

LIST OF FIGURES

Figure No.	Title of Figure	Page No.
Figure 1	Action mechanism of pour point depressant	3
Figure 2	Structures of some commonly used Pour Point Depressants	3
Figure 3	Structures of some commonly used viscosity index improver	4
Figure 4	Effect of temp. of polymeric additive in lube oil	5
Figure 5	Glycerol monooleate (GMO)	6
Figure 6	Action mechanism of anti-wear additives	6
Figure 7	Donor acceptor bond between AW additive and metal (Fe) surface	7
Figure 8	Structure of a monomeric zinc dialkyl dithiophosphate	7
Figure 9	Action mechanism of dispersant additive	8
Figure 10	General structure of a succinimide based and Mannich Base dispersants	8
Figure 11	Radical trapping by hindered phenols	9
Figure 1.2.1	IR spectra of homo polymer (P-1)	30
Figure 1.2.2	¹ H NMR spectra of homo polymer (P-1)	30
Figure 1.2.3	¹³ C NMR spectra of homopolymer (P-1)	31
Figure 1.2.4	IR spectra of copolymer (P-3)	31
Figure 1.2.5	¹ H NMR spectra of copolymer (P-3)	32
Figure 1.2.6	¹³ C NMR spectra of copolymer (P-3)	32

List of Figures

Figure 1.3.1	FT-IR spectra of polydecyl acrylate	46
Figure 1.3.2	¹ H- NMR spectra of polybehenyl acrylate	46
Figure 1.3.3	¹³ C- NMR spectra of poly behenyl acrylate	47
Figure 1.3.4	Plot of PWL (Percent Weight Loss) vs Temperature (in K)	47
Figure 1.3.5	Plot of photo micrographic images of base oil and additive (P-1, P-2, P-3, and P-4) doped base oil.	48
Figure 1.4.1	FT-IR spectrum of co-polymer of BA- 1-decene (P3)	65
Figure 1.4.2	¹ H NMR spectrum of co-polymer of BA- 1-decene (P3)	65
Figure 1.4.3	¹³ C- NMR spectrum of co-polymer of BA - 1-decene (P3)	66
Figure 1.4.4	FT-IR spectrum of co-polymer of IDA- 1-decene (P7)	66
Figure 1.4.5	¹ H NMR spectrum of co-polymer of IDA - 1-decene (P7)	67
Figure 1.4.6	¹³ C NMR spectrum of co-polymer of IDA - 1-decene (P7)	67
Figure 1.5.1	FT-IR spectra of (a) polymer (A) and (b) polymer/ZnO nano composite (Z-3)	82
Figure 1.5.2	¹ H NMR spectra of polymer (A) and the PNC (Z-3)	83
Figure 1.5.3	¹³ C NMR spectra of polymer (A) and the composite (Z-3)	84
Figure 1.5.4	XRD spectra of prepared ZnO nanoparticles	85
Figure 1.5.5	SEM images (a, b, c and d) of prepared ZnO nanoparticle at different magnifications	85
Figure 1.5.6	TGA data of polymer (A) and polymer/ZnO nanocomposite (Z-1, Z-2 and Z-3)	86
Figure 1.5.7	Plot of viscosity index of the lube oil blended with additives at different concentration levels	86

List of Figures

Figure 1.5.8	Plot of pour point of the lube oil blended with additives at different concentration	87
Figure 1.5.9	Wear scar diamete	87
Figure 2.1	General structure of vegetable oil (triglyceride)	90
Figure 2.2.1	FT-IR spectra of homopolymer of castor oil (P-1)	107
Figure 2.2.2	¹ H NMR of homopolymer of castor oil (P-1)	108
Figure 2.2.3	¹ H NMR of copolymer of castor oil and styrene (P-2)	108
Figure 2.2.4	GPC chromatogram of the copolymer P-1	109
Figure 2.2.5	GPC chromatogram of the copolymer P-2	109
Figure 2.2.6	GPC chromatogram of the copolymer P-3	110
Figure 2.2.7	GPC chromatogram of the copolymer P-4	110
Figure 2.2.8	GPC chromatogram of the copolymer P-5	111
Figure 2.2.9	GPC chromatogram of the copolymer P-1, after biodegradation	111
Figure 2.2.10	GPC chromatogram of the copolymer P-2, after biodegradation	112
Figure 2.2.11	GPC chromatogram of the copolymer P-3, after biodegradation	112
Figure 2.2.12	GPC chromatogram of the copolymer P-4, after biodegradation	113
Figure 2.2.13	GPC chromatogram of the copolymer P-5, after biodegradation	113
Figure 2.3.1	A representative FT-IR spectra of the rapeseed oil – styrene copolymer	129
Figure 2.3.2	A representative ¹ H NMR spectra of rapeseed oil – styrene copolymer	130

List of Figures

Figure 2.3.3	A representative ^{13}C NMR spectra of rapeseed oil-styrene copolymer	130
Figure 2.3.4	FT-IR spectra of the homo polymer of rapeseed oil	131
Figure 2.3.5	^1H NMR spectra of homo polymer of rapeseed oil	131
Figure 2.3.6	^{13}C spectra of homo polymer of rapeseed oil	132
Figure 2.3.7	A representative FT-IR spectra of the copolymer after biodegradability test	132