelpermeation chromatography). Then the performance evaluation was done as VII, PPD (Pour point depressant) and AW(Anti-wear).The shear stability of the prepared polymers were also determined and was found that copolymer is better shear stable than homopolymer. Chapter III describes the preparation of myristyl acrylate by two different polymerisation processes, thermal polymerisation and microwave polymerisation and also using two different initiators (BZP and AIBN) in each case of polymerisation process.The characterization of the polymers was carried out through FT-IR, NMR and Viscometric molecular weight determination. The thermal stability of the polymers was determined by thermo gravimetric analysis (TGA) and shear stability of the polymers were determined as per ASTM D - 3945 method. The performance of all the polymers in two different base oils wasstudied. It was found that polymer prepared by microwave assisted method showed better thermal stability over the one prepared by thermal method but the shear stability of the polymer was influenced by the nature of the initiator rather than the way polymerization process and initiator BZP provides better shear stability compare to AIBN. Study also described that Viscosity index of AIBN initiated polymer is more than that of BZP initiated both in thermal and microwave condition. Chapter IV discussed about homopolymer of isodecyl acrylate (IDA) and isooctyl acrylate (IOA) and their copolymer with styrene in different mole fraction.Characterisation of each polymer was carried out through FT-IR, NMR spectra and

molecular weight determined by GPC method. Performance of the polymers as VII, PPD, AW was determined and was found that homopolymer of isodecyl acrylate exhibit better additive performance than that of isocotyl acrylate.

Part II “Polyacrylate and Ionic liquid blend as a multifunctional lubricating oil additive” is divided into two chapter, chapter I and chapter II. Chapter I is the brief introduction of the part I study. Chapter II described the synthesis and characterisation of decyl acrylate polymer and it was blended with ionic liquid. The characterisation of blending was carried out by spectral method and molecular weight was determined by GPC method. Performance (VI, PP, and AW) of the blend in comparison with the homopolymer of decyl acrylate was studied.The mechanism of action of the additives as PPD was studied by photo micrographic image.It was found that though the VII property of blend is somewhat less than homopolymer, but, it’s Anti-wear property makes it as a potent lubricating additive.

Part III “Multifunctional vegetable oil polymer as a lubricating oil additive” is divided into three chapter, chapter I, chapter II and chapter III. Chapter I is the background of respective work. Chapter II described the biodegradable lube oil additives obtained from copolymer of rice bran oil and dodecyl acrylate with different wt./wt. ratio. The copolymers were characterized by spectroscopy (FT-IR, NMR), TGA and by molecular weight determination through GPC. Performance evaluation of all the prepared polymers in mineral base oil as viscosity index improver, pour point depressant was carried out according to standard ASTM methods. The mechanism of action of the additives as PPD was studied by photo micrographic image. Biodegradability was measured by i) Disc diffusion methodand ii) Soil burial test. The polymer samples recovered after the tests were measured tocalculate effective weight loss. GPC analysis and FT-IR spectra of recovered sampleswere compared with respective results before the tests to confirm the biodegradablenature of the copolymers.Comparison of performance of copolymer with homopolymer also carried out. The study was reveals that copolymer showed VII and PPD property and also response a lot in biodegradability

test.Chapter III discussed about the biodegradability and multifunctional characteristics of homopolymer of palm oil and it's copolymer with decyl acrylate. Characterisation of the polymers was done by spectral method (FT-IR, NMR) and molecular weight determined through GPC. Multifunctional performance (VI, PP, shear stability) and biodegradability of the polymers was determined and compared. It was found that though the copolymer is to some extent less biodegradable than homopolymer of palm oil but the other multifunctional performance makes it a potent biodegradable multifunctional lubricating oil additive.