

Synthesis, Characterization and Evaluation of Castor oil-based Acylated Derivatives as Potential Lubricant Base Stocks

Gorla Geethanjali, Korlipara V. Padmaja, Rachapudi B. N. Prasad*

**Centre for Lipid Research, CSIR-Indian Institute of Chemical Technology,
Hyderabad 500 007, Andhra Pradesh, India.**

Correspondence to:

E-mail address: rbnprasad@iict.res.in (R.B.N. Prasad).

Tel.: +91 040 27193179; fax: +91 040 27193370.

Table S1: Physico-Chemical and Lubricant Properties of Acylated Derivatives of Castor Oil

Property	AcECO	PrECO	BuECO	HxECO
Density	0.9592	0.9614	0.9641	0.9655
Specific gravity	0.9701	0.9650	0.9622	0.9564
Hydroxyl Value	0.55	0.82	0.75	2.35
Kinematic 40(°C)	112.6	114.4	117.6	125.1
Viscosity(cSt) 100(°C)	14.84	14.67	15.14	15.40
Viscosity Index	136	132	134	129
Pour Point (°C)	- 24	- 21	-30	-27
Copper strip corrosion	1a	1a	1a	1a
Flash point (°C)	262	272	278	280
NOACK evaporation loss (%)	3.25	3.39	3.56	3.92
Air release value (min)	15.80	17.00	21.55	22.29
RPVOT (min)	15	15	15	10
Weld Load (Kg)	150	160	160	170

Table S2: Physico-Chemical and Lubricant Properties of Methyl 12-Acyloxy Octadecenoate-Rich Fatty Acid Methyl Esters

Property	PrECFAME	BuECFAME	HxECFAME
Density 15°C	0.9277	0.9289	0.9307
Specific gravity	0.9365	0.9297	0.9153
Kinematic 40 °C	8.221	8.750	8.961
Viscosity 100°C (cSt)	2.470	2.560	2.651
Viscosity Index	122.75	130.93	139.12
Pour Point (°C)	-21	-18	-18
Copper strip corrosion	1a	1a	1a
Flash point (°C)	222	222	222
NOACK	37.36	36.21	23.40
Evaporation loss (%)			
Air release value (min)	0.38	0.48	0.58
RPVOT (min)	5	5	10
Emulsion characteristics	40:40:0 (3 min)	40:40:0 (4 min)	40:40:0 (5 min)
Weld Load (Kg)	130	140	140

Table S3: Physico-Chemical and Lubricant Properties of 2-Ethyl-hexyl 12-Acyloxy Octadecenoate-Rich Fatty Acid Esters

Property		PrECFA2EtHE	BuECFA2EtHE	HxECFA2EtHE
Density	15°C	0.91461	0.90867	0.90988
Specific gravity	15 °C	0.91543	0.90949	0.90770
Hydroxyl Value		1.35	0.79	0.53
Kinematic Viscosity (cSt)	40 °C	8.641	10.55	12.59
	100°C	3.541	3.651	3.777
Viscosity Index		144.82	148.91	155.69
Pour Point (°C)		-36	-39	-39
Copper strip corrosion		1a	1a	1a
Flash point (°C)		182	182	174
NOACK evaporation loss (%)		22.87	23.27	24.27
Air release value (min)		0.55	0.81	0.99
RPVOT (min)		5	7.5	10
Emulsion characteristics		40:40:0 (1 min)	40:40:0 (1 min)	40:40:0 (5 min)
Weld Load (Kg)		140	150	150

ASTM method (D 445 – 01): Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (the Calculation of Dynamic Viscosity)

The method of calculation of viscosity measurements were carried out according to ASTM method (D 445 – 01). According to the method, in section **10.2.2**: If the two determinations of kinematic viscosity, calculated from the flow time measurements, agree within the stated determinability figure for the product, use the average of these determinations to calculate the kinematic viscosity result to be reported. Record the result. If the determinations of kinematic viscosity do not agree within the stated determinability, repeat the measurements of flow times after thorough cleaning and drying of the viscometers and filtering of the sample.

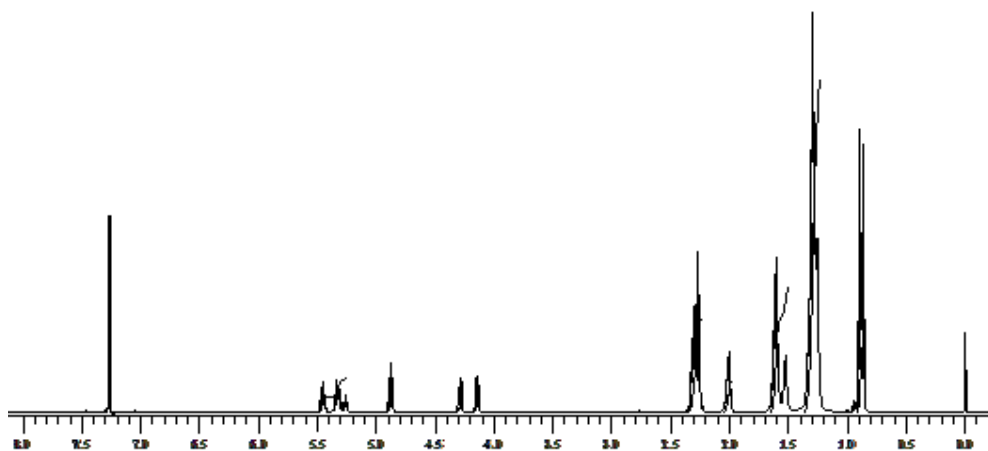


Figure S1: ^1H NMR Spectrum of Butanoylated Castor Oil

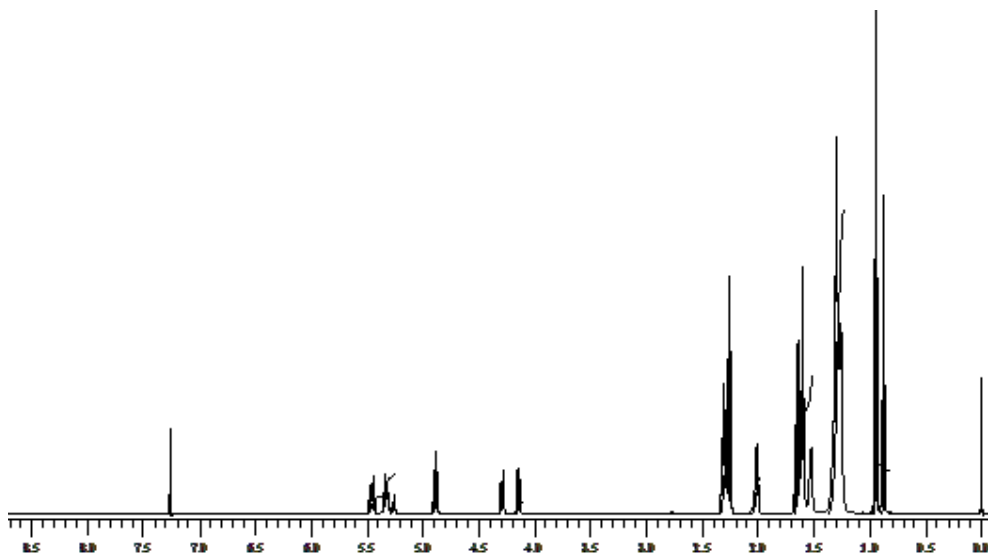


Figure S2: ^1H NMR Spectrum of Hexanoylated Castor Oil

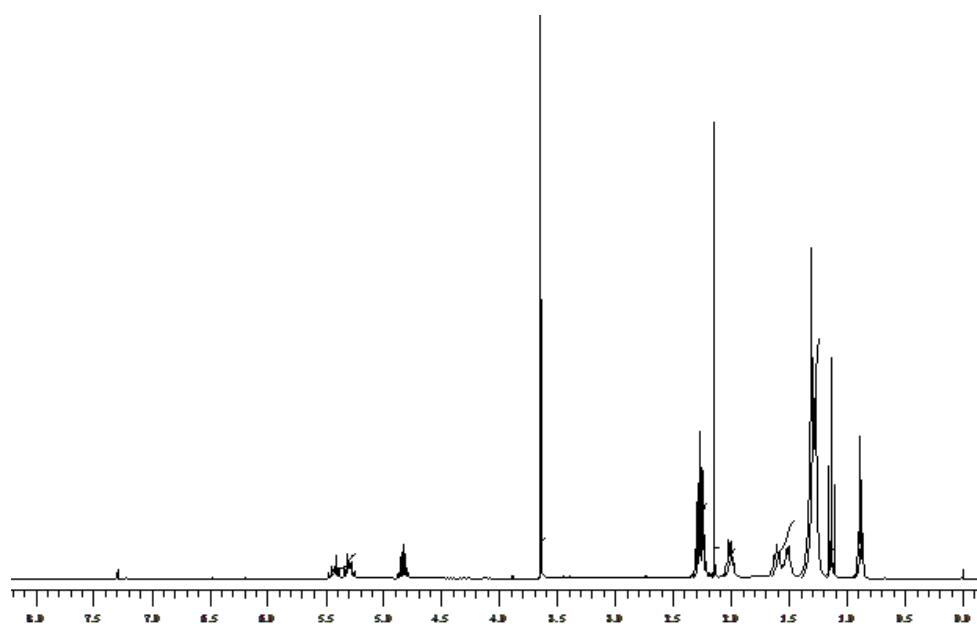


Figure S3: ^1H NMR Spectrum of Butanoylated Castor Fatty Acid Methyl Esters

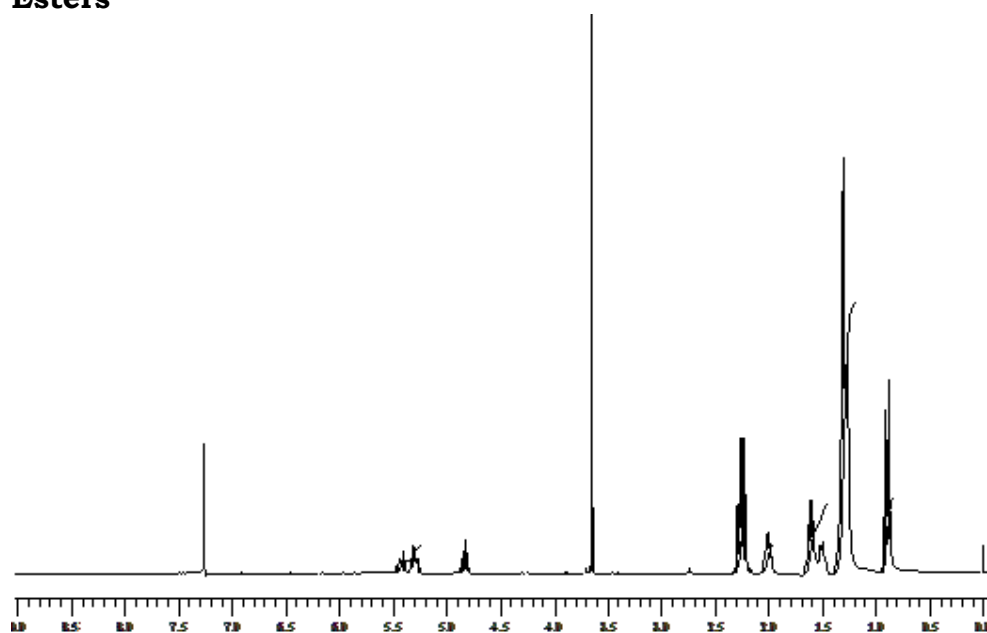


Figure S4: ^1H NMR Spectrum of Hexanoylated Castor Fatty Acid Methyl Esters

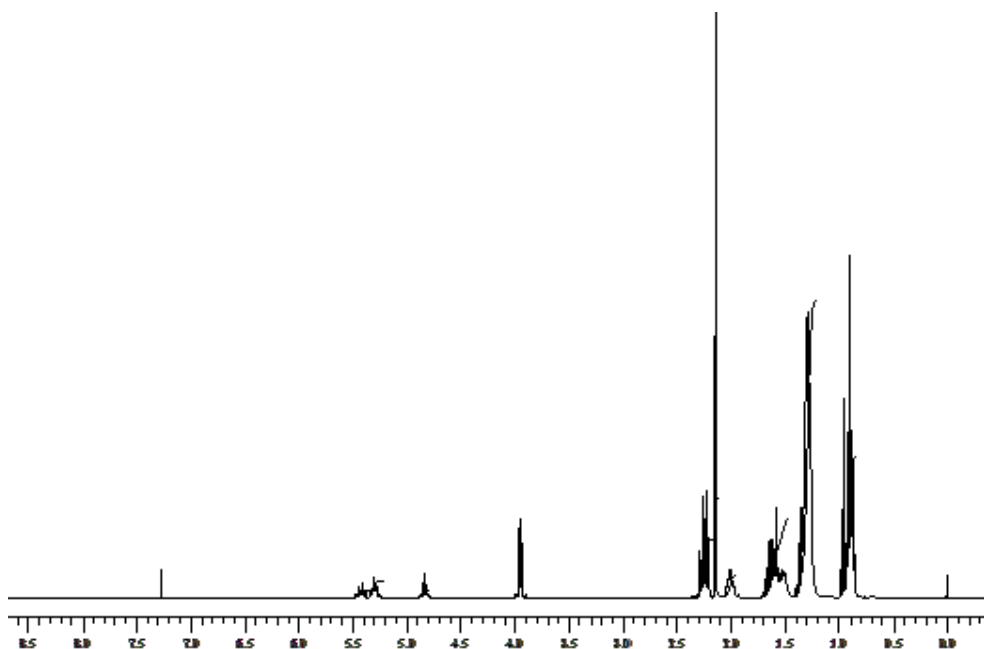


Figure S5: ^1H NMR Spectrum of Butanoylated Castor Fatty Acid 2-Ethylhexyl Esters

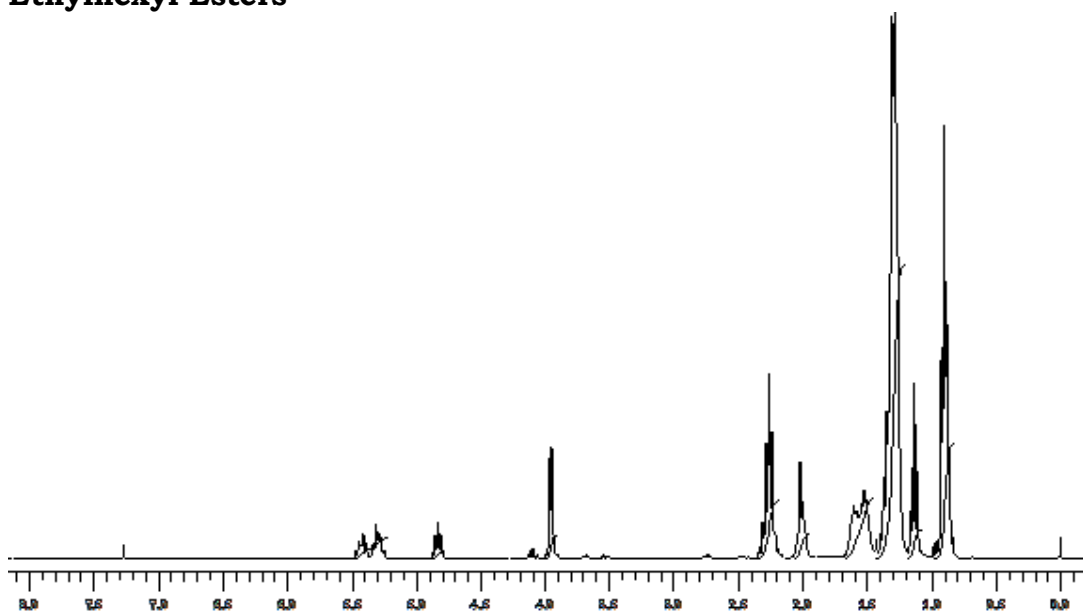


Figure S6: ^1H NMR Spectrum of Hexanoylated Castor Fatty Acid 2-Ethylhexyl Esters

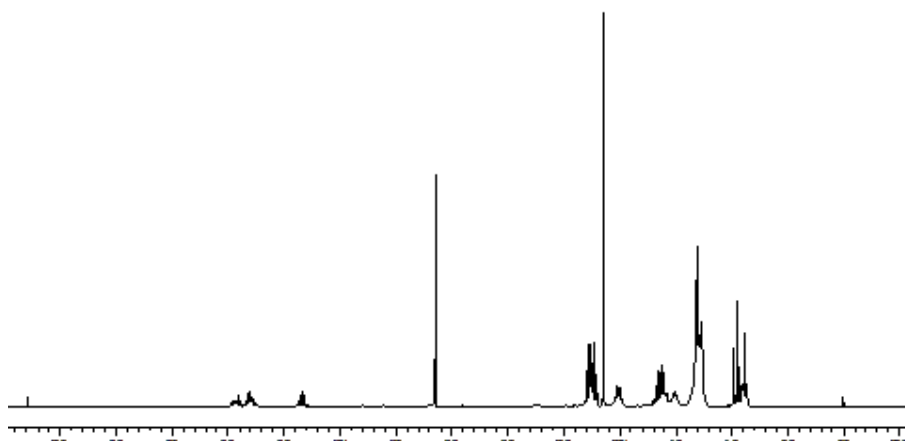


Figure S7: ¹H NMR Spectrum of Propionylated Castor Fatty Acid Methyl Esters

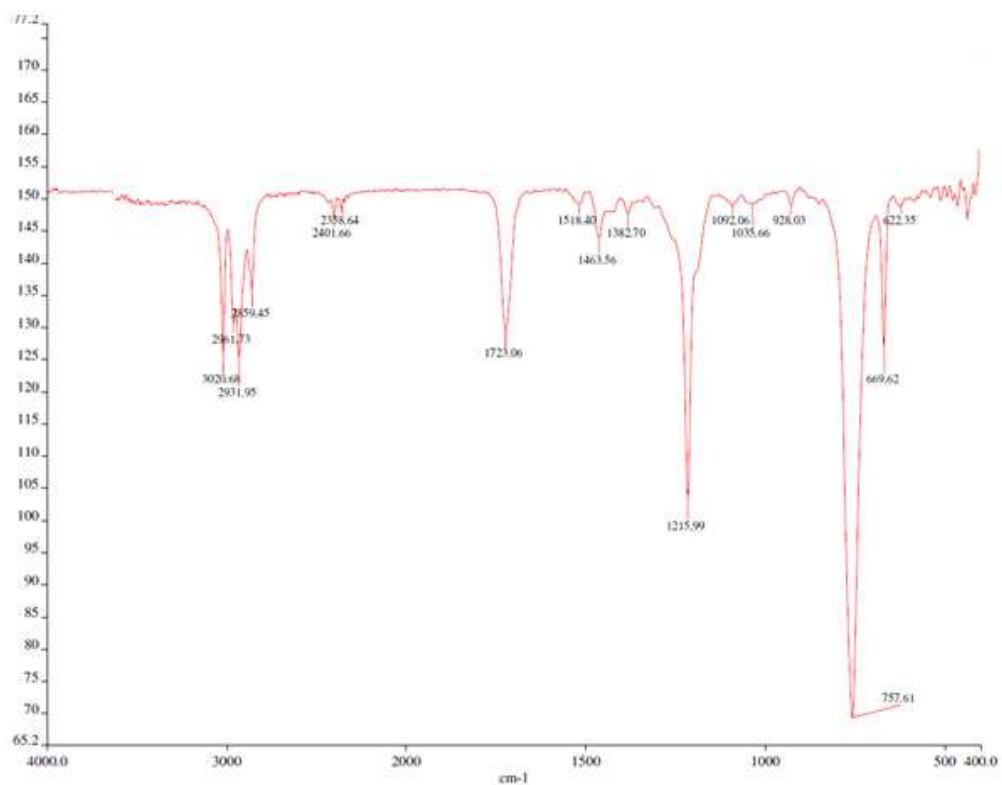


Figure S8: FTIR Spectra of Butanoylated Castor Fatty Acid 2-Ethylhexyl Esters

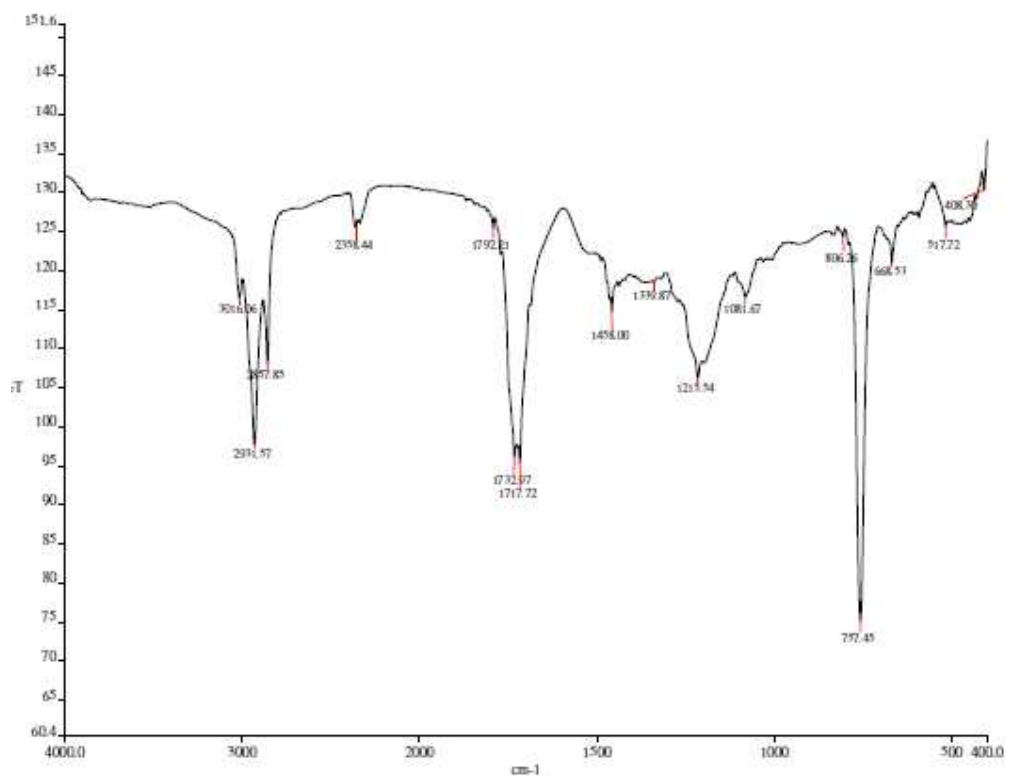


Figure S9: FTIR Spectra of Propionylated Esters of Castor Oil

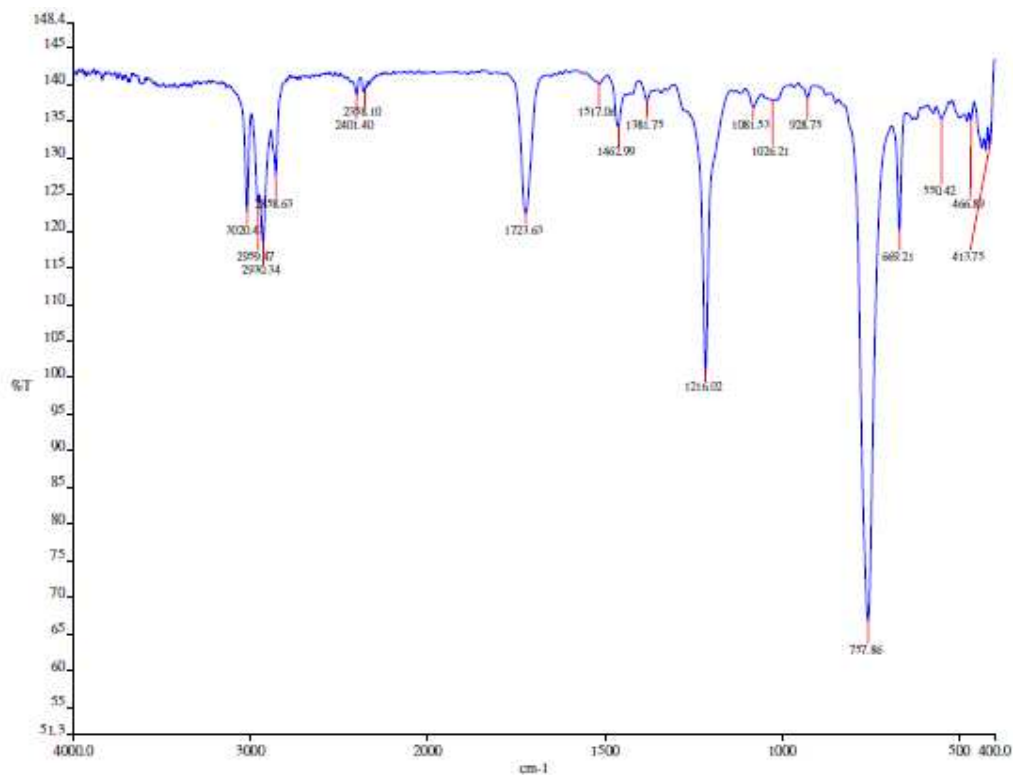


Figure S10: FTIR Spectra of Propionylated Castor Fatty Acid 2-Ethylhexyl Esters

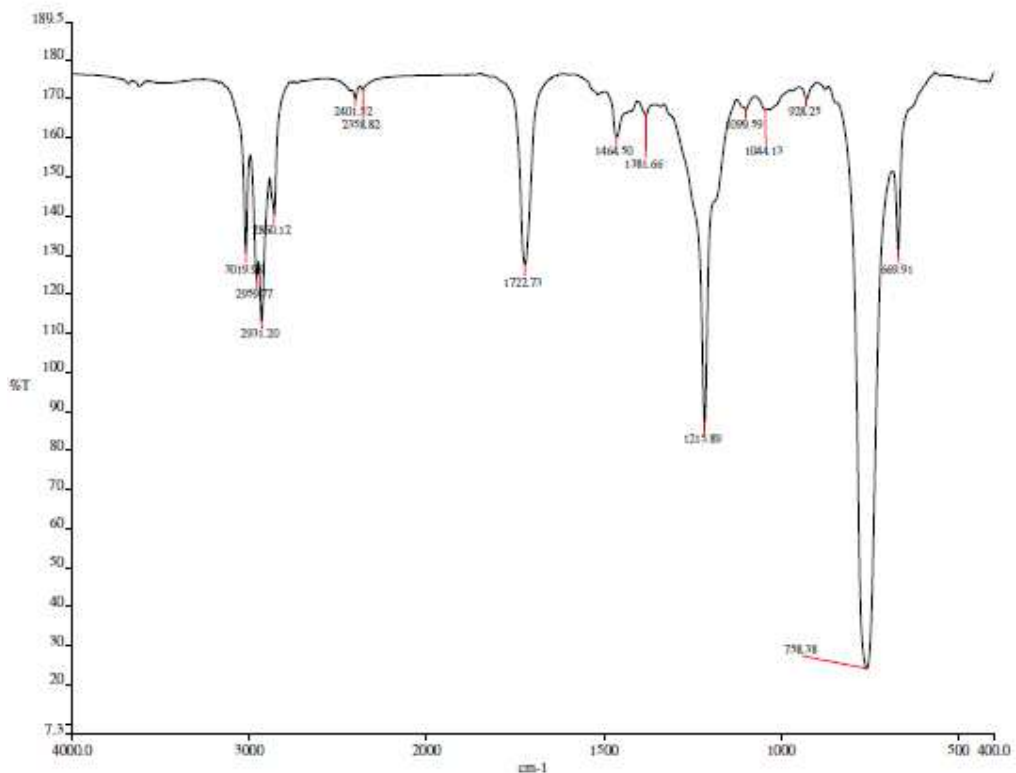


Figure S11: FTIR Spectra of Hexanoylated Castor Fatty Acid 2-Ethylhexyl Esters

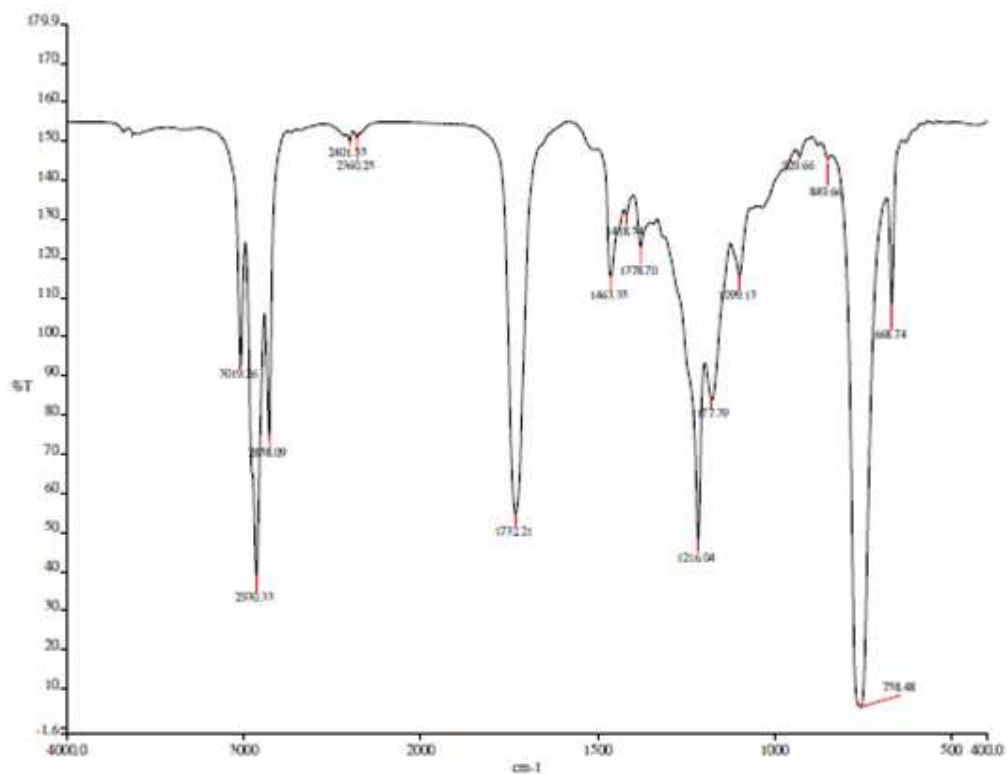


Figure S12: FTIR Spectra of Hexanoylated Esters of Castor Oil