PREFACE

The petroleum and automotive industries are developing technologies and materials for the supply of better than better service products for engines and motor vehicles in this ever growing and fast moving world. Increasing consumer demands and economic pressures have converted the internal combustion engines more and more sophisticated ones. As a result, engine oils are becoming more stressed, giving rise to a need for new multifunctional additives. Hence new lubricants are developed to meet the changes required. For example, a new engine design configuration may require improved lubricant performance and on the other hand, a different service application or lubricant drain interval may require changes in lubricant performance. A vast group of research scientists have been engaged to identify these changes and to develop new lubricant additives or enhance the performance of the existing ones by simple modification to satisfy the requirements.

Base oils or synthetic base stocks alone cannot provide all the engine lubricant functions required by a modem gasoline or diesel engine. Over the last eighty years a number of chemical additives have been developed to enhance base stock properties, overcome their deficiencies and provide the new performance levels required by the technological evolution of engines or by new regulations. But no single additive component can do everything. Several additive components are needed to deliver the performance required. Performance requirements change as engine design, operating conditions, legislation, and source of supply and processing methods of the base oil change. Several additive components of different chemistry are used, at concentrations from 0.005% to more than 10% as is required.

The present thesis deals with the development of some effective polymeric additives for both the lube oil and crude oil. All the prepared additives were characterised by FT–IR and NMR spectroscopy. Their molecular weights were determined by Gel Permeation Chromatography (GPC) method. **Chapter II.A** demonstrates the utilisation of polymer blend as lube oil additive. Polymer blend has been an easy and economic polymer modification process to generate new polymeric material with better performance, at least in terms of mechanical and thermal stability. Hence a comparative study has been provided here between the performance of the blend and its parent copolymer a lube oil additive.

The succeeding work embodied in **Chapter II.B** provides an investigation about the effect of percentage of initiator used in the polymerisation process, on the performance of the polymers prepared. Here number of homopolymers and copolymers were prepared via free radical polymerisation process using different percentages of initiator either BZP or AIBN. Then these polymers were evaluated as pour point depressant and viscosity index improver in lube oil. In addition, their shear stability in lube oil was also evaluated. A visible effect of amount of initiator has been marked on the performance of the polymers prepared.

Chapter III.A demonstrates the efficiency polymeric additives for crude oil. High viscosity and wax deposition at low temperature are main barriers against crude oil extraction, transportation via pipeline and even storage in reservoirs. Varieties of remedial methods have been applied to overcome such obstacles over the decades. In this chapter some methacrylate–based polymeric additives have been prepared and employed as pour point depressants for crude oil.

Subsequent work in **Chapter III.B** deals with utilisation of polymer blend as flow improver as well as viscosity modifier for crude oil. Since polymer blends are supposed to be mechanically more stable than its parent polymers, their shear stability in crude oil also measured to check whether they are strong enough maintain their activity even under severe stress such as may be experienced during turbulent flow of crude oil.

In addition, ionic liquids (ILs) also have attracted much attention as a promising candidate with lots of capabilities in this lubrication. Especially their low volatility, non–flammability, thermal stability, moisture stability and miscibility with organic compounds have been the point of attraction to be explored in the world of petroleum science. But ILs are comparatively much more expensive than the traditional lube oils. Hence it wouldn't be economical to replace the mineral base oils with ILs, rather the later can be added to the lube oil in very small quantity as an additive to formulate a better lubricating package. The **Chapter IV** cites the application of ILs as lube oil and crude oil additives. **Chapter IV.A** in particular, has investigated here whether ionic liquids can enhance the performance of a polymeric additive in lube oil. Besides, a number of studies have established that ILs are quite good at viscosity reduction of crude oil. On the other hand polymers are also proved to

do the same quite effectively. **Chapter IV.B** shows whether ionic liquid–doped additives can do it better and whether they are more resistant against mechanical shear.